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PHYSICS ABSTRACTS

Physics Abstracts is one of a series of abstracts publications produced by INSPEC. Published twice monthly by the Institution of Electrical Engineers, it forms the world's major English-language abstracting service for the physics community.

SUBJECT SCOPE & COVERAGE

Physics Abstracts covers the whole field of physics. An impression of its scope can be gained from the classification scheme. The information contained in *Physics Abstracts* is derived from a wide range of sources including journals, reports, books, dissertations and conference papers published in all countries and languages of the world.

The number of items included is currently running at over 100,000 per year.

JOURNALS SCANNED

A list of the journals scanned for the INSPEC services is published with the twice-yearly author indexes to *Physics Abstracts*. Additions and amendments to this list are included in *Physics Abstracts* towards the end of the first issue for each month.

FORM OF ENTRY

All entries in *Physics Abstracts* follow the same basic pattern. The following example identifies the individual parts of a typical entry for an article from a journal.

Entry No. in PA ↓ **Title of paper** ↓

87093 PAC study of molecular rotational motions in dilute solutions.

Authors → A.Baudry, P.Boyer, J.D.Fabris, P.Vulliet (Lab. d'Interactions Hyperfines, CENG, Grenoble, France). ← **Author's affiliation**

Source of paper → *Hyperfine Interactions (Netherlands)*, vol.10, no.1-4, p.1057-62 (June 1981). (Proceedings of the Fifth International Conference on Hyperfine Interactions, Berlin, Germany, 21-25 July 1980).

The rotational tumbling of neutral chelates of hafnium dissolved in several organic solvents was studied via ^{181}Ta DPAC experiments. The results are compared with the predictions of a hydrodynamic model with partial slip boundary conditions. The influence of solute-solvent interactions and/or associations on the quadrupole relaxation is discussed. (16 refs.) } **Abstract**

Entries for other types of material differ mainly in the reference to the source, e.g., a report will refer to the report series and the number of the individual report. A conference paper on the other hand will normally refer to the title, place and date of the conference at which the paper was given.

SUBJECT ARRANGEMENT & SUBJECT GUIDE

The abstracts are arranged by subject in accordance with the scheme in the CLASSIFICATION and CONTENTS which appears opposite. The page number for the start of each subject section is given. An alphabetical index to the scheme—the SUBJECT GUIDE—follows the CLASSIFICATION and CONTENTS.

SUBJECT INDEXES

Detailed twice-yearly subject indexes to the individual entries are provided separately, covering the periods January-June and July-December. In these SUBJECT INDEXES each major concept occurring in each paper abstracted is indexed under headings drawn from the INSPEC Thesaurus.

AUTHOR INDEX

At the end of each issue, an alphabetical index of authors is provided showing the entry number of the items written by them. These indexes are cumulated every six months and, with the addition of the title of the individual papers, are published separately to cover the periods January-June and July-December of each year.

SUBSIDIARY INDEXES

Where appropriate, the following subsidiary indexes are included for the convenience of users:

Bibliography index of articles where a significant list of references or bibliography is contained.

Book index of books received and abstracted.

Corporate Author index where a corporate organisation rather than an individual is responsible for publication. This index includes all reports.

Conference index with reference to individual papers.

Subscription prices and ordering procedure are shown on the inside back cover.

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Physics Abstracts

CLASSIFICATION AND CONTENTS

The abstracts are arranged by subject in accordance with the following scheme. The page number for each section is given. The CLASSIFICATION AND CONTENTS is followed by an alphabetical guide to the scheme, the SUBJECT GUIDE.

The classification scheme is the result of cooperation between INSPEC, the American Institute of Physics, the European Physical Society and the Physics Working Group of the ICSU-AB.

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00.00 GENERAL

01.00 COMMUNICATION, EDUCATION, HISTORY, AND PHILOSOPHY

01.10 ANNOUNCEMENTS, NEWS, AND ORGANIZATIONAL ACTIVITIES

98613 Energy 83. Towards an Energy Policy for Australia.
Barton, Australia: Instn. Eng., Australia (1983), 329 pp.
Conference held at: Canberra, Australia. Date 11-13 May 1983. Sponsors: Australian Inst. Energy; Instn. Eng., Australia. The following topics were dealt with: policy factors affecting energy use and development, resource and production factors both as opportunities and limitations followed by utilisation factors stimulating energy consumption. 18 papers were presented, of which all are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

01.30 PHYSICS LITERATURE AND PUBLICATIONS

01.30B Publications of lectures (advanced institutes, summer schools, etc.)

Polymer physics: organization of macromolecules in the solid state ....See Entry 101592

01.30C Conference proceedings

98614 CRYOSEM '81. Second International Seminar on Low Temperature Physics.
Acta Phys. Acad. Sci. Hung. (Hungary), vol.53, no.3-4 (1982). [received: Aug. 1983]
Conference held at: Visegrad, Hungary. Date 8-10 Oct. 1981. The following topics were dealt with: flux pinning in superconductors; superconducting magnets; properties of type II superconductors; semiconductor physics; thermal conductivity of metals and alloys; metallic glasses. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

98615 Niagara River-Lake Ontario Pollution Problem.
J. Great Lakes Res. (USA), vol.9, no.2 (1983).
Conference held at: Sault Ste. Marie, Ont., Canada. Date May 1982. The following topics were dealt with: Niagara River, Lake Ontario, Canada, pollution, sediment, metals, major elements, geochemistry, radiodating, sedimentology, chlorinated hydrocarbonds, nepheloid layer, P, halocarbon, stratigraphy, bar, water quality, bacteria level, nutrient, Welland River, surface microlayer, biota, phytoplankton, agal membranes, fish and vegetation.

98616 Proceedings of the Topical Meeting of the COSPAR Interdisciplinary Scientific Commission B and Symposium 6 of the COSPAR Twenty-Fourth Plenary Meeting.
Adv. Space Res. (GB), vol.2, no.12 (1982). [received: May 1983]
Conference held at: Ottawa, Canada. Date 16 May-2 June 1982. Sponsors: COSPAR; IAU; et al. Discusses meteorites, inclusions, presolar grains, early Solar System magnetic history, lunar palaeomagnetism, impact magnetisation, interstellar magnetism, comet spacecraft missions, Periodic Comet Halley (1982i), impact processes, asteroids and cratering.

98617 Proceedings of Symposium 1 and Workshop V of the COSPAR Twenty-Fourth Plenary Meeting.
Adv. Space Res. (GB), vol.3, no.2 (1983).
Conference held at: Ottawa, Canada. Date 16 May-2 June 1982. Sponsors: COSPAR; Int. Union Geol. Sci.; URSI; et al. The papers presented at this symposium describe various studies involving the use of remote sensing techiques for geological exploration. Ore and petroleum deposits were considered in a number of papers and describe work in a wide range of countries including the USSR, Yugoslavia, India, Spain, Nepal, China, Sudan, Sierra Leone, USA and Egypt. Other papers describe the geology and crust structure of various regions. Vegetation, chemistry and temporal aspects of ore discovery were also studied. The last group of papers presented discussed the selection of spectral bands for various remote sensing applications. Altogether 42 papers were published which are published in full in the present proceedings.

98618 Proceedings of Symposium 3 of the COSPAR Twenty-Fourth Plenary Meeting.
Adv. Space Res. (GB), vol.3, no.3 (1983).
Conference held at: Ottawa, Canada. Date 16 May-2 June 1982. Sponsors: COSPAR; IAU; URSI; et al. The following topics were dealt with: radiowave emissions from the giant planets, planetary magnetospheres, ring systems, photopolarimetry of Saturn and Titan, Saturnian equatorial haze, Io plasma torus. Altogether 16 papers were presented at this conference.

98619 Proceedings of the 4th ADINA Conference.
Comput. & Struct. (GB), vol.17, no.5-6 (1983).
Conference held at: Cambridge, MA, USA. Date 15-17 June 1983. The conference dealt with applications of the finite element computer program for automatic dynamic incremental nonlinear analysis (ADINA) in a variety of mechanical and civil engineering problems. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

98620 Symposium on Environmental Effects on Fibre-Reinforced Plastics.
Composites (GB), vol.14, no.3 (July 1983).
Conference held at: London, England. Date 12-13 July 1983. Sponsors: Carr Reinforcements; Ciba-Geigy Plastics Div.;Fothergill Rotorway Composites; Hysol Grafil; Pilkington/Fibreglass. The following topics were dealt with: accelerated ageing; analysis of moisture gradients; effect of moisture, acidic and aqueous environments on the properties of fibre reinforced composites; environmental and post-impact fatigue; thermal expansion and long-term durability; stress corrosion cracking and stress-rupture life. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

98621 Optics and Images in Law Enforcement II.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.339 (1982). [received: Aug. 1983]
Conference held at: Arlington, VA, USA. Date 4-5 May 1982. The following topics were dealt with: photographic surveillance using Kodak scientific type emulsions; new directions in the use of infrared technology for drug detection; optics development in the Scientific Research and Development Branch (SRDB); image processing system for the enhancement and deblurring of photographs; disguise detection and identification using infrared imagery; image dynamic range compression for law enforcement; law enforcement applications of high speed videography; image processing operations and systems for legal applications; design of an automatic vehicle surveillance system; second generation night surveillance and low-cost instant surveillance systems.

98622 Field Measurement and Calibration Using Electro-Optical Equipment: Issues and Requirements.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.356 (1983).
Conference held at: San Diego, CA, USA. Date 24-25 Aug. 1982. The following topics were dealt with: measuring the characteristics of the ambient atmosphere; determining the parameters of the battlefield environment; instrumentation and requirements for measurement of transmission and radiance in the field research in remote sensing. 22 papers were presented, of which 14 are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

98623 Industrial and Commercial Applications of Holography.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353 (1983).
Conference held at: San Diego, CA, USA. Date 24-25 Aug. 1982. The following topics were dealt with: holographic overviews; holographic displays; holographic optical elements; holographic materials and applications of holography. 22 papers were presented, of which 21 are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

98624 Modern Utilization of Infrared Technology VIII.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.366 (1983).
Conference held at: San Diego, CA, USA. Date 26-27 Aug. 1982. The following topics were dealt with: data processing approach to jitter suppression; optical technique for increasing fill factor of mosaic arrays; application of fast IR detectors to detonation science; automatic testing of IR components; atmospheric transmittance derived from radiance measurements; IR imaging techniques for flaw detection in composite materials; near-IR mapping spectrometer for investigation of Jupiter and its satellites; Monte Carlo sets of synthetic background scenes; alternate approaches to cryogenic cooling; advanced low altitude IR Earth sensors; detection range computation by convolution for IR detectors; atmospheric IR emission; observed at altitude of 27000 to 28000 in and transition flow effects on plume radiation. 21 papers were presented, all of which are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

98625 Symposium on Halide and other Nonoxide Glasses.
Glass Technol. (GB), vol.24, no.3 (June 1983).
Conference held at: Cambridge, England. Date 23-26 March 1982. The following topics were dealt with: beryllium fluoride glasses; zirconium as raw material for special glasses; optical properties of fluoride glasses; infrared transmitting materials; chalcogenide glass optical fibres; fluoride glasses of 3d transition metals. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

98626 Meeting of the Nordic Association for Applied Geophysics.
Geoexploration (Netherlands), vol.21, no.4 (1983).
Conference held at: Copenhagen, Denmark. Date 10-12 Jan. 1983. Discusses gravity fields, Nordkalotte Project, data analysis, Greenland, Caledonides, Norway, geomagnetism, Finland, impulse radar, aeromagnetics, trough depths, potential fields, magnetotelluric data, Denmark, Faeroe Islands, thermal conductivity, Scandinavia, temperature logging, marine slides, seismic monitoring, North Sea, Kattegat, faulted reservoir, coal seams, fault structure, Sweden, Libya, prospecting, resistivity, fracture zones, radioactive waste disposal, induced polarisation, Spitzbergen and chemical waste.

98627 Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS.
Helv. Phys. Acta (Switzerland), vol.56, no.1-3 (1983).
Conference held at: Lausanne, Switzerland. Date 28-30 March 1983. Sponsors: Swiss Nat. Sci. Found.; Swiss Soc. Natural Sci.; Federal Inst. Technol. The following topics were dealt with: localisation; quantum Hall effect; itinerant magnetism and valence fluctuations; superconductivity; excitations and electronic states in metals; metallic glasses; polymer glasses; and glass topology; deep centres in semiconductors; semiconductor applications; picosecond spectroscopy; core level spectroscopy; positronium and muonium in solids; atomic structure of solids; interface structure and electronic properties; small particles, clusters and colloids; lattice dynamics; excitations in low dimensional systems; phase transitions; structural glasses; sol-gel transitions and percolation; two dimensional melting; macroscopic quantum phenomena; chaos and driven systems. 70 papers are published in full in the present proceedings and

4 as abstracts only. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

98628 8th IEEE International Semiconductor Laser Conference.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.6 (June 1983).
Conference held at: Ottawa, Ont., Canada. Date 13-15 Sept. 1982. The following topics were dealt with: materials characterisation; temperature dependence of long-wavelength lasers; laser modes; high power lasers; short wavelength lasers; new structures; dynamic effects; amplification and reliability. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

98629 On the 90th Anniversary of the Birth of O.Yu. Shmidt.
Izv. Akad. Nauk SSSR Fiz. Zemli, vol.18, no.6 (1982). [received: June 1983]
Conference held at: Moscow, USSR. Date 26-27 Oct. 1981. The following topics were dealt with: cosmogony of the solar system, planetary satellite origin, Earth origin and evolution, and atmospheric and oceanic circulation.

98630 Anton L. Hales Symposium on 'Some Recent Advances in Geophysics'.
J. Geophys. Res. (USA), vol.88, no.B4 (10 April 1983). [received: Aug. 1983]
Conference held at: Dallas, TX, USA. Date 5-6 Oct. 1981. Global seismicity, earthquakes, teleseismic propagation, Rayleigh wave attenuation, crustal structure, East Pacific Rise thermal structure, lithosphere subduction and tectonics.

98631 Analysis and Interpretation of Atmospheric CO_2 Data.
J. Geophys. Res. (USA), vol.88, no.C6 (20 April 1983).
Conference held at: Bern, Switzerland. Date 14-18 Sept. 1981. The following topics were dealt with: the global distribution CO_2 in the atmosphere, CO_2 exchange between the atmosphere and ocean, C isotopes in the atmosphere including tree ring evidence, fossil fuel combustion CO_2, air pollution and C isotope fallout due to nuclear weapons testing.

98632 Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors.
J. Nucl. Mater. (Netherlands), vol.117 (July 1983).
Conference held at: St. Louis, MO, USA. Date 25-28 Oct. 1982. Sponsors: TMS-AIME/ASM Nucl. Metall. Committee; ASM Electr., Magnetic & Opt. Phenomena Activity. The following topics were dealt with: radiation damage analysis in the fusion program; energy dependence of defect production; defect behaviour under fusion irradiation environments; helium partitioning and transport; pulsed irradiation microstructures; ion irradiation effects; effect of irradiation on segregation; irradiation induced creep; martensitic stainless steel fusion structures; neutron irradiation effects in austenitic stainless steels. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

98633 Proceedings of the Conference on Mathematical Analysis and Applications.
J. Math. & Phys. Sci. (India), vol.17, no.2 (April 1983).
Conference held at: Madras, India. Date 12-13 Nov. 1982. The following topics were dealt with: maximum entropy principle; renewal processes; redundant systems; harmonic maps; function algebra; graphs; table matrix L-systems; Dirac equations; Malcev vatieties; lattices. 7 papers were presented, all of which are published in full in the present proceedings. Abstracts of some of the individual papers can be found under the relevant classification codes in this or future issues.

98634 Vacuum Symposium Proceedings (Kobe 1982).
J. Vac. Soc. Jpn. (Japan), vol.26, no.5 (1983).
Conference held at: Kobe, Japan. Date 1982. The following topics were dealt with: diffusion; outgassing; leak detection; diffusion pumps; ion pumps; time-of-flight mass spectrometer; RBS; contamination; surface segregation; sputtering; surface roughness; electron beam bombardment; flash desorption spectroscopy; discharge cleaning; adsorption; electron diffraction; field emission; valves; extended appearance-potential fine structure analysis; ion bombardment; atom-probe analysis; adhesion; film thickness control; ion gun; coating techniques; and ionization. 72 papers were presented, 40 of which are published in full in the present proceedings, and 32 as abstracts only.

98635 European Geophysical Society Symposium on Plasma and Energetic Particles in the Magnetosphere.
J. Geophys. (Germany), vol.52, no.3 (1983).
Conference held at: Leeds, England. Date 23-27 Aug. 1982. The following topics were dealt with: auroral ion precipitation, magnetosphere, density, plasmasphere irregularities motion, magnetopause, boundary layer, flux transfer events, ring current, radiation belts composition, He ions, charge and high energy electrons.

98636 Proceedings of the Workshop on 'Cosmic Magnetic Fields' in Honour of Giorgio Abetti.
Mem. Soc. Astron. Ital. (Italy), vol.53, no.4 (1982). [received: June 1983]
Conference held at: Florence, Italy. Date 21-23 Oct. 1982. The following topics were dealt with: magnetic fields on Sun, planetary magnetism, interplanetary fields, interstellar fields, stellar magnetism and high energy sources.

98637 Frascati Workshop 1982: The First Stellar Generations.
Mem. Soc. Astron. Ital. (Italy), vol.54, no.1 (1983).
Conference held at: Vulcano, Eolie, Italy. Date 6-10 Sept. 1982. The following topics were dealt with: early enrichment in the galactic halo, Population II stars, asymptotic giant branch evolution, halo stars, cool stars, abundances, nucleosynthesis, metal-poor stars, globular clusters, galactic disks, molecular clouds, open stellar systems, Population III stars, star formation, zero metal stars, s and r process element abundances, supernova remnants, supernovae, and heavy element formation.

98638 Proceedings zum Kolloquium WOPHYS '82. Meteorologische Probleme der Wolkenphysik und ihre theoretische und instrumentelle Bearbeitung (Proceedings of Colloquium WOPHYS ' 82. Cloud Physics Meteorological Problems Theoretical Instrumentational Workings).
Meteorol. Rundsch. (Germany), vol.36, no.3 (June 1983).
Conference held at: Konigstein, Germany. Date 17-19 May 1982. The following topics were dealt with: The ice production processes in clouds, a probe for measuring cloud droplet concentration, cloud droplet spectrometer probes, cloud condensation nuclei counters, chemical composition of rain, particle scavenging by rain and cloud drops, cloud ice droplet growth and far infrared radiation flux, cloud microphysics and radiation fog.

98639 Symposium uber Kosmologie und Relativistische Astrophysik (Symposium on Cosmology and Relativistic Astrophysics).
Mitt. Astron. Ges. (Germany), no.58 (1983).
Conference held at: Konstanz, Germany. Date 21-25 March 1983. The following topics were dealt with: X-ray sources and pulsars, light element abundances, quantum gravity, and galaxy formation.

98640 Meeting of the Basic Science Section of the British Ceramic Society, 'Fabrication Science 3'.
Proc. Br. Ceram. Soc. (GB), no.33 (May 1983).
Conference held at: London, England. Date 13-14 Dec. 1982. The following topics were dealt with: preparation of powders; vibrocompaction; fibre preparation; superplastic forming. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

98641 Symposium on the Rheological Properties of Polymers. 65th Chemical Conference of the Chemical Institute of Canada.
Polym. Eng. & Sci. (USA), vol.23, no.8 (mid-June 1983).
Conference held at: Toronto, Ont. Canada. Date 30 May-2 June 1982. The following topics were dealt with: the role of rheology in plastics processing; and the use of rheology in characterisation of materials. 22 papers were presented, of which 7 are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

98642 Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals'.
Radiat. Eff. (GB), vol.72, no.1-4 (1983).
Conference held at: Dublin, Ireland. Date 29 Aug.-3 Sept. 1982. Sponsors: Aer Lingus; Bank of Ireland; An Bord Bainne; et al. The following topics were dealt with: laser spectroscopy of colour centres; defect structure analysis and deexcitation of defects, relaxation measurements of colour centres; carrier trapping, defect formation, and luminescence properties, irradiation and annealing effects on colour centres. 37 papers were presented, all of which are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

98643 Third Symposium on Recent Crustal Movements and Phenomena Associated with Earthquakes and Volcanism.
Tectonophysics (Netherlands), vol.97, no.1-4 (1983).
Conference held at: Tokyo, Japan. Date 12-13 May 1982. The following topics were dealt with: new results in recent crustal movement studies at a local or regional scale, crustal deformations associated with volcanism, crustal deformations associated with seismic activity, error analysis, computations, and methods of measurements.

98644 Neutron Radiography. Proceedings of the First World Conference.
Dordrecht, Netherlands: Reidel (1983), xvii+1072 pp. [90 277 1528 9]
Conference held at: San Diego, CA, USA. Date 7-10 Dec. 1981. Sponsors: ASTM; American Soc. Nondestructive Testing; British Inst. Nondestructive Testing. The following topics were dealt with: neutron radiography; reactor facilities with nuclear applications; reactor facilities with general applications; general industrial applications; applications in the nuclear industry (fuel); general nuclear industry applications; nonindustrial applications; real-time applications. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

98645 Ninth International Symposium on Machine Processing of Remotely Sensed Data with Special Emphasis on Natural Resources Evaluation.
West Lafayette, IN, USA: Purdue Univ. (1983), x+430 pp.
Conference held at: West Lafayette, IN, USA. Date 21-23 June 1983. Sponsors: IEEE; Crop Sci. Soc. America; Soc. American Foresters; et al. The following topics were dealt with: image science, agricultural applications of remote sensing, natural resource evaluation, feature analysis and transformation, international and domestic technology transfer, scene simulation and modelling, image enhancement, supervised and unsupervised classification, thematic mapper data processing, and geographical information systems.

98646 Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting.
Richland, WA, USA: Battelle Press (1983), xiii+658 pp. [3 540 90856 0]
Conference held at: Richland, WA, USA. Date 19-22 April 1982. The following topics were dealt with: national overviews; high level waste management practices; decontamination and size reduction, incineration technology; high level waste vitrification technology; LLW and ILW management practices; transuranic waste management; alternative high-level waste forms; aqueous treatment technology for non-HLW; remote aspects of treating and handling radioactive wastes; treatment of defense high-level waste; immobilisation technology for non-HLW; treatment of West Valley high-level waste; low-level waste handling; transportation and disposal. 114 papers were presented, of which all are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

98647 Cosmochemistry and the Origin of Life. Proceedings of the NATO Advanced Study Institute.
Dordrecht, Netherlands: Reidel (1983), viii+386 pp. [90 277 1544 0]
Conference held at: Maratea, Italy. Date 1-12 June 1981. Discusses cosmochemistry, origin of life, chemical elements synthesis, interstellar matter, comets, Solar System, chemical evolution, terrestrial early atmosphere composition and climatology, sediment dating, biologically mediated isotope fractionations and molecular fossil record.

98648 Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium.
New York, USA: North-Holland (1983), xiii+298 pp. [0 444 00782 2]
Conference held at: Boston, MA, USA. Date Nov. 1982. Sponsors: Air Force Office Sci. Res. The following topics were dealt with: photodeposition of metal structures; photoetching of electronic materials; diagnostics of semiconductor structures; photoformation of insulators; diagnostics of conventional and laser processing; photodeposition of semiconductors; photochemical doping. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

98649 Greater Los Angeles Area Energy Symposium.
North Hollywood, CA, USA: Western Periodicals Company (1980), ix+211 pp.
Conference held at: Los Angeles, CA, USA. Date 28 Oct. 1980. Sponsors: Los Angeles Council Eng. Sci. The following topics were dealt with: energy management in industry, commerce, residences and hospitals; transportation fuel and energy conservation; power from central receivers and parabolic dishes; solar powered flight; uranium resources; LWR plant costs; LMFBR conceptual design and safety; nuclear waste disposal; biomass and solid waste energy sources; cogeneration; shale-oil products; geothermal energy; and wind energy. 34 papers were presented, of which 31 are published in full in the present proceedings, and three as abstracts only. Abstracts of individual papers can be found under the relevant classfication codes in this or other issues.

98650 Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics.
Berlin, Germany: Springer-Verlag (1983), xiv+298 pp. [3 540 12276 1]
Conference held at: Sitges, Barcelona, Spain. Date 5-11 Sept. 1982. The following topics were dealt with: random processes; chaotic systems; strange attractors; dynamical systems. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

98651 Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop.
Cambridge, England: Cambridge (1982), xiii+432 pp. [0 521 24732 2]
Conference held at: London, England. Date 3-21 Aug. 1981. The following topics were dealt with: quantum gravity; fields; topology; spontaneous symmetry breaking; supergravity; cosmology; the early Universe; quantisation; supersymmetric Yang-Mills theories. 26 papers were presented, all of which are published in full in the present proceedings. Abstracts of individual papers can be found under the relevent classification codes in this or future issues.

98652 Alloy Phase Diagrams. Proceedings of a Symposium.
New York, USA: North-Holland (1983), xi+436 pp. [0 444 00809 8]
Conference held at: Boston, MA, USA. Date Nov. 1982. The following topics were dealt with: alloy phase stability; applications of thermodynamic models in phase diagram data evaluation; rapid solidification processing; constrained equilibria and specialized phase diagrams; experimental determination of phase diagrams. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

98653 Cohesive Properties of Semiconductors under Laser Irradiation. Proceedings of the NATO Advanced Study Institute.
The Hague, Netherlands: Martinus Nijhoff (1983), xix+614 pp. [90 247 2857 6]
Conference held at: Cargese, Corsica, France. Date 19-30 July 1982. The following topics were dealt with: reordering processes in laser irradiated semiconductors; laser and speckle patterns; laser irradiation and transport theory; phase diagrams, crystal growth and solidification; optical properties and recombination mechanisms of semiconductors; dense plasmas and time resolved Raman studies; plasma annealing and laser sputtering; defects, semiconductor synthesis and laser annealing. 27 papers were presented, all of which are published in full in the present proceedings.

98654 Sixth ESA Symposium on European Rocket & Balloon Programmes & Related Research (ESA SP-183).
Paris, France: ESA (1983), xxi+479 pp.
Conference held at: Interlaken, Switzerland. Date 11-15 April 1983. The following topics were dealt with: national balloon and sounding rocket programmes; the energy budget of the middle atmosphere; Middle Atmosphere Physics Projects; range facilities and range improvements; ionospheric/magnetospheric coupling; ground-based observations; sounding-rocket and balloon technology, and new measuring techniques; materials and life sciences; astrophysics; and the future of sounding-rocket and balloon research in Europe. 80 papers were presented, of which 79 are published in full in the present proceedings, and one as abstract only.

98655 Physics of Superionic Conductors and Electrode Materials. Proceedings of a NATO Advanced Study Institute on the Physics of Superionics Conductors and Electrode Materials.
New York, USA: Plenum Press (1983), vii+281 pp. [0 306 41271 3]
Conference held at: Odense, Denmark. Date 4-22 Aug. 1980. The following topics were dealt with: ion transport models; lattice sums calculations; molecular dynamics and Monte Carlo simulations. 15 papers were presented, all of which are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

98656 Planet Mars. Proceedings of a Workshop (ESA SP-185).
Paris, France: ESA (1982), v+120 pp.
Conference held at: Leeds, England. Date 27 Aug. 1982. The following topics were dealt with: the Martian magnetic environment; the geological evolution of Mars; Martian tectonics; the gravity field of Mars; Kepler at Mars; the aeronomy of the lower atmosphere of Mars; the atmospheres of the terrestrial planets; the solar radiation incident at the top of the Martian atmosphere; CO_2, O_2 and H_2O in the Martian atmosphere; ultraviolet absorption in the Martian atmosphere; the Martian airglow and scattered sunlight; the initial thermal history of Mars; permafrost melting and dissolution of the Martian landscape; Martian volcanic eruptions; and multispectral imaging of Mars. 16 papers were presented, all of which are published in full in the present proceedings.

98657 Laser-Solid Interactions and Transient Thermal Processing of Materials.
New York, USA: Elsevier (1983), xvii+769 pp. [0 444 00788 1]
Conference held at: Boston, MA, USA. Date 1-4 Nov. 1982. Sponsors: US DOE. The following topics were dealt with: energy transfer and phase transformations; crystallisation of amorphous semiconductors; solid and liquid phase phenomena; rapid crystallisation; impurity incorporation and metastable surfaces; transient thermal processing of silicon for devices; crystallisation of silicon on insulators; compound semiconductors; metallic surface alloys. 98 papers were presented, all of which are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

98658 Proceedings of the 1982 CERN School of Physics (CERN 83-05).
Geneva, Switzerland: CERN (1983), ix+304 pp.
Conference held at: Cambridge, England. Date 5-18 June 1982. The following topics were dealt with: experimental tests of gauge theories; fundamentals of QCD; applications of QCD; unification and ground unification; results from the CERN proton-antiproton collider; lattice gauge theory; astrophysics, cosmology and high energy physics. 8 paper were presented, of which all are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

98659 Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206).
Noordwijk, Netherlands: ESA (1983), xiv+123 pp.
Conference held at: Cologne, Germany. Date 9-11 March 1983. Sponsors: Eur. Low Gravity Res. Assoc.; ESA; German Aerospace Res. Establ. The topics dealt with included: the significance of gravity on biological systems; the sensitivity of plants towards gravity; the effects of space environmental factors on cell proliferation; the effect of spaceflight on lymphocyte activation; the effects of microgravity on the mechanisms for genetic recombination; dosimetric mapping inside the Biorack; problems of 0 g simulation with the fast-running Clinostat; the influence of gravity on cell growth and migration; the scientific goals of the D1-mission. 26 papers are published in full in the present proceedings.

98660 Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981.
New York, USA: Plenum (1983), ix+378 pp. [0 306 41038 9]
Conference held at: Freiburg, Germany. Date 31 Aug.-11 Sept. 1981. Sponsors: NATO. This volume explores elementary particle physics and statistical mechanics and by comprehensively comparing their structures and methods gives a deeper understanding of each. Leading physicists from a number of countries examine the structural similarities between elementary particle physics and statistical mechanics, tracing the similarities to their origins. They also provide a comparison of solution and approximation schemes and report on those new results and methods in both fields that are indicative of an intimate connection between them. The contributors present up-to-date information on basic topics in statistical mechanics and phase transitions, dynamical systems, solvable lattice models, lattice gauge theories, and a number of topics illustrative on the interrelationship between the two fields. Supplementary information is provided on experimental implications and neighboring fields. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

98661 Astrophysical Jets. Proceedings of an International Workshop.
Dordrecht, Netherlands: Reidel (1983), xvi+327 pp.
Conference held at: Torino, Italy. Date 7-9 Oct. 1982. Sponsors: Osservatorio Astron. Padova; Soc. Astron. Italiana; et al. The following topics were dealt with: small scale structure of radio sources; radio jets; the quasar 3C 273; the radio galaxy NCG 6251; variable radio sources; optical jets; the BL Lacertae object PKS 0521-36; the spiral galaxy NGC 3310; Centaurus A (NGC 5128); Markarian 335; SS 433; X-ray emission from jets; the Seyfert galaxy NGC 4151; supercritical accretion discs; black hole driven hydromagnetic flows; pressure-confined supersonic jets; magnetic fields; reflection jets; and instabilities in astrophysical jets. 35 papers were presented, all of which are published in full in the present proceedings.

Proceedings of Workshop I of the COSPAR Twenty-Fourth Plenary Meeting .
....See Entry 104583

01.30E Monographs, and collections

98662 Origin and evolution of planetary atmospheres. A.Henderson-Sellers.
Bristol, England: Adam Hilger (1983), xv+240 pp. [0 85274 385 8]
The author describes the development of planetary atmospheres, using the temperature as the fundamental characteristic of the atmospheric environment. The first chapters of the book describe the origin of the Sun and the other bodies of the solar system, and the mechanisms which control the structure of planetary atmospheres during the evolutionary processes. The later chapters deal with the primary evolutionary histories of the planets and their major satellites, and review shorter term climatological changes. The history of the Earth's atmosphere is described in detail, with particular reference to the origin and evolution of life. The book is intended to serve both as a text for taught courses and as a monograph for the research community.

01.30K Handbooks, dictionaries, tables and data compilation

98663 The First Dictionary of the Nomenclature of Celestial Objects (solar system excluded). A.Fernandez, M.-C.Lortet, F.Spite.
Astron. & Astrophys. Suppl. Ser. (France), vol.52, no.4, 186 pp. (June 1983).
Lists acronyms which are used (generally as the leading characters) in source names; it is not a general list of the abbreviations of the names of catalogues. References to the catalogues are given together with notes on X- and γ-ray sources, nomenclature based on constellation names, and objects having individual names. (900 refs.)

98664 Thermochemical properties [of titanium, its compounds and alloys]. O.Kubaschewski (Tech. Hochschule Aachen, Aachen, Germany).
At. Energy Rev. Spec. Issue (Austria), no.9, p.3-71 (1983).
Data tables are given showing heat capacities, entropies, enthalpies and Gibbs free energies of Ti, Ti-H_2, Ti-D_2, halides, oxides, titanates, chalcogenides, pnictides, Ti-C, Ti-Si, Ti-B, Ti-Al, Ti-Cr, Ti-Cu, Ti-Fe, Ti-Hg, Ti-Ir, Ti-Mo, Ti-Mo, Ti-Nb, Ti-Ni, Ti-Pd, Ti-Pt, Ti-V, and Ti-Zr. (219 refs.)

98665 Phase diagrams [of titanium alloys]. O.Kubaschewski-Von Goldbeck (Tech. Hochschule Aachen, Aachen, Germany).
At. Energy Rev. Spec. Issue (Austria), no.9, p.75-197 (1983).
Phase diagrams are given for Ti-Ag, Ti-Al, Ti-As, Ti-Au, Ti-B, Ti-Ba, Ti-Be, Ti-Bi, Ti-C, Ti-Ca, Ti-Cd, Ti-Co, Ti-Cr, Ti-Cu, Ti-Fe, Ti-Ga, Ti-Ge, Ti-H, Ti-Cu, Ti-Fe, Ti-Ga, Ti-Ge, Ti-H, Ti-Hf, Ti-Hg, Ti-In, Ti-Ir, Ti-K, Ti-Li, Ti-Mg, Ti-Mn, Ti-Mo, Ti-N, Ti-Na, Ti-Nb, Ti-Ni, Ti-O, Ti-Os, Ti-P, Ti-Pb, Ti-Pb, Ti-Pt, Ti-Pu, Ti-Re, and all the Ti-rare earth alloys except those with Eu and Yb. (344 refs.)

98666 Crystal structure and density data. I. Intermetallic compounds of titanium. P.Rogl (Inst. of Phys. Chem., Univ. of Vienna, Vienna, Austria).
At. Energy Rev. Spec. Issue (Austria), no.9, p.201-369 (1983).
Deals with binary, ternary, and multi-component compounds of titanium with the metallic elements of the Periodic Table. Not treated are halides and chalcogenides and compounds with the elements of Group VA, with H, B, C, Si and Ge. The first table given comprises structural data of titanium as well as binary intermetallic compounds of titanium. The alloy systems concerned are listed in alphabetical order and the intermetallic compounds of each elemental combination are arranged with increasing content of titanium. The references and notes for each elemental combination indicated under the alloy systems are again listed in alphabetical order. Information on binary compounds in general has been extracted from the higher-order intermetallic systems, but some information is also contained in ternary or high-order combinations with elements not covered (borides, carbides, silicides, germanides, etc.). (769 refs.)

98667 Crystal structure and density data. II. Titanium halides and chalcogenides. H.F.Franzen (Dept. of Chem., Iowa State Univ., IA, USA).
At. Energy Rev. Spec. Issue (Austria), no.9, p.371-438 (1983).
For pt.I see ibid., no.9, p.201 (1983). Data is given on the unit cell dimensions, number of formula units in the unit cell, structural type, crystal system and space group for titanium oxides, sulphides, selenides, tellurides, fluorides, chlorides, bromides, iodides, oxygluorides, oxychlorides, oxybromides, and many different titanates. (370 refs.)

98668 Diffusion [in titanium and its alloys]. O.Kubaschewski (Tech. Hochschule Aachen, Aachen, Germany).
At. Energy Rev. Spec. Issue (Austria), no.9, p.441-60 (1983).
The results of measurements of diffusion rates in titanium and its alloys and compounds are listed in the form of Arrhenius constants, $D=D_0.e^{-Q/Rt}$, where D_0 is given cm^2/s and Q in kcal/mol, which may be converted into kJ/mol by multiplication with 4.185, if required. In the case of titanium the plots of the log D versus 1/T do not always constitute straight lines. The object of this compilation is not to discuss the reasons for this phenomenon but to present data. Curved log D versus 1/T plots are therefore either represented by two Arrhenius equations or pertinent remarks are added as notes. (81 refs.)

98669 Nuclear data sheets for A=108. R.L.Haese, F.E.Bertrand, B.Harmatz, M.J.Martin (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Nucl. Data Sheets (USA), vol.37, no.2, p.289-391 (Oct. 1982).
Nuclear structure information pertaining to A=108 has been reviewed. The level properties obtained from decay and reaction experiments are shown in the drawings. Experimental methods, references, and comments are given in the text. (151 refs.)

98670 Traceable temperatures. An introductory guide to temperature measurement and calibration. J.V.Nicholas, D.R.White.
Wellington, New Zealand: Science Information Division, DSIR (1982), 226 pp. [0 477 06708 5]
This book is an introduction to temperature measurement and calibration. The concept of traceability is used to ensure that a thermometer's calibration is traced to international standards. Organisations which can assist in this are outlined. Various temperature scales are examined and the International Practical Temperature Scale (IPTS) is detailed. Mercury-in-glass thermometers, thermocouples, and platinum resistance thermometers are considered in detail and their care and the best means of calibrating them are also described. Systematic and random errors and the methods of calibration required to evaluate them are discussed. Guidance is given on how to use thermometers to avoid the most common sources of error. Some additional topics included are: thermodynamics, heat transfer, error treatment, and instrumentation for resistance measurement. Other temperature-measuring devices—thermistors, solid state detectors, radiation pyrometers, and resonance thermometers—are outlined.

Ion-implantation dense cascade data .... See Entry 101731

01.30M Textbooks for graduates and researchers

98671 AC loss and macroscopic theory of superconductors. W.J.Carr,Jr..
New York, USA: Gordon & Breach (1983), xii+158 pp. [0 677 05700 8]
The chapters of the book are arranged into three parts; part I deals with introductory material, part II with hysteresis loss in bulk superconductors and part III with multifilament conductors. An attempt has been made to establish a reasonably rigorous framework from which losses in superconductors can be calculated. Emphasis has been placed on simplicity and generality rather than on maximum accuracy for a particular problem. For this reason the London-Bean approximation is used in most of the hysteresis calculations, and for the multifilament conductor, simplifications such as constant permeability are assumed. Some of the results presented are new and untested, and may, in fact, require modification. Loss expressions are given in terms of the magnetic field applied to an individual conductor, and for such a conductor in a coil, careful analysis is required just to obtain the 'applied' field. The book does not include an extensive review of the underlying microscopic physics of superconductors. The focus is on the macroscopic description of bulk material. The principal novel feature is the use of macroscopic field theory to investigate the losses in multifilament conductors. The use of this approach reduces the problem to a solution of a set of Maxwell equations and allows the investigation of a wide range of problems which would be difficult to examine by other means. (50 refs.)

98672 Spectroscopy and excitation dynamics of condensed molecular systems. V.M.Agranovich, R.M.Hochstrasser [Ed.]
Amsterdam, Netherlands: North-Holland (1983), xvi+692 pp. [0 444 86313 3]
This volume is largely concerned with electronic and vibrational excitations having a distinctly molecular identification so that the spectroscopy has a molecular character. These molecular levels are subject to perturbations resulting from interactions amongst the molecules or between the molecules and their environment. Such properties set this class of materials apart from wider band molecular systems and conducting polymers. The subject of this compilation is therefore more concerned with fundamental processes and novel properties, than with new molecular materials. Nevertheless, the subject matter deals with the behavior of many different classes of materials, including molecular crystals, chemically and isotopically mixed crystals, and glasses. Condensed phase spectroscopy originating from the early explorations of molecular luminescence and electronic states, especially in glasses, followed by the postwar decades of experimental and theoretical study of insulating molecular crystals. But new technology has originated new directions for this field. Many of the contributions to the present volume—and indeed a large proportion of current researches in spectroscopy—are dependent on laser methods. Experiments based on lasers have resulted in measurements being made of condensed phase properties that were hitherto unknown. These include homogeneous lineshapes, inelastic interactions, coherent energy transport, quasiparticle scattering and new optical effects. The measurements have in turn stimulated new theoretical investigation especially in quantum statistical mechanics.

98673 Vacuum technology, thin films, and sputtering. An introduction. R.V.Stuart.
London, England: Academic Press (1983), viii+151 pp. [0 12 674780 6]
This book is written to provide an introduction to vacuum technology in general and the sputtering process in particular. It is written for the novice, whether lab assistant, technician, technologist, engineer, or manager, whose vocation, avocation, and interests necessitate investigating the applications of vacuum technology, thin films, and sputtering. It is expected that those for whom this book is written will have a sufficient technological orientation that their background will enable them to grasp the fundamentals in the manner in which they are presented. It is hoped that experts in the field will find this book helpful in reducing demands on their time for teaching newcomers.

98674 Size effects in thin films. C.R.Tellier, A.J.Tosser.
Amsterdam, Netherlands: Elsevier (1982), ix+310 pp. [0 444 42106 8]
The book contains four chapters concerned with how size effects in thin films affect the (i) electrical properties, (ii) galvanomagnetic properties, (iii) thermoelectric properties, and (iv) mechanical and electromechanical properties. New developments in the theory are presented and the results discussed in the light of experimental findings. Those subjects which could be of interest in the next few years are indicated: such topics include quantum size effects in semiconductors, the effect of a transverse quantizing magnetic field, the correlation between transport properties of metal films and sophisticated models of surface scattering. For any transport property simple analytical expressions are given, if they are known, since they could facilitate a rough qualitative description of the observed phenomena. The authors also attempt to point out the intrinsic limitations of the conduction models in order to avoid blind alleys when interpreting experiments. The book should be useful to those researching in the field or as a reference textbook.

98675 Charged beam interaction with solids. Y.-H.Ohtsuki.
London, England: Taylor & Francis (1983), viii+248 pp. [0 85066 239 7]
The theory of the interactions of electrons, positrons, protons and light and heavy ions with solids and solid surfaces is treated in detail. The phenomena dealt with include channelling and blocking, inelastic scattering of electrons and ions, dechannelling, the effect on the solid of impact of the charged particle and resulting effects on the particle itself, and finally the interactions of charged particles with solid surfaces. Discussion is limited to the first stages of the interactions, and the author does not therefore touch on secondary phenomena, such as secondary particle emission. The book should prove useful to a graduate beginning his or her research in the field, since quite a wide range of material is covered in detail, using mathematics not beyond undergraduate level. (392 refs.)

98676 Quantum theory of magnetism. Second corrected and updated edition. R.M.White.
Berlin, Germany: Springer-Verlag (1983), xi+282 pp. [0 387 11462 9]
The text presents a uniform treatment of the physical principles underlying magnetic phenomena in matter in the context of linear response theory. It provides the reader with a conceptual framework for understanding the wide range of magnetic phenomena as well as the relationship of magnetism to other areas of physics. Since the first edition was published in 1970 there have been numerous advances, and new phenomena have been discovered. These new developments have been incorporated into the original organization, thereby bringing the book up to date as well as indicating the generality of the approach. (186 refs.)

98677 Medical imaging systems. A.Macovski.
Englewood Cliffs, NJ, USA: Prentice-Hall (1983), xiv+256 pp. [0 13 572685 9]
This book is based on a continuously updated set of notes for a graduate course in electrical engineering. It comprises 11 chapters dealing with the following subjects: introduction; linear systems; physics of projection radiography; source considerations in radiographic imaging; recorder resolution considerations; noise considerations in radiography and fluoroscopy; tomography; nuclear medicine; basic ultrasonic imaging; ultrasonic imaging using arrays; selected topics in medical imaging. (61 refs.)

98678 Quantum theory of light. Second edition. R.Loudon.
Oxford, England: Clarendon Press (1983), xiv+393 pp. [0 19 851152 3]
With a view to providing a detailed account of the basic theory required for an understanding of the properties of light and its interaction with atoms, the book bridges the gap between the more formal development of quantum electrodynamics and the application of the theory to the explanation of experimental results written at a post-graduate level, the topics covered include; Planck's radiation law and the Einstein coefficients, quantum mechanics of the atom-radiation interaction, fluctuation properties of chaotic light, the quantised radiation field, interaction of the quantised fields with atoms, photon optics, generation and amplification of light, resonance fluorescence, light scattering and nonlinear optics. (207 refs.)

98679 Quantum processes in polar semiconductors and insulators. H.Stumpf.
Braunschweig, Germany: Vieweg (1983), 2 vol. xii+850 pp.
In this book the physics and the corresponding theory of processes and reactions of ideal and non-ideal, i.e. impure polar semiconductors and insulators are discussed and developed. In particular, binary compounds of the type I-VII and the technically interesting II-VI and III-V types are treated. Based on the quantum theoretical microscopic description of crystals as many-particle systems of electrons and nuclei, a complete deduction is given starting at the microscopic level and finally obtaining quantities which can be compared to the experiment, i.e. average equilibrium and non-equilibrium values of quantum statistical reaction kinetic quantities for combined electron, phonon, and photon processes and reactions with and without external fields. (3522 refs.)

Origin and evolution of planetary atmospheres .... See Entry 98662
Introduction to optical fibers .... See Entry 98680

01.30P Textbooks for undergraduates

98680 Introduction to optical fibers. A.H.Cherin.
New York, USA: McGraw-Hill (1983), x+326 pp. [0 07 010703 3]
The book is written at senior level undergraduate/first year graduate level and comprises 11 chapters dealing with the following subjects: introduction to optical fibres; EM theory review; basic waveguide equations (wave and ray optics); the dielectric slab waveguide; the step-index fibres; the graded-index fibre; fabrication of optical fibres; fibre measurements; packaging of optical fibres; source coupling, splices and connectors; fibre system examples.

01.30R Surveys and tutorial papers; resource letters

Thermochemical properties [of titanium, its compounds and alloys] .... See Entry 98664
Phase diagrams [of titanium alloys] .... See Entry 98665
Crystal structure and density data. I. Intermetallic compounds of titanium .... See Entry 98666
Crystal structure and density data. II. Titanium halides and chalcogenides .... See Entry 98667
Diffusion [in titanium and its alloys] .... See Entry 98668
A unified formulation of the construction of variational principles .... See Entry 98735
Some remarks on gravity and quantum mechanics .... See Entry 98903
Quantizing fourth order gravity theories .... See Entry 98908
Twenty-five years of the maximum-entropy principle .... See Entry 98933
Statistical mechanics of cellular automata .... See Entry 98935
Techniques for the measurement of forces between solids .... See Entry 99095
Nuclear magnetic double resonance: the use of difference spectroscopy .... See Entry 99142
Commercial image analysers and the characterization of microscopical images .... See Entry 99177
Sensitizer centres: formation, properties, function and efficiency .... See Entry 99210
Theory of double-jet emulsification (review) .... See Entry 99225
TEM/STEM requirements: multipurpose or specialized instruments? .... See Entry 99238
Monte Carlo computations in lattice gauge theories .... See Entry 99308
The renormalization group and critical phenomena .... See Entry 99309
The lattice gauge theory approach to quantum chromodynamics .... See Entry 99310
Quantum chromodynamics: theory and experiment .... See Entry 99415

LWR safety research at EPRI: an update ... See Entry 99698

On the coolability of degraded LWR cores ... See Entry 99699

Evaluation of events involving unplanned boron dilutions in nuclear power plants ... See Entry 99701

From accelerators to storage rings to ? ... See Entry 99917

Development of the different REQ accelerating structures and operation experience ... See Entry 100088

Intramolecular energy redistribution in polyatomic ions ... See Entry 100292

On vibrational energy localization at high levels of excitation. Vibrational excitons ... See Entry 100360

Vibrational spectra and vibrational states of simple gas-phase hydrogen-bonded dimers ... See Entry 100394

Infrared study of molecular rotation in liquids ... See Entry 100396

The determination of absolute configuration using nuclear magnetic resonance techniques ... See Entry 100425

Cluster spectroscopy ... See Entry 100472

The proton potential in short hydrogen bonds ... See Entry 100500

Phase conjugation in stimulated scattering ... See Entry 100862

Fiber-optic detectors ... See Entry 100921

Industrial applications of acoustical holography ... See Entry 100978

Shear modification of polymers ... See Entry 101163

Turbulence modeling for computational aerodynamics ... See Entry 101192

Problems in flow acoustics ... See Entry 101209

Spectroscopy and diagnostics of highly ionized plasma ... See Entry 101474

DC breakdown of ultra-high vacuum gaps ... See Entry 101487

Explosive crystallization in a-Ge and a-Si: a review ... See Entry 101559

Amorphous Si, crystallization and melting ... See Entry 101560

Interrelation of crystal structure with physical properties in complex perovskite-type oxides ... See Entry 101675

Disclinations in solids ... See Entry 101705

Fibrillation of the mixtures of crystallizable, amorphous and poorly crystalline polymers ... See Entry 101829

Point-contact electron-phonon interaction spectra of pure metals ... See Entry 101885

Diffusion of small molecules in polymers ... See Entry 102059

Friction on quantized vortices in helium II. A review ... See Entry 102087

Anisotropic superfluidity of liquid ^{3}He (fundamental theoretical notions) ... See Entry 102096

Phase relationships for adsorbed layers on surfaces ... See Entry 102143

Electronic structure of amorphous semiconductors ... See Entry 102241

Studies on electronic processes in graphite during the last decade in Japan ... See Entry 102248

Conducting polymers: solitons or not? ... See Entry 102360

The Monte Carlo method for the solution of charge transport in semiconductors with applications to covalent materials ... See Entry 102371

The quantized Hall effect ... See Entry 102440

Compositional and doping superlattices in III-V semiconductors ... See Entry 102496

Theory of magnetic superconductors ... See Entry 102560

Ferroelectric polymers ... See Entry 102827

Production of microstructures by laser pyrolysis ... See Entry 103063

Decomposition processes in Al-Zn-Mg alloys ... See Entry 103157

The metallurgy of continuous-annealed drawing-quality sheet steel ... See Entry 103173

Laser heat treatment: the state of the art ... See Entry 103182

Mechanical properties of ceramics. I. Elastic properties of ceramics ... See Entry 103194

History effects in polycrystalline BCC metals and steel subjected to rapid changes in strain rate and temperature ... See Entry 103210

Some surprising features of the plastic deformation of body-centered cubic metals and alloys ... See Entry 103227

Mechanical properties of ceramics. II. Strength and fracture of ceramics ... See Entry 103290

Mechanical properties of ceramics. III. Hardness and toughness of ceramics ... See Entry 103291

Review of neutron radiography development activities at Argonne National Laboratory ... See Entry 103455

A review of ten years of operation of the industrial neutron radiography facilities associated with the Triton reactor at the Fontenay aux Roses nuclear research center ... See Entry 103456

Beta-alumina for sodium-sulphur batteries ... See Entry 103674

Structural domains in proteins and their role in the dynamics of protein function ... See Entry 103783

Hyperthermia, immunity and metastasis ... See Entry 103793

Cerebellar stimulation for spasticity ... See Entry 103831

Potassium currents in the frog node of Ranvier ... See Entry 103839

A survey of finite element analysis in orthopedic biomechanics: the first decade ... See Entry 103919

Diagnostics with ultrasound ... See Entry 103992

Beam steering with linear arrays ... See Entry 103994

Ultrasound transducers for pulse-echo medical imaging ... See Entry 103995

Thermometry in radiofrequency hyperthermia of malignant tumours ... See Entry 104015

The significance of gravity on biological systems ... See Entry 104076

Substantiation of local hyperthermia in radiation therapy ... See Entry 104110

The treatment of scoliosis using electrical stimulation of muscle ... See Entry 104113

Control of movements by functional neuromuscular stimulation ... See Entry 104123

Control surveys ... See Entry 104170

Gravimetry ... See Entry 104171

Earth tides ... See Entry 104172

Geodetic theory ... See Entry 104173

Status of the geopotential ... See Entry 104174

Radio interferometry ... See Entry 104175

Polar motion and Earth rotation ... See Entry 104176

Satellite altimetry ... See Entry 104177

Satellite positioning ... See Entry 104178

Main field and recent secular variation ... See Entry 104211

Archaeo- and paleosecular variation, and long-term asymmetries of the geomagnetic field ... See Entry 104212

Geomagnetic reversals and excursions: their paleomagnetic record and implications for the geodynamo ... See Entry 104213

Magnetic polarity stratigraphy ... See Entry 104214

Geomagnetism of Earth's core ... See Entry 104215

Magnetic anomalies ... See Entry 104216

Paleomagnetism and the motion of large and small plates ... See Entry 104217

Electromagnetic induction studies ... See Entry 104218

Geothermal conditions of Hungary ... See Entry 104284

Crustal movement ... See Entry 104329

Spatial resolution of remotely sensed imagery. A review paper ... See Entry 104358

The physical oceanography of fjords ... See Entry 104387

Stratospheric water vapor ... See Entry 104496

A warm, equable Cretaceous: the nature of the problem ... See Entry 104553

Application of lasers in oceanographic investigations (review) ... See Entry 104604

New techniques [in geodesy] ... See Entry 104624

Recent ISEE observations of the magnetopause and low latitude boundary layer: a review ... See Entry 104677

Ionic composition of the Earth's radiation belts ... See Entry 104680

Some recent developments in the study of the elements and isotopes of the cosmic radiation ... See Entry 104697

Planetary geodesy ... See Entry 104756

New light on cold worlds ... See Entry 104797

1983d: May's surprise comet ... See Entry 104810

Magnetic flux tubes on the Sun ... See Entry 104828

Searching for black holes ... See Entry 104906

The galactic extinction of extragalactic objects. I. The csc *b* law and the extinction coefficient ... See Entry 104936

The new Milky Way ... See Entry 104967

01.30T Bibliographies

98681 **Recent publications in the area of organic conductors and related phenomena.** A.J.Hodina.
Synth. Met. (Switzerland), vol.6, no.1, p.73-98 (June 1983).
A bibliography is given of recent publications in the following areas: general organic conductors; (CH)$_x$ (polyacetylene and derivatives); TTF (tetrathiafulvalene and related compounds); TCNQ (tetracyanoquinodimethane and related compounds); TMSF (tetramethyltetraselenafulvalane and related compounds); miscellaneous charge transfer salts and complexes; one-dimensional systems; NbSe$_3$ and TaS$_3$ (niobium triselenide, tantalum trisulphide and related compounds); charge and spin density wave dynamics; graphite intercalation compounds; and other related intercalation and layered compounds. (238 refs.)

The First Dictionary of the Nomenclature of Celestial Objects (solar system excluded) ... See Entry 98663

Magnetic flux tubes on the Sun ... See Entry 104828

01.40 EDUCATION

98682 **Doing applied science in a college.** R.P.Riesz (Post-Graduate Phys. Dept., American Coll., Madurai, India).
Eur. J. Phys. (GB), vol.4, no.1, p.34-7 (1983).
The under-utilisation of educational resources including teaching staff and the physical assets of colleges is a worldwide phenomenon, which has special consequences for developing nations and other situations with limited resources. The improvement of this situation in a particular Indian college through the introduction of a non-teaching Department of Applied Science is described. The object of this department is to use the ordinary resources of the college, both in manpower and equipment, for non-tutorial purposes in the service of the community, without disturbing or threatening the tutorial role of the college and without any financial cost to the college. Other roles of such a department are described, and a method is described for extending the concept of such a department to other situations. (no refs.)

98683 **Preliminary study of operational level of University students.** M.C.D.Ure (Univ. Federal Fluminense, Niteroi, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.2, p.363-74 (June 1982). In Portuguese.
The reasonings used by elementary physics students at UFF to solve four Piagetian tasks (floating bodies, pendulum, probability and correlations) are studied through clinical interviews. These are compared to the answers given by Genevan adolescents, and the differences are examined and discussed. A rough estimate of the percentages of responses corresponding to each operatory level is obtained, for comparison to those obtained by other authors while the difficulties in interpreting them when dealing with adults are considered. (11 refs.)

98684 **Evaluation of laboratory instruction: an alternative proposal.** A.M.F.Passos (Dept. de Ciencias, Univ. Federal do Acre, Rio Branco, Brazil), M.A.Moreira.
Rev. Bras. Fis. (Brazil), vol.12, no.2, p.375-86 (June 1982). In Portuguese.
A study is described, carried out in the area of laboratory instruction in which an alternative is proposed for the evaluation of this instruction, which tries to investigate to what extent students are able to identify the physical phenomenon underlying an experiment, the method used and the answer (results) obtained for the basic question. The research findings suggest that many times the students are not able to identify these aspects which might be characterized as constituting the 'structure' of the experiment. (5 refs.)

98685 Influence of organisation of content on students' cognitive learning: a comparative study. S.S.Peduzzi (Dept. de Fisica, Univ. Federal de Santa Catarina, Florianopolis, Brazil), M.A.Moreira.
Rev. Bras. Fis. (Brazil), vol.12, no.2, p.ds387-404 (June 1982). In Portuguese.
An experiment was carried out in order to investigate possible differences, concerning student's cognitive learning, which could arise from two different approaches to the organization of the content of electricity and magnetism: one based on the learning theory of David Ausubel and the other the traditional one. The experiment was performed with students enrolled in the Physics III course of UFSC. (16 refs.)

01.50 EDUCATIONAL AIDS

98686 Atomic hydrogen and fundamental physical constants. G.W.Series (J.J. Thomson Phys. Lab., Univ. of Reading, Reading, England), D.N.Stacey.
Eur. J. Phys. (GB), vol.3, no.3, p.129-35 (1982). [received: Aug. 1983]
The authors describe techniques which allow the study in undergraduate laboratories of the spectrum of atomic hydrogen. The Rydberg constant, the electron-proton mass ratio, and the fine-structure constant are evaluated from the measurements. The key to the series of experiments is a discharge tube in which atomic lines dominate over the molecular lines. (5 refs.)

98687 A Josephson effect apparatus for the undergraduate laboratory. B.P.Allen, J.E.Whitehouse (J.J. Thomson Phys. Lab., Univ. of Reading, Reading, England).
Eur. J. Phys. (GB), vol.3, no.3, p.136-8 (1982). [received: Aug. 1983]
An apparatus to enable the observation of the Josephson effect is described. Simplifications in the construction make it suitable for use as an undergraduate laboratory experiment. The superconducting tunnel junction is formed after cooling to liquid helium temperature in an ordinary storage dewar. The conductors of a coaxial waveguide serve to draw together the two elements of the junction, which is then irradiated with X-band microwaves transmitted by the guide. Accurate determination of the microwave frequency and the voltage interval between the current steps lead to a value of e/h. (6 refs.)

98688 Use of computers in science education. H.-M.Staudenmaier (Inst. fur Anwendungen der Informatik, Univ. Karlsruhe, Karlsruhe, Germany).
Eur. J. Phys. (GB), vol.3, no.3, p.144-51 (1982). [received: Aug. 1983]
In University teaching computers have mainly been used in computer assisted instruction projects. The author presents further methods for applying computers in science education. The author's approach was to combine the teaching aims of a particular subject—e.g. physics—with aspects of computing relevant to a given application. The author developed a special course as well as two laboratories and now reports on methods and practical experiences. (27 refs.)

98689 On the stability of the hydrogen atom. G.Sauer (Liebig-Schule, Giessen, Germany), W.Kuhn.
Eur. J. Phys. (GB), vol.3, no.3, p.155-8 (1982). [received: Aug. 1983]
Reference to the solution of the Schrodinger equation does not give much physical insight into the problem of stability because it is far from obvious how the conclusion follows from the equation. The common arguments derived from the Heisenberg uncertainty principle are not sufficient to establish the existence of a stable ground state. The proof for a lower bound of the hydrogen hamiltonian may be recast into physical terms by introducing an effective localisation potential. (6 refs.)

98690 Beware of surface tension!. E.Guyon, J.Prost (Lab. d'Hydrodynamique et de Mecanique Phys., Paris, France), C.Betrencourt, C.Boulet, B.Volochine.
Eur. J. Phys. (GB), vol.3, no.3, p.159-68 (1982). [received: Aug. 1983]
Interfacial phenomena play such a crucial role in life processes that the teaching of them must be an essential part of undergraduate programmes in life sciences. However, the role of interfacial tension, seen as a force per unit length of the separation perimeter between different media, is not always clearly seen in this teaching. The authors illustrate the difficulties by considering several problems of radial symmetry, in particular that of a liquid drop laid down on a solid plane or on top of an immiscible liquid, the role of gravity being taken into account. In addition to the boundary condition at the rim of the drop (the classical Young's relation), the balance between the Laplace and the hydrostatic force over the surfaces can be expressed as a condition at the perimeter which should not be confused with the previous condition. The confusion is the cause of unsatisfactory derivations of relations such as capillary ascent in a tube (Jurin's formula). (14 refs.)

98691 A model of the eye for use in medical education. J.Dekker, J.Steketee, G.S.A.M.van de Ven (Dept. of Biological & Medical Phys., Erasmus Univ. Rotterdam, Rotterdam, Netherlands).
Eur. J. Phys. (GB), vol.3, no.3, p.169-73 (1982). [received: Aug. 1983]
A model simulating the operation of the human eye has been constructed for use in a practical medical physics course. The following experiments carried out with the aid of this model are described: (i) Refractive power measurements to determine whether the eye is myopic or hypermetropic, calculation of the refractive power of the lens needed to correct this condition if present and testing of the lens prescribed in this way. (ii) Accommodation measurements. (iii) Simulation of the surgical removal of the crystalline lens of the eye which is often necessary in the treatment of cataract, and calculation of: (*a*) the power of the lens to be implanted in the eye to correct this aphakia, or (*b*) the power of the lens needed to correct the aphakia if no lens is implanted; and testing of the prescribed lenses. (iv) Demonstration of the effect of pupil diameter on depth of focus. (v) Demonstration of the influence of ocular opacity—caused e.g. by cataract—on the sharpness of the image on the retina. (no refs.)

98692 Implicit meanings in physics: students and constants. L.Viennot (Lab. de Didactique de la Phys., Univ. Paris VII, Paris, France).
Eur. J. Phys. (GB), vol.3, no.3, p.174-80 (1982). [received: Aug. 1983]
Statements with implicit meanings are often used in physics. The paper deals with the importance and the possible consequences of such a practice, in the specific realm of constants. The question in fact is what meanings are triggered by common statements containing the word 'constant' and the ensuing difficulties which result. The word 'constant' may evoke a range of meanings with the two following notions at each end: number, the essential being its numerical value; and a constant function of certain variables, the important thing now being the listing of these variables. In this way constants appear as a particular aspect of functions of several variables. The results of an investigation among French and Belgian students at the beginning of their studies at University are reported and analysed. The usual interpretation of the word 'constant' is biased towards the numerical aspect of this notion, at the expense of its functional meaning. Lastly a plea follows for using excercises of 'text criticism' as pedagogical tools in teaching. (3 refs.)

98693 On the mathematical uniqueness of Minkowski space. P.J.Lemos (Dept. of Phys., North Texas State Univ., Denton, TX, USA).
Eur. J. Phys. (GB), vol.4, no.1, p.1-2 (1983).
By using the formalism of Real Clifford Algebras, it is shown that the largest number of dimensions N for which a vector space $\mathbf{V}_{NQ}$ ($Q=+1$ or -1) over the Reals (i.e. one that has a Clifford Algebra $\mathbf{C}_{NQ}$ with pseudoscalar i satisfying $i^2=Q$) gives a unique geometry is $N=4$ with corresponding $Q=-1$. Moreover, the uniquely defined geometry is the one given by the Minkowski metric. (6 refs.)

98694 On the phases of atomic eigenfunctions. M.A.B.Whitaker (New Univ. of Ulster, Coleraine, N Ireland).
Eur. J. Phys. (GB), vol.4, no.1, p.3-4 (1983).
Attention is drawn to the fact that in a number of recent books the relative phases of the given spherical harmonics are not such as will lead to the commonly accepted matrices for quantities such as I_x. Some historical discussion is added. (12 refs.)

98695 Dirac-bracket quantisation of a constrained nonlinear system: the rigid rotator. N.K.Falck, A.C.Hirshfeld (Inst. fur Phys., Univ. Dortmund, Dortmund, Germany).
Eur. J. Phys. (GB), vol.4, no.1, p.5-9 (1983).
The authors discuss the Dirac-bracket quantisation procedure for the nonrelativistic rigid rotator. In cartesian coordinates this system exhibits two important features which are also characteristic of the nonabelian gauge theories, it is constrained, and nonlinear. By comparing to the known solution in polar coordinates the author demonstrate that simple hermiticity conditions are sufficient to allow the unambiguous application of the Dirac quantisation method to such nonlinear dynamical systems. (11 refs.)

98696 Volcanoes on Io. L.M.Celnikier (Lab. d'Astron., Univ. Pierre et Marie Curie, Paris, France).
Eur. J. Phys. (GB), vol.4, no.1, p.10-15 (1983).
The tidal forcing phenomenon used to predict the existence of volcanic activity on Io, is treated from a very simple point of view which nevertheless reproduces to a sufficient accuracy the final conclusions of the prediction, while highlighting the essential physical processes involved. (11 refs.)

98697 Angular momentum in quantum mechanics as a group study topic. W.E.Burcham, M.Jobes (Dept. of Phys., Univ. of Birmingham, Birmingham, England).
Eur. J. Phys. (GB), vol.4, no.1, p.16-23 (1983).
A largely practical approach to the teaching of angular momentum in quantum mechanics at the undergraduate level is described. In an intensive seven week period towards the end of their final year, under-graduates working in pairs perform experiments in nuclear physics which demonstrate some of the important properties of angular momentum. Three experiments are selected and discussed in this article to illustrate the teaching method. The existence of intrinsic spin and parity is investigated by measuring the polarisation of annihilation radiation; the conservation of angular momentum is demonstrated by a measurement of orbital angular momentum in a nucleon transfer reaction and the coupling of angular momenta is illustrated by the method of angular correlation. (12 refs.)

98698 A dynamic model for the demonstration of planetary motions or 'celestial mechanics on the desk'. L.S.Toth (Inst. for General Phys., Eotvos Univ., Budapest, Hungary), A.Bardocz.
Eur. J. Phys. (GB), vol.4, no.1, p.24-33 (1983).
A dynamic model for the demonstration of planetary motion is described. It is a rubber membrane strained on a ring and pulled down in its middle. The 'planets' of the model are small balls moving on the rubber surface. The force acting on the balls is inversely proportional to the distance from the centre so only Kepler's second law is valid for the motion of the balls. The velocity hodograph of the Kepler motion is analysed theoretically and experimentally. The phenomenon of the perturbation of the real planet's motion is modelled, too, with the help of a somewhat bigger ball which also deforms the rubber-surface in its neighbourhood. All the essential cases of the perturbation are modelled, as is the special case: the motion in the Lagrangian-5 resonance point. (1 ref.)

98699 Analogue solutions of linear programs. J.N.Boyd, P.N.Raychowdhury (Dept. of Math. Sci., Virginia Commonwealth Univ., Richmond, VA, USA).
Eur. J. Phys. (GB), vol.4, no.1, p.38-41 (1983).
The general linear program with all variables non-negative is modelled with a circuit of batteries, resistors, voltmeters, and ammeters. From this model, a general analogue solution of the linear program follows. A specific example is taken from game theory. It is suggested that use of analogue techniques may be useful in examining changes in program solutions as the constraints of the problem are varied. (5 refs.)

98700 Quick and easy measurement of the band gap in semiconductors. Y.Canivez (Service de Phys. du Solide, Univ. de l'Etat, Mons, Belgium).
Eur. J. Phys. (GB), vol.4, no.1, p.42-4 (1983).
A simple method for measuring band gap in semiconductors is described, involving transport measurement in a p-n junction. Fairly accurate results are given for germanium, silicon and gallium arsenide. (6 refs.)

98701 Nonlinear optical experiments with solid-state lasers. I.S.Ruddock, G.Scott (Dept. of Natural Philosophy, Univ. of Strathclyde, Glasgow, Scotland).
Eur. J. Phys. (GB), vol.4, no.1, p.45-7 (1983).
A low cost method of recording data in undergraduate experiments employing single-shot solid-state lasers is described. It is demonstrated by its use in the study of optical phase conjugation. (6 refs.)

98702 Magnetic field measurements near a steel plate. L.Kristjansson (Sci. Inst., Univ. of Iceland, Reykjavik, Iceland).
Eur. J. Phys. (GB), vol.4, no.1, p.48-52 (1983).
Measurement of the components of the magnetic field caused by the edge of a large steel plate, provides a simple introduction to the study of potential fields. Results can be compared quantitatively to theoretical derivations. This experiment is particularly useful in geophysics instruction. (2 refs.)

98703 Thermodynamics of stability of nonequilibrium steady states. R.P.Rastogi, Ram Shabd (Gorakhpur Univ., Gorakhpur, India).
J. Chem. Educ. (USA), vol.60, no.7, p.540-5 (July 1983).
Thermodynamic theory of the stability of equilibrium states is well established and good accounts are available in standard textbooks. The stability of nonequilibrium states is of considerable current interest in view of its application to oscillatory processes, limit cycle behavior, and bifurcation phenomena. The thermodynamic theory of stability is well advanced. The purpose of the article is to present a concise and critical account of this important development in nonequilibrium thermodynamics. The criterion for the stability of nonequilibrium steady states has been critically examined for consecutive and monomolecular triangular reactions, autocatalytic reactions, auto-inhibited reactions, and the Lotka-Volterra model. (19 refs.)

98704 External weighing with analytical balances: determination of magnetic susceptibility of inorganic compounds. H.E.Toma, A.M.C.Ferreira, V.K.Lakatos Osorio (Inst. de Quimica, Univ. de Sao Paulo, Sao Paulo, Brazil).
J. Chem. Educ. (USA), vol.60, no.7, p.600-1 (July 1983).
Recently, Eaton and Eaton (1979) have reported a way of working with magnetic susceptibility determination, without changing the functional aspects of a standard analytical balance. Their procedure consists essentially in using small, strong permanent magnets as the weighing body placed directly on the pan, while the sample under investigation is kept suspended by a fixed holder. The paper describes another approach, which has proved highly efficient in providing accurate weighings under circumstances where the sample cannot be placed directly on the balance pan. The approach is based on external weighing, and uses a new, simple apparatus which may be designed for any kind of analytical balance. It has the advantage of not requiring a hole through the base of the balance, as in previous work employing external weighing. (14 refs.)

98705 An inexpensive high pressure optical absorption cell for IR-VIS-UV studies. V.E.Rodgers, C.A.Angell (Purdue Univ., West Lafayette, IN, USA).
J. Chem. Educ. (USA), vol.60, no.7, p.602-4 (July 1983).
Describes an optical cell suitable for high pressure studies between at least −130°C and +150°C which can be assembled for about $50.00 and which is simple to use. (12 refs.)

98706 Two readily-constructed instruments for the teaching laboratory (colorimeter and polarimeter). N.S.Isaacs (Univ. of Reading, Reading, England).
J. Chem. Educ. (USA), vol.60, no.7, p.607-10 (July 1983).
The perennial problem of providing reliable instrumentation in the teaching laboratory on a diminishing budget is seldom solved by the substitution of cheaper models since their performance may be inadequate for the experiments to be performed. The author reports designs for a colorimeter (absorptiometer) and for a polarimeter both of which may be constructed readily with average workshop facilities. Both use light emitting diodes as light sources of various wavelength and photoresistors as the active light receptors, these components being both inexpensive and rugged. Stability and reproducibility are ensured by the use of the double beam principle. The principles of each instrument may be readily understood by the students who use them. (no refs.)

98707 Preparation of polarising sheets. V.R.Dumke, G.Woehl,Jr. (Centro Politecnico Univ. Federal do Parana, Curitiba, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.2, p.405-10 (June 1982).
The purpose of the work is to indicate a process for obtaining polarizing sheets in teaching laboratories, increasing the possibilities of experiments and, in some cases, reconditioning damaged equipment. (5 refs.)

98708 On-line computer demonstrations in a visual perception class. M.W.Vernoy (Univ. of California, Irvine, CA, USA).
1982 Western Educational Computing Conference and Trade Show, San Diego, CA, USA, 18-19 Nov. 1982 (CA, USA: California Educ. Comput. Consortium 1982), p.98-102
Several different on-line computer demonstrations for use in a visual perception class are discussed. Included are demonstrations involving such topics as color vision, psychophysical methods, shape constancy, visual information processing and geometrical illusions. Similar demonstrations could be used in many types of science classes. Off-line uses of the materials generated by these programs is also discussed. (6 refs.)

01.60 BIOGRAPHICAL, HISTORICAL, AND PERSONAL NOTES

98709 Abbe's error. J.Rienitz (Inst. of Sci. Microscopy, Univ. of Tubingen, Tubingen, Germany).
Microsc. Acta (Germany), vol.87, no.3, p.335-52 (May 1983).
Up to the present it is considered as one of Abbe's major achievements to have found out a fundamental difference in the image formation of self-luminous and illuminated objects. This idea of Abbe is, however, erroneous. The author first sketches the relevant findings before Abbe. Then some ideas of Abbe as well as his error are described and the latter is refuted. It follows that Abbe's diffraction experiments, originally intended to support the Abbe theory of image formation of illuminated objects, can be interpreted by means of aperture diffraction which Abbe merely conceded to self-luminous objects. Thus aperture diffraction on the one hand and the Abbe manner of consideration on the other are, if the distribution of coherence is considered, two different but completely equivalent manners of representation of the image formation in the microscope. (22 refs.)

Scattering electrons in Budapest (and elsewhere) .... See Entry 98714

01.65 HISTORY OF SCIENCE

98710 Advances in quantum molecular sciences—a tribute to Kenichi Fukui. P.-O.Lowdin (Dept. of Quantum Chem., Uppsala Univ., Uppsala, Sweden).
THEOCHEM (Netherlands), vol.12, p.3-24 (Aug. 1983).
The authors presents a brief historical survey of the development of various concepts in chemistry which has led to the establishment of modern theoretical chemistry and particularly quantum chemistry—to which Professor Fukui has contributed so much. (no refs.)

98711 The Universe from $<10^{-36}$ second to $>10^{30}$ years. II. M.J.Rees (Inst. of Astron., Univ. of Cambridge, Cambridge, England).
Curr. Sci. (India), vol.52, no.11, p.509-17 (5 June 1983).
For pt.I see ibid., vol.20, p.443 (1983). The author traces the history of scientific cosmology and expounds his ideas on various aspects of the Universe, viz. the 'observable Universe', the ultra-early Universe, the far future: 'unseen mass', fine tuning and the anthropic principle. (18 refs.)

98712 The equation of state for solids 1843-1926. E.Mendoza (Dept. of Sci. Teaching, Hebrew Univ., Jerusalem, Israel).
Eur. J. Phys. (GB), vol.3, no.3, p.181-7 (1982). [received: Aug. 1983]
The equation of state for solids was published by Gruneisen in 1926; however it had a long and chequered history before that. A closely similar equation was first written down as early as 1843 on theoretical grounds—where it must be understood that the theories were those prevailing at the time and the mathematical methods were those then acceptable among physicists. The basis was the plausible idea that forces produced by heat (or caloric) were identical with mechanical forces, so that in all metals the thermal expansion coefficient should be proportional to Young's modulus. When the problem was tackled again in the present century, the theoretical model assumed that the law of force between atoms in metals was universal. Only when Gruneisen came to write his third paper was the equation fully understood. (24 refs.)

98713 The inhabitants of the Earth are always burning things. I.J.Murgatroyd (Christ's Coll., Cambridge, England).
Eur. J. Phys. (GB), vol.3, no.3, p.188-90 (1982). [received: Aug. 1983]
A third-year undergraduate's essay written as part of the final honours examinations in science at Cambridge University is presented. It describes the history of the use of combustion by the human race, from the discovery of fire to the development of fusion power. This brief survey is presented in the form of a field report from an extraterrestrial being from Capella II written for the Journal of Applied Psychology of that planet. (no refs.)

98714 Scattering electrons in Budapest (and elsewhere). I.Hargittai (Dept. of Structural Studies, Hungarian Acad. of Sci., Budapest, Hungary).
J. Mol. Struct. (Netherlands), vol.100, p.129-42 (July 1983).
Some of the recent research of the Budapest Electron Diffraction Group is described in anecdotal-historical perspective. The importance of international cooperation is emphasized. (31 refs.)

Development and status of MINDO/3 and MNDO .... See Entry 100263

01.75 SCIENCE AND SOCIETY

98715 FTIR in the service of art conservation. J.C.Shearer (J. Shearer Consulting Inc., Rochester, NY, USA), D.C.Peters, G.Hoepiner, T.Newton.
Anal. Chem. (USA), vol.55, no.8, p.874a-80a (July 1983).
The advent of Fourier transform infrared spectroscopy allows quick analysis of nanogram-size samples with little sample preparation at a reasonable cost. (14 refs.)

02.00 MATHEMATICAL METHODS IN PHYSICS

02.10 ALGEBRA, SET THEORY, AND GRAPH THEORY

98716 Tensor conditions for algebraic spinors. P.R.Holland (Dept. of Phys., Birkbeck Coll., London, England).
J. Phys. A (GB), vol.16, no.11, p.2363-74 (1 Aug. 1983).
The spinor may be defined as an element of a minimal ideal (primitive element) in a Clifford algebra. The author poses the question: what are the necessary and sufficient covariant conditions to be imposed on the antisymmetric tensors of a Clifford number such that it is primitive? The solution to this problem is illustrated for the case of the real Pauli algebra. Special cases of the conditions yield the non-relativistic two-component spinors in spin space and spinor-tensor relations given by previous writers. (31 refs.)

98717 Maximal Abelian subalgebras of real and complex symplectic Lie algebras. J.Patera, P.Winternitz, H.Zassenhaus (Centre de Recherche de Math. Appliquees, Univ. de Montreal, Montreal, Quebec, Canada).
J. Math. Phys. (USA), vol.24, no.8, p.1973-85 (Aug. 1983).
The authors provide guidelines for classifying maximal Abelian subalgebras (MASAs) of the symplectic Lie algebras $sp(2n, \mathbf{R})$ and $sp(2n, \mathbf{C})$ into conjugacy classes under the Lie groups $\mathrm{Sp}(2n, \mathbf{R})$ and $\mathrm{Sp}(2n, \mathbf{C})$, respectively. The task of classifying all MASAs is reduced to the classification of orthogonally indecomposable (OID) MASAs. Two types of orthogonally indecomposable MASAs of $sp(2n, \mathbf{C})$ exist: 1. Indecomposable maximal Abelian nilpotent subalgebras (MANSs). 2. Decomposable MASAs [their classification reduces to a classification of MANSs of $sl(n, \mathbf{C})$]. Four types of orthogonally indecomposable MASAs of $sp(2n, \mathbf{R})$ exist: 1. Absolutely indecomposable MASAs (MANSs). 2. Relatively indecomposable MASAs [their classification reduces to a classification of MANSs of $su(p,q)$ for $p+q=n$]. 3. Decomposable absolutely OID MASAs [involving MANSs of $sl(n, \mathbf{R})$]. 4. Decomposable relatively OID MASAs [involving MANSs of $sl(n/2, \mathbf{C})$, for n even]. Low-dimensional cases of $sp(2n,F)$ ($n=1, 2, 3$, $F=\mathbf{R}$ or $\mathbf{C}$) are treated exhaustively. The algebras $sp(2,\mathbf{R})$, $sp(4,\mathbf{R})$, $sp(6,\mathbf{R})$ have 3, 10, and 30 classes of MASAs, respectively; $sp(2,\mathbf{C})$, $\mathrm{sp}(4,\mathbf{C})$, and $sp(6,\mathbf{C})$ have 2, 5, and 14 classes of MASAs, respectively. For $n \geq 4$ infinitely many classes of MASAs exist. (38 refs.)

Proceedings of the Conference on Mathematical Analysis and Applications .... See Entry 98633

Normal form and representation theory .... See Entry 98746

Quantum set theory .... See Entry 98794

On the nodal behaviour of eigenfunctions .... See Entry 98833

Indefinite-metric quantum field theory of general relativity. XVI. Extension of tensorlike commutation relations .... See Entry 98899

On some Gaussian ensembles of Hermitian matrices .... See Entry 98956

Singular behaviour of certain infinite products of random 2×2 matrices .... See Entry 99014

A new approach to the dynamic analysis of structures using fixed frequency dynamic stiffness matrices .... See Entry 101036

Eigenvalue approach to the longitudinal vibration of a circular cylinder coupled with a thermal field .... See Entry 101121

Rotational dynamics with geometric algebra .... See Entry 104710

Celestial mechanics with geometric algebra .... See Entry 104711

Geometry of spinor regularization .... See Entry 104712

02.20 GROUP THEORY

(for algebraic methods in quantum mechanics, see 03.65; for symmetries in elementary particle physics, see 11.30)

98718 Symmetry properties of direct sum systems. D.J.Newman (Dept. of Phys., Univ. of Hong Kong, Hong Kong).
J. Phys. A (GB), vol.16, no.11, p.2375-87 (1 Aug. 1983).
An interpretation of double coset decompositions of groups is given in terms of the construction of systems from similar disjoint subsystems. A natural labelling scheme is developed for the direct product states of systems of this type, providing an extension of the concept of unique labelling. An application of the decoupling transformation to finite direct sum systems is investigated. (21 refs.)

98719 A generalized imprimitivity theorem for a class of POV-measures. S.Twareque Ali (Dept. of Maths., Concordia Univ., Montreal, Quebec, Canada).
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.492-4
The author discusses some recently obtained results on the problem of generalizing the imprimitivity theorem of Mackey (1949), to the case where the underlying projection valued measure is replaced by a commutative positive operator valued (POV) measure. A possible extension of the group representation to a K-space is also discussed. (5 refs.)

98720 Inversions in twistor space. P.M.van den Broek (Dept. of Appl. Maths., Twente Univ. of Technol., Enschede, Netherlands).
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.495-6
Twistor space T is equal to T^4 with Hermitian form $\langle KL,L'\rangle=L_0L_2'+L_1L_3'+L_2L_0'+L_3L_1'$. Elements of T are called twistors; the rays of T, called projective twistors, form projective twistor space PT. If $L\in T$ and $L\neq O$ one denotes by L the projective twistor with $L\in \mathit{L}$. If $\langle L,L'\rangle=0$ for each $L\in\mathit{L}$ and each $L'\in\mathit{L}'$ then L and L' are said to be orthogonal. Projective twistors correspond to congruences of null lines in compactified Minkowski space. Let C be the conformal group; C has the coset decomposition $C=C_o+pC_o+tC_o+ptC_o$ where C_o is the restricted conformal group, p denotes space inversion and t denotes time inversion. C is isomorphic to the group of transformations of PT which preserve orthogonality; the action of C on PT provides an explicit realisation of this isomorphism. To each transformation of PT which preserves orthogonality there corresponds a unique ray of semilinear transformations (ROST) of T_o. (3 refs.)

98721 Physical group theory and Euclidean space. H.Venables (Portsmouth Polytech., Portsmouth, England).
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.497-8
An outline is given of the considerations involved in using group elements in place of Euclidean space. (1 ref.)

98722 Some aspects of random walks on groups. P.W.Kasteleyn (Inst.-Lorentz voor Theoretische Natuurkunde, Leiden, Netherlands).
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.499-512
The author is concerned with random walks on countable groups. After the introduction of the main concepts three special subjects are treated: random walks on free groups with a finite number of generators, random walks on certain non-abelian extensions of the additive groups Z^d and random walks on groups with a stochastic colouring. (15 refs.)

98723 Self-triality in statistical mechanics and field theory. R.Shankar (J.W. Gibbs Lab., Yale Univ., New Haven, CT, USA).
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.534-40
The author presents a system which exhibits self-triality, a natural extension of the Kramers-Wannier self-duality. There are three complete sets of variables ψ, R and L for describing the system. Any two are disorder variables with respect to the third and the Hamiltonian has the same form when expressed in terms of ψ, R or L. (11 refs.)

Maximal Abelian subalgebras of real and complex symplectic Lie algebras .... See Entry 98717

Renormalization of non-analytical unimodal maps .... See Entry 98729

On integrability of quadratic area preserving mappings in the plane .... See Entry 98730

Normal form and representation theory .... See Entry 98746

Construction of integrable systems by dressing a free motion with a potential .... See Entry 98749

Symmetries of finite hard rod systems .... See Entry 98758

Clebsch-Gordan coefficients of the SU_3 group that satisfy boundary conditions .... See Entry 98852

Analysis of comparison of different ways of identification of spin functions variables .... See Entry 98858

On the algebraic properties of the Luttinger model .... See Entry 98859

A constructive-axiomatic approach to the Lie structure in general spacetime by the principle of approximative reproducibility .... See Entry 98871

Gauge invariance in the strong coupling BCS-model .... See Entry 98947

Functional renormalization-group theory of universal $1/f$ noise in dynamic systems .... See Entry 98970

Ising model on finitely presented groups .... See Entry 99035

Dynamic groups and coexistence phenomena .... See Entry 99069

Group contraction and macroscopic quantum systems .... See Entry 99332

A property of the structure constants of finite dimensional compact simple Lie algebras .... See Entry 99355

Kronecker product of Sp(2*n*) representations using generalised Young tableaux .... See Entry 99356

Octonionic description of exceptional Lie superalgebras .... See Entry 99359

SU(3) in an O(3) basis: eigenvalue spectrum of the Q_1^0 and O_1^0 operators .... See Entry 99365

SU(4) in an SO(4) basis: shift operator technique .... See Entry 99366

Branching rules and even-dimensional rotation groups SO_{2k} .... See Entry 99378

Remarks on the renormalization group in statistical fluid dynamics .... See Entry 101172

Simple criteria for the existence of Cochran cyclotomic sets .... See Entry 101613

Geometry of spinor regularization .... See Entry 104712

02.30 FUNCTION THEORY, ANALYSIS

98724 The development of bivariational principles for the calculation of upper and lower bounds. D.C.Pack (Dept. of Math., Univ. of Strathclyde, Glasgow, Scotland).
Arch. Mech. (Poland), vol.34, no.3, p.275-85 (1982).
Shows how complementary bivariational principles for the calculation of upper and lower bounds to inner products involving the solution of equations of the type $Tf=f_0$ may be developed from simple basic ideas. These are illustrated in detail for the case when T is a linear self-adjoint operator in a real Hilbert space, and the method of extension of the ideas to non-self-adjoint and, finally, to nonlinear operators is shown, with examples of formulae at present available for practical use. (16 refs.)

98725 A new interpolation formula in the form of a continued fraction. B.Michalik (Inst. of Phys., Czechoslovak Acad. Sci., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.7, p.713-19 (1983).
An interpolation formula in the form of a continued fraction is derived. In the limit case, when the table points are equal, it turns into an expansion of the function into a fraction near the point. The formula can be a useful tool for interpolating singular functions. As an application, a series of methods for solving nonlinear equations is derived, the first two of them being identical with the methods of Halley and Kiss. (5 refs.)

98726 Nonlinear transformations and integrable evolution equations. B.G.Konopelchenko (Inst. of Nuclear Phys., Novosibirsk, USSR).
Fortschr. Phys. (Germany), vol.31, no.5, p.253-96 (1983).
The transformation properties of the partial differential equations integrable by the inverse scattering transform method are considered. It is shown that the nonlinear transformations characteristic to the integrable equations (symmetry groups, Backlund-transformations) and integrable equations themselves are contained in certain universal nonlinear transformations group which is defined by linear spectral problem. (96 refs.)

98727 Symmetries of differential equations. IV.. F.Gonzalez-Gascon (Dept. de Fisica Teorica, Univ. de Salamanca, Salamanca, Spain), A.Gonzalez-Lopez.
J. Math. Phys. (USA), vol.24, no.8, p.2006-21 (Aug. 1983).
For pt.III see Hadronic J., vol.3, p.1457 (1980). By an application of the geometrical techniques of Lie (1971), Cohen (1911), and Dickson (1924), it is shown that a system of differential equations of the form $x_i^{(r_i}=F_i$ (where $r_i>1$ for every $i=1,\ldots,n$, upper bounds have been computed for the maximum number of independent symmetry vectors that these systems can possess: the upper bounds are given by $2n^2+nr+2$ (when $r>2$), and by $2n^2+4n+2$ (when $r=2$). The group of symmetries of $\bar{x}^{(r}=\bar{0}(r>1)$ has also been computed, and the result obtained shows that when $n>1$ and $r>2$ the number of independent symmetries of these equations does not attain the upper bound $2n^2+nr+2$, which is a common bound for all systems of differential equations of the form $\bar{x}^{(r}=\bar{F}(t,\bar{x},\ldots,\bar{x}^{(r-1)})$ when $r>2$. On the other hand, when $r=2$ the first upper bound obtained has been reduced to the value n^2+4n+3; this number is equal to the number of independent symmetry vectors of the system $d\ddot{x}/dt^2=\bar{0}$, and is also a common bound for all systems of the form $d\ddot{x}/dt^2=F(t,\bar{x},d\dot{x}/dt)$. (13 refs.)

98728 Some oscillation theory. W.Leighton (Dept. of Math., Univ. of Missouri, Columbia, MO, USA).
Z. Angew. Math. & Mech. (Germany), vol.63, no.7, p.303-15 (1983).
In the first section the author extends an interesting result due to Nehari (1957) and develops some related ideas. The remainder has principally to do with sufficient conditions for oscillation of solutions of differential equations of the form $y''+p(x)y=0$, where $p(x)$ is at least piecewise continuous on $I:[a,\infty)$ and changes sign infinitely often in I. In the last section, however, some earlier results of the author on focal and σ-points are extended. (19 refs.)

98729 Renormalization of non-analytical unimodal maps. M.Cosnard, A.Eberhard (Lab. IMAG, Grenoble, France).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.262-3
Let U be the set of unimodal continuous selfmaps of $[-1,+1]$. The renormalization operator R is a map from a part V of U in U defined as follows: let f be in V and $\alpha=-f(1)$, $\mathrm{V}x\epsilon[-1,+1]$, $Rf(x)=-{}^1/_\alpha f^2(-\alpha x)$. The authors purpose is to study the properties of R applied to particular subsets of U and to show the differences with Feigenbaum theory of the analytical case. (5 refs.)

98730 On integrability of quadratic area preserving mappings in the plane. E.Fontich (Univ., Politecnica de Barcelona, Barcelona, Spain).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.270-1 (4 refs.)

Proceedings of the Conference on Mathematical Analysis and Applications .... See Entry 98633

On the integrability of some generalized Lotka-Volterra systems .... See Entry 98750

Exact solution for a class of integral equations of mixed boundary-value problems of elasticity and mathematical physics .... See Entry 98771

Connection between the existence of bisolitons for quadratic nonlinearities and a factorization of the associate linear operator .... See Entry 98779

Qualitative theory of stochastic differential equations and quantum mechanics of disordered systems .... See Entry 98802

On a new hierarchy of Hamiltonian soliton equations .... See Entry 98817

Measure for measure: covariant skeletonizations of phase space path integrals for systems moving on Riemannian manifolds .... See Entry 98820

Liouvillian Green's functions and self-energies for energy-shift and decay phenomena .... See Entry 98844

Integral representations and addition theorems for product of confluent hypergeometric functions derived by Green's function .... See Entry 98847

Green's functions, states and renormalisation .... See Entry 98909

The asymptotic evaluation of a class of path integrals. II. .... See Entry 98958

Functional renormalization-group theory of universal $1/f$ noise in dynamic systems .... See Entry 98970

Entropy and smooth dynamics .... See Entry 98981

Strange attractors for differential delay equations .... See Entry 98983

Solutions of stochastic differential equations and fractal trajectories .... See Entry 98985

Non-linear mechanics of a string in a viscous noisy environment .... See Entry 99000

Darboux transformations for non-Abelian and nonlocal equations of the Toda chain type .... See Entry 99034

Systematic method for solving transport equations derived from master equations .... See Entry 99049

Functional methods .... See Entry 99269

Application of inverse scattering method to singular solutions of nonlinear equations. I .... See Entry 99320

Complete valence-shell ionization spectra of N_2 and CO: application of the extended two-particle-hole Tamm-Dancoff approximation (2ph-TDA) .... See Entry 100234

Application of the asymptotic Green's-function approximation to e^--H scattering ...... See Entry 100570

On the Abel transformation in the problem of diffraction by a thin strip ...... See Entry 100642

A characterization of the range of the divergent beam X-ray transform ...... See Entry 100644

Introduction to two-dimensional Fourier analysis ...... See Entry 100668

A solvable master equation for population inversion ...... See Entry 100719

Elastic property anisotropy dependence of fibre composite material on its structure ...... See Entry 101035

A class of biharmonic end-strip problems arising in elasticity and Stokes flow ...... See Entry 101050

A twelfth order theory of transverse bending of transversely isotropic plates ...... See Entry 101089

Some observations on boundary conditions for the shallow-water equations in two space dimensions ...... See Entry 101258

On Volterra's boundary value problem for axial-symmetric flows with free surfaces in porous media ...... See Entry 101328

Coupling between ECRH-driven and ohmic plasma currents .. See Entry 101441

Linear stability analysis of double-diffusive solar pond ...... See Entry 103715

Application of two-dimensional Fourier transforms to problems of visual perception ...... See Entry 103857

An approximate solution to the equation $\epsilon XY(dY/dX)=X-Y(Y+1)$ ...... See Entry 104848

02.40 GEOMETRY, DIFFERENTIAL GEOMETRY, AND TOPOLOGY

(see also 04. Relativity and gravitation)

On the mathematical uniqueness of Minkowski space ...... See Entry 98693

Renormalization of non-analytical unimodal maps ...... See Entry 98729

On integrability of quadratic area preserving mappings in the plane ...... See Entry 98730

On the interaction of quantum spinor fields with extended objects ...... See Entry 98863

Cauchy problem for the Einstein equations. III ...... See Entry 98887

Magnetic monopole in the general theory of relativity ...... See Entry 98898

Axially symmetric gauge fields of magnetic monopoles ...... See Entry 99290

Geometric aspects of supersymmetry and quantisation of fermions ...... See Entry 99357

The exact $q\bar{q}$ potential in Nambu string theory ...... See Entry 99438

Topology of the electronic current density in molecules ...... See Entry 100222

02.50 PROBABILITY THEORY, STOCHASTIC PROCESSES, AND STATISTICS

(see also 05. Statistical physics)

98731 On the foundations of the physical probability concept. A.Harkamper, H.-J.Schmidt (Fachbereich Phys., Univ. Osnabruck, Osnabruck, Germany).
Found. Phys. (USA), vol.13, no.7, p.655-7 (July 1983).
An exact formulation of the frequency interpretation of probability is proposed on the basis of Ludwig's concept (1970, 1978) of physical theories. Starting from a short outline of this concept, a formal definition of weak approximate reduction is developed, which covers the reduction of probability to frequency as a special case. (21 refs.)

98732 Chaotic modulation of correlation functions. T.Nagashima, H.Haken (Inst. fur Theoretische Phys., Univ. Stuttgart, Stuttgart, Germany).
Phys. Lett. A (Netherlands), vol.96A, no.8, p.385-8 (25 July 1983).
For a certain family of 1-D maps, the temporal development of autocorrelation functions is analyzed exactly. A qualitatively new feature—chaotic modulation—of the correlation function is reported. (6 refs.)

98733 The nature and correlation of random distributions. R.A.Bagnold.
Proc. R. Soc. London Ser. A (GB), vol.388, no.1795, p.273-91 (8 Aug. 1983).
The ordered patterns of random distributions in many different fields are examined from the viewpoint of an experimental physicist relying on measured facts. By reversing the traditional graphics, that is, by plotting logarithm of frequency against an additive variate scale, the complete pattern can be traced with far greater discrimination. No indisputable evidence has so far been found for the existence of the Gaussian or 'normal' distribution. The general pattern appears as a hyperbola, the exponential asymptotes of which intersect at a value of the logarithm of frequency, ln q, dependent on the arbitrarily chosen interval of measurement. A different but synonymous representation of the same reality is obtained by choosing a different interval. The arbitrariness is removed in a new way by a change of interval such that the asymptotes intersect at the certainty ln $q=0$, i.e. unit probability. The two transformed asymptotes are then represented by the two independent exponentials $q=C_1^{y'}$ and $q=C_2^{y'}$. When and only when this transformation is made, the mode frequency value is predictable in terms of the bases C_1 and C_2 which thereby define the distribution in absolute terms and so, for the first time, allow random distributions in different fields to be correlated. The bases C_1 and C_2 appear as the respective chances of an independent interval or step taken along the variate towards smaller and larger values. The evidence suggests, intriguingly, that Nature restricts the mean chance $\bar{C}$ to the narrow range 0.5 to 0.2, where 0.5 is the even-chance value. (9 refs.)

98734 One-sided Monte Carlo batch tolerance limits. W.Gerisch, W.Strogies (BAM, Berlin, Germany).
Z. Angew. Math. & Mech. (Germany), vol.63, no.7, p.325-6 (1983). (11 refs.)

Proceedings of the Conference on Mathematical Analysis and Applications ...... See Entry 98633

Stochastic quantization method of fermion fields ...... See Entry 98862

Twenty-five years of the maximum-entropy principle ...... See Entry 98933

Transition from quasi-periodicity to chaos in a system of coupled nonlinear oscillators ...... See Entry 98963

Generalization of Baker's transformation—chaos and stochastic process on a Smale's horse-shoe ...... See Entry 98965

Correlators of processes in very simple systems with strange attractors ...... See Entry 98972

Stochastic quantization of nonAbelian gauge field—unitarity problem and Faddeev-Popov ghost effects ...... See Entry 99291

Monte Carlo computations in lattice gauge theories ...... See Entry 99308

Binomial vs. Poisson statistics in radiation studies ...... See Entry 100209

Experimental dead-time distortions of Poisson processes ...... See Entry 100210

A study of statistical moments of shortwave fields, propagating in a medium with strong, Gaussian random inhomogeneities. The system of moment equations ...... See Entry 100638

Theoretical and experimental investigations of light scattered from a rotating ground glass ...... See Entry 100666

Statistical properties of modal noise in fibre-laser systems ... See Entry 100914

Probability distributions for the strength of composite materials. IV. Localized load-sharing with tapering ...... See Entry 101138

Introduction to Monte Carlo simulation techniques ...... See Entry 101631

A probabilistic approach to the models of spin glasses ...... See Entry 102668

Statistical comparison of models for estimating solar radiation on inclined surfaces ...... See Entry 103656

Statistical differences of reaction time in Schizophrenic and normal person groups to four modes of light stimulation ...... See Entry 103859

02.60 NUMERICAL APPROXIMATION AND ANALYSIS

98735 A unified formulation of the construction of variational principles. E.Gerjuoy (Phys. Dept., Univ. of Pittsburgh, Pittsburgh, PA, USA), A.R.P.Rau, L.Spruch.
Rev. Mod. Phys. (USA), vol.55, no.3, p.725-74 (July 1983).
The use of variational principles as a calculational tool is reviewed, with special emphasis on methods for constructing such principles. In particular, it is shown that for a very wide class of problems it is possible to construct a variational principle (VP) for just about any given quantity Q of interest, by routine procedures which do not require the exercise of ingenuity; the resultant VP will yield an estimate of Q correct to second order whenever the quantities appearing in the VP are known to first order. The only significant requirement for application of the routine procedures is that the entities which enter into the definition of Q be uniquely specified by a given set of equations; the equations may involve difference or differential or integral operators, they may be homogeneous or inhomogeneous, linear or nonlinear, self-adjoint or not, and they may or may not represent time-reversible systems. No numerical calculations are presented, but procedures for the construction of VPs are illustrated for numerous quantities Q of physical interest, particularly those Q arising in quantum-mechanical scattering and transition probability calculations. For pedagogical purposes VPs are also derived for several problems in classical and (simple) mathematical physics which the authors hope will prove instructive and perhaps even amusing. The quantum-mechanical quantities Q whose VPs are examined include various matrix elements and the quantum-mechanical eigenfunctions themselves. Topics examined include some points which have not always been appreciated in the literature, such as the necessity for properly specifying the phase when complex eigenfunctions are involved, and the importance of avoiding, wherever possible, formulations requiring the inversion of singular operators. The basic element of the technique is the recognition that the defining equations of a system can be incorporated into the VP as constraints through the use of (generalized) Lagrange multipliers; these can be constants, scalar, vector, or tensor functions of one or more variables, operators, etc. In the typical problem, these Lagrange multipliers L serve as a new set of adjoint functions or entitites, and the construction of the VP simultaneously provides well-defined equations for the L. Moreover, these L often have ready physical significance themselves; for example, they often may be regarded as generalized Green's functions. (213 refs.)

98736 Binomial smoothing filter: a way to avoid some pitfalls of least-squares polynomial smoothing. P.Marchand, L.Marmet (Dept. de Phys., Univ. Laval, Quebec, Canada).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.1034-41 (Aug. 1983).
Some pitfalls of least-squares polynomial (LSP) smoothing (better known to analytical chemists as Savitzky-Golay smoothing) are demonstrated and discussed, as well some remedies. For instance, smoothing by long LSP sequences leads to transmission zeros, phase reversals, and overshoots that may be objectionable in some applications. An alternative method, the binomial smoothing filter is described and some of its properties are presented. It is shown to be preferable to LSP smoothing in many cases. It is faster, better behaved in both the data and the frequency domains for many applications, and simple to use and to program or to implement in hardware. Finally, the action of a filter of a given order is easy to predict. (19 refs.)

98737 Automatic partitioning of certain three-dimensional domains into finite elements. N.P.Tyrkova, I.A.Kholmyanskii (Automobile & Highway Inst., Omsk, USSR).
Strength Mater. (USA), vol.14, no.7, p.925-7 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.60-1 (July 1982).
An algorithm for the automatic partitioning of certain three-dimensional domains into tetrahedron-type elements is proposed. The following method is adopted for the partitioning. A domain is first partitioned into layers with several sections. Boundary partitioning is performed in each section; in this case, the number of points of the boundary partitioning is the same for all sections. One of the sections is partitioned into triangles using the procedure described by Umanskii (see Probl. Prochn., no.6, p.83-7, 1978). (4 refs.)

A new interpolation formula in the form of a continued fraction ...... See Entry 98725

On the automatic solution of nonlinear finite element equations ...... See Entry 98769

Kinetics of a finite one-dimensional mixture of hard rods with different masses ...... See Entry 99024

A canonical integration technique ...... See Entry 100017

Two-dimensional curve fitting in counting experiments ...... See Entry 100211

Image transmission characteristics of dielectric slab with gradient index ...... See Entry 100894

Influence of mode coupling on differential mode delay ...... See Entry 100898

Excess loss of single-mode jacketed optical fiber at low temperature ...... See Entry 100899

Numerical computation using finite elements for the moving interface in heat transfer problems with phase transformation ...... See Entry 101016

Finite element techniques for problems of unbounded domains ...... See Entry 101037

Effective methods of accounting for local variation in stiffness characteristics in the finite-element method .... See Entry 101060

Operator split methods for the numerical solution of the elastoplastic dynamic problem .... See Entry 101076

A boundary element solution to elasto-plastic torsion of solids of revolution .... See Entry 101078

Finite element analysis of 3-ply laminated conical shell for flutter .... See Entry 101107

A numerical method for the forced nonlinear vibration .... See Entry 101122

One approach to numerical analysis of free vibrations of thin-walled structures .... See Entry 101127

Numerical analysis of wave processes in a shell-rod system .. See Entry 101128

Determination and simulation of stable crack growth in ADINA .... See Entry 101131

Numerical-analytical method of solving dynamic contact problems .... See Entry 101152

Molecular dynamics with constraints .... See Entry 101632

Orthogonal collocation for the analysis of immobilized enzyme systems .... See Entry 103492

Numerical optimization of a solar air heating system based on encapsulated PCM storage .... See Entry 103726

Generalized least-squares solutions to quasi-linear inverse problems with a priori information .... See Entry 104363

03.00 CLASSICAL AND QUANTUM PHYSICS; MECHANICS AND FIELDS

03.20 CLASSICAL MECHANICS OF DISCRETE SYSTEMS: GENERAL MATHEMATICAL ASPECTS

(for applied classical mechanics of discrete systems, see 46.10; for celestial mechanics, see 95.10)

98738 A class of operator equations in nonlinear mechanics. N.W.Bazley (Math. Inst., Univ. of Cologne, Cologne, Germany), R.J.Weinacht.
Appl. Anal. (GB), vol.15, no.1-4, p.7-14 (1983).
A nonlinear evolution equation in Hilbert space is introduced and is shown to govern a broad class of problems of nonlinear solid mechanics. The simplest oscillations of this equation are described by a generalized Lienard equation. (11 refs.)

98739 About an averaging method available in a whole resonance zone for nonautonomous and nonlinear classical Hamiltonian systems. M.Karatchentzeff (Lab. de Thermodynamique des Fluides, Orsay, France), G.Lochak.
Ann. Fond. Louis de Broglie (France), vol.8, no.2, p.155-86 (1983). In French.
The authors extend to nonlinear classical Hamiltonian systems the resonant averaging method. They study an integrable autonomous system perturbed by a time period or pseudo-periodic field, using a generalized Bogolioubov-Mitropolsky method (1963). Approximate solutions are presented which describe the continuous response of the system to the perturbation frequency over a large range. Finally, they illustrate the method for the case of a physical nonlinear pendulum with a periodic parametric perturbation. (12 refs.)

98740 Discrete mechanics of arbitrary order. A.Marciniak (Dept. of Numerical Methods, A. Mickiewicz Univ., Poznan, Poland).
Comput. Methods Appl. Mech. & Eng. (Netherlands), vol.39, no.2, p.159-78 (Aug. 1983).
On the basis of Greenspan's descrete mechanics a new technique for obtaining difference dynamical equations of arbitrary high order is developed. The presented method conserves most of the constants of motion. Numerical examples illustrate this fact. (12 refs.)

98741 Paths to turbulence. J.P.Eckmann (Dept. de Phys. Theorique, Univ. de Geneve, Geneve, Switzerland).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.805-11 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Sometimes, a physicist must step back from his everyday problem and try to understand, or at least to feel, the possibilities offered to him beyond those tools he is accustomed to. The author's aim was to provide such a perspective and to encourage the physicist to consider its applicability in his future research. Such an enterprise cannot provide readymade answers to the major open problems of theoretical physics, and in particular, the author does not answer in any definitive, or even provisional way, the quest for any understanding of the beauties of turbulence. The title was chosen for want of better alternatives. The author's main aim was thus to transmit a set of ideas which seem most helpful in a class of problems of classical physics, although there are some interesting connections with quantum-mechanical problems. (11 refs.)

98742 On periodic orbits of two spheroidal rigid bodies. S.Elshaboury, S.Elkilany (Dept. of Appl. Math., Ain Shams Univ., Cairo, Egypt).
Indian J. Pure & Appl. Math., vol.14, no.6, p.735-40 (June 1983).
The authors consider the problem of the translational rotational motion of two spheroidal rigid bodies which experience no forces other than mutual gravitational attraction. It is assumed that (1) the bodies are homogeneous oblate ellipsoids of revolution and (2) the meridional eccentricities of both components are small parameters. The equations of motion are obtained in canonical Delaunay-Andoyer's elements. Putting the equations on that form simplifies possibility of obtaining the *n*th approximation which agrees with the realistic problem. Also, the conditions for existence of periodic solutions are discussed using the small parameter method of Poincare. (6 refs.)

98743 The classical dynamics of three particles in hyperspherical coordinates. B.R.Johnson (Chem. & Phys. Lab., Aerospace Corp., El Segundo, CA, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.1906-15 (15 Aug. 1983).
Classical dynamics of the three body problem, formulated in hyperspherical coordinates, is investigated. Hamilton's equations of motion are derived and then reduced from 12th order to eighth order. In addition to the general case in which the system moves in three-dimensional space, the special cases of planar motion, collinear motion, and zero angular momentum motion are studied and related. A brief description of the theory of small amplitude vibrations and normal modes in hyperspherical coordinates is also presented. (25 refs.)

98744 A new approach to perturbation theory: star diagrams. J.C.Houard, M.Irac-Astaud (Lab. de Phys. Theorique et Math., Univ. Paris VII, Paris, France).
J. Math. Phys. (USA), vol.24, no.8, p.1997-2005 (Aug. 1983).
Perturbation theory for first-order nonlinear differential equations with source is developed in a new way, and associated with diagrams that are called star diagrams. In some cases the method allows one to express the *n*-point functions in explicit form. (3 refs.)

98745 Symmetries, conservation laws, and time reversibility for Hamiltonian systems with external forces. A.J.Van der Schaft (Math. Inst., Univ. of Groningen, Groningen, Netherlands).
J. Math. Phys. (USA), vol.24, no.8, p.2095-101 (Aug. 1983).
A system theoretic framework is given for the description of Hamiltonian systems with external forces and partial observations of the state. It is shown how symmetries and conservation laws can be defined within this framework. A generalization of Noether's theorem is obtained. Finally a precise definition of time reversibility is given and its consequences are explored. (20 refs.)

98746 Normal form and representation theory. R.Cushman (Math. Inst., Rijksuniv. Utrecht, Utrecht, Netherlands), A.Deprit, R.Mosak.
J. Math. Phys. (USA), vol.24, no.8, p.2102-17 (Aug. 1983).
Representation theory of Lie algebras is called upon to develop a procedure for normalizing a dynamical system with two degrees of freedom in the neighbourhood of an equilibrium when the Hamiltonian $H(x,y,X,Y)$ in the coordinates (x,y) and their conjugate momenta (X,Y) is of the type $H=(X^2+Y^2)/2+V(x,y,X,Y)$, the potential energy V being a sum of homogeneous polynomials in the phase variables of degree strictly greater than 2. The fact that the resulting potential V' is a polynomial in the new coordinates (x',y') and the angular momentum $G'=x'Y'-y'X'$ implies that the normalization is a rotation in the configuration space from a fixed frame to an ideal frame. The technique is intended for normalizing a Hamiltonian in equilibrium at the origin when the Lie derivative associated with the quadratic part is not semisimple, e.g. the planar restricted problem of three bodies at the equilateral equilibrium L_4 when the basic frequencies are equal (Routh's singular case). (29 refs.)

98747 A simple proof of a particular case of C. Siegel's center theorem. R.de la Llave (Univ. of Minnesota, MN, USA).
J. Math. Phys. (USA), vol.24, no.8, p.2118-21 (Aug. 1983).
The author gives an elementary proof of a particular case of C. Siegel's center theorem, based on a method of M. Herman (1981). Even if the proof has less generality than the standard one, it is simpler and provides sharper bounds. (9 refs.)

98748 On the variational theory of linear configuration-dependent systems. J.G.Papastavridis (School of Engng. Sci. & Mech., Georgia Inst. of Technol., Atlanta, GA, USA).
J. Sound & Vib. (GB), vol.89, no.1, p.85-94 (8 July 1983).
The stability of equilibrium of a linear (holonomic and scleronomic), nondissipative and non-gyroscopic, circulatory system is treated via Hamilton's (stationary or varying) action principle, thus showing how the well-known energetic theorems of the virial and work/energy for the adjacent states of motion follow by special choices of the virtual displacements (from these states). The discussion ends with the study of the (first-order) change of the action's variation along the system's eigenvalue (frequency-load) curve; here one finds expressions for the load (reminiscent of the classical Rayleigh's quotient), and the slope of this curve; these results have been discovered by other methods, such as that of the adjoint to the given system. (15 refs.)

98749 Construction of integrable systems by dressing a free motion with a potential. S.Wojciechowski (Inst. of Theoretical Phys., Univ. of Warsaw, Warsaw, Poland).
Phys. Lett. A (Netherlands), vol.96A, no.8, p.389-92 (25 July 1983).
A new family of integrable systems is presented. The construction of this family is based on a Lie algebra associated with the scaling properties of translationally invariant homogeneous potential of order −2. (4 refs.)

98750 On the integrability of some generalized Lotka-Volterra systems. T.C.Bountis (Dept. of Math. & Computer Sci., Clarkson Coll., Potsdam, NY, USA), M.Bier, J.Hijmans.
Phys. Lett. A (Netherlands), vol.97A, no.1-2, p.11-14 (8 Aug. 1983).
Several integrable systems of nonlinear ordinary differential equations of the Lotka-Volterra type are identified by the Painleve property and completely integrated. One such integral case of N first order ode's is found, with $N-2$ free parameters and N arbitrary. The concept of integrability of a general dynamical system, not necessarily derived from a hamiltonian, is also discussed. (20 refs.)

98751 Hamiltonian symmetries of the Henon-Heiles system. A.P.Fordy (Dept. of Maths., Univ of Manchester, Inst. of Sci. & Technol., Manchester, England).
Phys. Lett. A (Netherlands), vol.97A, no.1-2, p.21-3 (8 Aug. 1983).
Hamiltonian symmetries are used to find all the parameter ranges for which the Henon-Heiles Hamiltonian system $H=(\dot{x}^2+\dot{y}^2+c_1x^2+c_2y^2)/2+ax^2y-by^3/3$ is completely integral. (10 refs.)

98752 Conditions for the complete integrability of a dynamical system admitting alternative Lagrangians. M.Crampin (Faculty of Math., Open Univ., Milton Keynes, UK, England), G.Marmo, C.Rubano.
Phys. Lett. A (Netherlands), vol.97A, no.3, p.88-90 (15 Aug. 1983).
Gives conditions of a geometric nature sufficient for a dynamical system (antonomous, with finitely many degrees of freedom) which admits two alternative Lagrangian descriptions (where the Lagrangians are not just trivially related) to be completely integrable, in the sense of having *m* constants of the motion in involution (*m* being the number of degrees of freedom). (9 refs.)

98753 Stability of stationary motion of the symmetrical top with rounded peg. R.Togeiro de Figueiredo (Dept. de Fisica, Univ. Federal de Minas Gerais, Minas Gerais, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.3, p.443-58 (Sept. 1982).
The stability of stationary motion of the symmetrical top with rounded peg on a horizontal plane is studied. The possible rolling without sliding stationary motions are not all stable. (2 refs.)

98754 Regions of possible motion in mechanical systems. M.P.Kharlamov (State Univ., Donetsk, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.921-2 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.571-3 (Nov. 1982).
The author considers the dynamical system $\dot{x}=X(x)$, $x \in M$, which has the first integrals K_1, K_2, ..., K_n: $M \rightarrow \mathbf{R}$. As one of the problems related to the analysis of the behavior of the trajectories of the system, Smale (1970) posed the problem of the study of a topological type of integral manifolds, J_K. This problem can be solved by using a classification of the projections of the J_k

onto a certain manifold N (dim N<dim M) which arises in a natural way in mechanics. It is a space of variables which depend only on the configuration of objects. Study of the projections of phase trajectories onto the space of configuration variables is of independent interest, since these projections are directly related to the motions of a real system. (7 refs.)

98755 Weighting coefficient selection in the problem of optimal damping of wing elastic vibrations. T.K.Sirazetdinov, I.Kh.Khalitov.
Sov. Aeronaut. (USA), vol.25, no.2, p.37-42 (1982). Translation of: *Izv. VUZ Aviats. Tekh. (USSR)*, vol.25, no.2, p.35-40 (1982).
The authors present an algorithm for the design of an optimal system for control of an elastic wing with the a priori given requirements on the critical flutter speed and the characteristic of the wing bending-torsion vibration transient process. (6 refs.)

98756 Resonances: key elements to the understanding of nonlinear oscillations. I.Gumowski (Dynamic Systems Res. Group, Univ. of Toulouse, Toulouse, France).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.272-9
The objective of this paper is a critical discussion of problems related to the study of dynamically characteristic properties of solutions of specific equations of the form $\dot{x}=g(x,y,t)$, $\dot{y}=f(x,y,t)$, where t=time, x,y=scalar variables, describing physical evolution processes are considered, where f,g are sufficiently smooth functions of x,y,t and in addition periodic in t with a fixed period T>0, occurring in mechanics. (20 refs.)

98757 On systems passing through resonances. A.Delshams (Facultat de Matematiques, Univ. de Barcelona, Barcelona, Spain).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.280-1 (7 refs.)

98758 Symmetries of finite hard rod systems. P.Kasperkovitz, J.Reisenberger (Inst fur Theoretische Phys., Tech. Univ. Wien, Wien, Austria).
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.541-2
The authors consider N particles of mass m and diameter d moving on a line and interacting via elastic collisions. The particles are assumed to be enclosed by a freely movable, massless box of length L. This device makes the system slightly different from that with periodic boundary conditions. (2 refs.)

A dynamic model for the demonstration of planetary motions or 'celestial mechanics on the desk' ....See Entry 98698

Random mechanical vibrations ....See Entry 98785

Comments on microscopic mechanics, generalizations of classical mechanics and Planck's oscillators ....See Entry 98826

Dynamical symmetries: an approach to Jacobi fields and to constants of geodesic motion ....See Entry 98875

Scenarios for the onset of chaos ....See Entry 98952

Transition from quasi-periodicity to chaos in a system of coupled nonlinear oscillators ....See Entry 98963

Geometrically nonlinear mechanics in discrete system and application to plane frame-works ....See Entry 101030

Stability and integrability in the planar general three-body problem ....See Entry 104707

Periodic solutions of the restricted problem that are analytic continuations of periodic solutions of Hill's problem for small $\mu>0$ ....See Entry 104709

Elimination of the nodes in problems of n bodies ....See Entry 104713

Dirichlet-Weierstrass-Poincare problem ....See Entry 104716

Some mechanical invariants of elliptical orbits ....See Entry 104717

03.30 SPECIAL RELATIVITY

98759 On the quaternion representation of the proper Lorentz group SO(3,1). K.N.Srinivasa Rao, A.V.Gopala Rao, B.S.Narahari (Dept. of Phys., Univ. of Mysore, Mysore, India).
J. Math. Phys. (USA), vol.24, no.8, p.1945-54 (Aug. 1983).
Complex quaternions are investigated in detail, bringing out some new aspects of the relationship of the multiplicative group of unit complex quaternions (UCQ) with the proper Lorentz group SO(3,1). Constructing the proper Lorentz transformation (PLT) corresponding to a given UCQ, the quaternion parameters of a PLT are determined explicitly in terms of its element L_{ij}, and this quaternion parametrization is then utilized to obtain an interesting geometrical interpretation of SO(3,1) as the intersection of a hyperboloid with a cone in a real eight-dimensional Euclidean space E_8. The UCQ components are then related to the Lie-Cartan parameters of SO(3,1), leading to an identification of complex quantities which may be interpreted as the complex axis and angle of rotation. It is shown that any PLT admits a special type of Euler resolution which is at the same time a resolution into three Lorentz-Synge screws the two angles of which combine to form a complex Euler angle (or Euler-Brauer angle). It is also shown that on taking the rotation parameters in the formula for the D^j representation of SO(3) to be complex, one obtains the D^{j0} representation of SO(3,1); leading at once to its $D^{jj'}$ representation. Similarly, a formula for the character χ^{j0} of the D^{j0} representation, having a complete analogy to the character formula for SO(3), but in terms of a complex angle ω is obtained and this in turn yields a formula for the character $\chi^{jj'}$ in the $D^{jj'}$ representation of SO(3,1). (19 refs.)

98760 The spinning photon. R.A.Waldron (School of Math., Ulster Polytech., Newtownabbey, N Ireland).
Speculations Sci. & Technol. (Switzerland), vol.6, no.2, p.171-81 (June 1983).
A photon travelling with velocity c′ (which will be different from c if the source of the photon is moving with respect to the observer) has an internal energy $^1/_2mc^2$ and a translational kinetic energy $^1/_2$ mc'^2. The internal energy is identified with a spin energy $^1/_2I\omega^2$, ω being the angular velocity of spin and I the moment of inertia. On this view, the wave-like behaviour of light may be understood, including Doppler effect, interference and diffraction. At high frequencies (γ-rays, X-rays) photons are very small, very massive, and usually well separated; they behave as individual particles. At low frequencies (microwaves, radio waves) they are large, of small mass and interpenetrate each other; they behave much less like particles and much more like electromagnetic waves. (4 refs.)

03.40 CLASSICAL MECHANICS OF CONTINUOUS MEDIA: GENERAL MATHEMATICAL ASPECTS

98761 New integrable classical system with two degrees of freedom. V.I.Inozemtsev (Lab. of Theoretical Phys., JINR, Moscow, USSR).
Phys. Lett. A (Netherlands), vol.96A, no.9, p.447-8 (1 Aug. 1983).
It is shown that a classical system with hamiltonian $H=(p_1^2+p_2^2)/2+\lambda(q_1q_2)^{-2/3}$ possesses a constant of the motion $K=p_1p_2(p_1q_2-p_2q_1)+2\lambda(p_2q_2-p_1q_1)(q_1q_2)^{-2/3}$; the quantum system with the same hamiltonian has no constants of the motion which are polynomials in the momenta of order not higher than three, except H. (9 refs.)

98762 Perturbation method in boundary-value problems of the mechanics of deformable bodies. V.D.Kubenko, Yu.N.Nemish, K.I.Shnerenko, N.A.Shul'ga (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.11, p.955-70 (Nov. 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.11, p.3-20 (Nov. 1982).
The authors analyze for the most part two- and three-dimensional boundary-value problems for noncanonical domains, where the methods of solution and the vast number of specific results obtained on the basis thereof are attributable to members of the Institute of Mechanics of the Academy of Sciences of the Ukrainian SSR and to their students. The foundation of all these numerous investigations is a version of the boundary perturbation (deformation) method proposed by A.N. Guz in 1962. In the twenty years since that time other versions of the boundary perturbation method have been developed on the basis of the original, and corresponding scientific directions have evolved in the mechanics of deformable media; these topics are discussed. (187 refs.)

98763 Nonequilibrium thermodynamics of surface phenomena in solids. Yu.Z.Povstenko (Inst. of Appl. Mech. & Math., Acad. of Sci., Lvov, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.11, p.1035-9 (Nov. 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.11, p.100-5 (Nov. 1982).
Models a thin interfacial layer on the boundary between a solid $V^{(1)}$ and an external medium $V^{(2)}$ by a surface Σ with certain physicomechanical properties. The problem is to construct a two-dimensional analog of the ideal solid solution model with explicit treatment of specific characteristics of surface phenomena, using the methods of continuum mechanics and nonequilibrium thermodynamics. (15 refs.)

Comments on microscopic mechanics, generalizations of classical mechanics and Planck's oscillators ....See Entry 98826

Non-linear mechanics of a string in a viscous noisy environment ....See Entry 99000

03.40D Mathematical theory of elasticity

(see also 46.20 Continuum mechanics, and 46.30 Mechanics of solids)

98764 Homogenization and asymptotic expansions for solutions of the elasticity system with rapidly oscillating periodic coefficients. O.A.Oleinik, G.P.Panasenko (Moscow State Univ., Moscow, USSR), G.A.Yosifian.
Appl. Anal. (GB), vol.15, no.1-4, p.15-32 (1983).
Homogenization for a boundary value problem in linear elasticity is discussed. Justification is given for the asymptotic expansion in powers of a small parameter for a solution to the elasticity system in a half-space with rapidly oscillating periodic coefficients. (17 refs.)

98765 Some uniqueness and continuous dependence theorems for nonlinear elastodynamics in exterior domains. R.J.Knops (Heriot-Watt Univ., Edinburgh, Scotland), L.E.Payne.
Appl. Anal. (GB), vol.15, no.1-4, p.33-51 (1983).
Uniqueness and Holder continuous dependence upon the initial data of the null solution to the initial boundary value problem of nonlinear hyperelasticity are proved for exterior domains subject to mild asymptotic behaviour on the displacement, velocity and stress components. The strain-energy is not required to be locally sign-definite although at sufficiently large spatial distances it must be non-negative. Other limitations impose on the strain-energy become identically satisfied upon reduction to the linear theory. (27 refs.)

98766 The two-dimensional, linear orthotropic plate. R.P.Gilbert, G.C.Hsiao (Dept. of Math. Sci., Univ. of Delaware, Newark, DE, USA), M.Schneider.
Appl. Anal. (GB), vol.15, no.1-4, p.147-69 (1983).
The authors apply the analysis of Ciarlet and Destuynder (1979) to a two-dimensional linear orthotropic clamped plate. (14 refs.)

98767 Mathematical problems in elastic equilibrium with finite deformations. G.Grioli (Istituto di Analisi e Meccanica, Univ. di Padova, Padove, Italy).
Appl. Anal. (GB), vol.15, no.1-4, p.171-86 (1983).
The author considers the equilibrium problem for an elastic body with large deformations. A procedure based on the hypothesis of live loads and a stressed reference configuration is developed. (17 refs.)

98768 A nonconvex generalization of the notion of superpotential and applications. P.D.Panagiotopoulos (Univ. d'Aristote, Salonique, Greece).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.15, p.1105-8 (25 April 1983). In French.
The recent notion of generalized gradient is applied to the study of nonmonotone constitutive laws and boundary conditions. A unified procedure is derived for the study of certain variational inequalities of nonlinear type characterizing these mechanical systems. The notion of convex superpotential is generalized for non-convex energy functions. (9 refs.)

98769 On the automatic solution of nonlinear finite element equations. K.-J.Bathe, E.N.Dvorkin (Dept. of Mech. Engng., MIT, Cambridge, MA, USA).
Comput. & Struct. (GB), vol.17, no.5-6, p.871-9 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
An algorithm for the automatic incremental solution of nonlinear finite element equations in static analysis is presented. The procedure is designed to calculate the pre- and post-buckling/collapse response of general structures. Also, eigensolutions for calculating the linearized buckling response are discussed. The algorithms have been implemented and various experiences with the techniques are given. (16 refs.)

98770 Two families of finite deformations with constant strain invariants. W.-L.Yin (School of Engng. Sci. & Mech., Georgia Inst. of Technol., Atlanta, GA, USA).
Mech. Res. Commun. (GB), vol.10, no.3, p.127-32 (May-June 1983).
The celebrated problem of Ericksen concerning universal static solutions of homogeneous incompressible isotropic elastic bodies (see Z. Angew. Math. Phys., vol.5, p.466, 1954) has received a considerable amount of attention. The open questions posed by Ericksen concerns finite deformations with constant strain invariants. The author presents two new families of finite deformations with constant strain invariants. A distinctive feature of these deformations is that the three proper vectors of the deformation tensor (the principal directions of the finite strain) are anholonomic vector fields, i.e. these vector fields do not possess normal surfaces. Consequently, such deformations are associated with free thermal expansion or uniform growth of orthotropic bodies possessing a type of aeolotropy more general than what is usually called 'curvilinear aeolotropy'. (6 refs.)

98771 Exact solution for a class of integral equations of mixed boundary-value problems of elasticity and mathematical physics. V.N.Berkovich (All-Union Correspondence Inst. of Food Industry, Rostov-on-Don, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.914-15 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.327-30 (Nov. 1982).
The authors study the properties and the methods of construction of the exact solution of a class of integral equations that arise in mixed boundary-value problems of elasticity, acoustic, and diffraction theory for domains in the shape of a dihedral or a solid angle. The method used has been applied earlier in problems involving layer-shaped domains, and consists of looking for a solution in the form of a contour integral of functions that are regular on one side of the contour only. By a factorization method, the equation can be reduced to an exactly solvable system of equations for these functions. (8 refs.)

98772 Analysis of spherical shell with antisymmetric loading. I.S.Akhmed'yanov.
Sov. Aeronaut. (USA), vol.25, no.2, p.52-5 (1982). Translation of: *Izv. VUZ Aviats. Tekh. (USSR)*, vol.25, no.2, p.47-50 (1982).
The basic relations necessary for study of the stress-strain state of a spherical shell with action on the shell of a load symmetric relative to some meridional plane were presented by the author (1980). He proposes analogous relations which can be used to analyze the spherical shell with antisymmetric loading. (1 ref.)

Proceedings of the 4th ADINA Conference .... See Entry 98619

Weighting coefficient selection in the problem of optimal damping of wing elastic vibrations ....See Entry 98755

Comparison of two slideline methods using ADINA ....See Entry 101032

On the propagation of a thermo-elastic plane wave in a thin infinite plate with thermal relaxation ....See Entry 101097

Impedance profile inversion via the first transport equation .. See Entry 101114

Diffraction of elastic waves by a wedge with free boundaries ....See Entry 101123

Determination and simulation of stable crack growth in ADINA ....See Entry 101131

03.40G Fluid dynamics: general mathematical aspects

(see also 47. Fluid dynamics)

98773 The initial boundary value problem for the flow of a barotropic viscous fluid, global in time. W.Fiszdon, W.M.Zajaczkowski (Inst. of Fundamental Tech. Res., Polish Acad. of Sci., Warsaw, Poland).
Appl. Anal. (GB), vol.15, no.1-4, p.91-114 (1983).
The existence and uniqueness of solutions, in Sobolev spaces, of the initial boundary value problem, global in time for the set of equations describing the flow of a barotropic viscous gas is investigated. A proof is deduced only for the case of inflow into a bounded domain valid for small initial and boundary conditions. (16 refs.)

98774 Strange attractors in fluid dynamics. J.Guckenheimer (Dept. of Math., Univ. of California, Santa Cruz, CA, USA).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.149-56
In 1971, Ruelle and Takens published a paper about the nature of turbulence. Their work motivated experimental physicists to study the transition to aperiodic flow in traditional laboratory experiments. Some of these experiments, beginning with those of Gollub and Swinney (1975), have produced results which appear to corroborate the basic ideas of Ruelle and Takens. However, there are fluid dynamicists who remain skeptical of these strange attractor models of turbulence. This paper is a discussion of these issues. The author proposes means by which the Ruelle-Takens theories can be tested directly and offer suggestions for alternative models of the transition to aperiodic flow in situations where the strange attractor models appear inappropriate. (15 refs.)

98775 Experimental aspects of the period doubling scenario. A.Libchaber (Groupe de Phys. des Solides, Ecole Normale Superieure, Paris, France).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.157-64
Rayleigh-Benard experiments in helium, water and mercury have shown that, in small and moderate Prandtl number fluids, the period doubling scenario is one of the possible routes to chaos. One usually analyses the experimental results in terms of a one dimensional mapping. In such a model, the mapping of the interval as a dynamical system, there is a strict hierarchy in the order of appearance of bifurcations as a function of the control parameter R. As R increases, a cascade of period doubling bifurcations (pitchfork bifurcations) evolves to its limit, for R_{∞}. Beyond this value, a chaotic state sets in, in which two remarkable phenomena occur. First, a reverse bifurcation sequence appears which shows period halving with increasing R. Second, within this region, a universal sequence of periodic states (tangent bifurcations) occurs. The author reviews the results of Rayleigh-Benard experiments in helium and mercury, showing that the whole scenario is experimentally observed. ~~But~~ all the experiments indicate also that a somewhat different scenario is very frequent, where the period doubling cascade is interrupted. It is also shown that within the framework of a 2D map this behaviour can be explained. The two-dimensional mapping used is the Henon one. (11 refs.)

Are three-frequency quasiperiodic orbits to be expected in typical nonlinear dynamical systems? ....See Entry 98967

On the characterization of chaotic motions .... See Entry 98986

Remarks on the renormalization group in statistical fluid dynamics ....See Entry 101172

03.40K Waves and wave propagation: general mathematical aspects

(see also 46.30M Mechanical and elastic waves, 43.20 General linear acoustics)

98776 On the general behavior of acceleration waves. V.V.Menon, V.D.Sharma (Inst. of Technol., Banaras Hindu Univ., Varanasi, India), A.Jeffrey.
Appl. Anal. (GB), vol.16, no.2, p.101-21 (1983).
A systematic study is made of the general behaviour of solutions to the Bernoulli equation which governs the evolution of acceleration waves in nonlinear systems. The theorems obtained contain all the known results and, in some instances, when specialized to the case of an existing theorem they provide a sharper result. Attention is drawn to the connection between the results obtained here for the Bernoulli equation, and the corresponding results for the propagation of a weak discontinuity in a general quasilinear hyperbolic system. (19 refs.)

98777 On the conditions for definiteness of energy and charge. M.Koiv (Inst. of Phys., Acad. of Sci., Tartu, USSR), R.K.Loide.
J. Phys. A (GB), vol.16, no.11, p.2353-61 (1 Aug. 1983).
The algebraic conditions of definiteness of energy and charge for the first-order wave equations are analysed and re-examined. The known definiteness conditions are applicable when there is no mass-spin degeneracy. A procedure is suggested for their use in the degenerate case, and is illustrated by application to an indefinite theory of particles of spin $^3/_2$ and $^1/_2$. (19 refs.)

98778 A hierarchy of coupled Korteweg-de Vries equations and the normalisation conditions of the Hilbert-Riemann problem. D.Levi (Istituto di Fisica, Univ. di Roma, Roma, Italy), S.Wojciechowski.
J. Phys. A (GB), vol.16, no.11, p.2423-32 (1 Aug. 1983).
The authors discuss the normalisation conditions of the Hilbert-Riemann Problem which is of importance for the construction of the ladder of soliton solutions. For a given spectral problem they provide the prescription for constructing the appropriate normalisation condition. All this is applied to a new hierarchy of coupled Korteweg-de Vries equations to find the soliton solution which displays some peculiar phenomena. (16 refs.)

98779 Connection between the existence of bisolitons for quadratic nonlinearities and a factorization of the associate linear operator. H.Cornille, A.Gervois (Div. de la Phys., CENS, Gif-sur-Yvette, France).
J. Math. Phys. (USA), vol.24, no.8, p.2042-55 (Aug. 1983).
In a first part the authors investigate the exponential type bisolitons of the class of equations $(\epsilon+L_q)K=(\epsilon+\Sigma_{i+j-1}{}^{i+j=q}\ a_{ij}\ \partial x(i)t(j)^{i+j})K=(\lambda+\mu\partial_x)K^2$ $(\epsilon\neq 0,\ \lambda\neq 0$ or $\epsilon=\lambda=0)$, which are rational solutions and they assume that their denominators have no coupling between the solitons. They have found that their existence requires a factorization property of either the operator $\epsilon+L_q$ for $\epsilon\neq 0$, $\lambda\neq 0$, $q\leq 3$ or L_q for $\epsilon=\lambda=0$, $q\leq 3$ with the exception of the Burgers equation. They find three kinds of nontrivial bisolitons: either those associated with the mixed nonlinearity $(\lambda+\mu\partial_x)K^2$ alone, or those common to the mixed nonlinearity and KK_x or those belonging to KK_x alone. In the second part they look at the two last types of bisolitons for $q>3$ and give a constructive method leading both to factorized linear operators and to the explicit determination of the bisolitons. They consider mainly $l_{q-2}(t)$ $(a\partial_t+b\partial_x+c\partial_{xx})G=(\partial_x G)^2$, $K=G_x$, with the linear operator factorizing the linear part of the Burgers equation, $l_{q-2}(t)$ is a differential operator in variable t only. The general G solution is a linear combination of log Δ and Δ^{-i}, $i=1,\ldots,q\text{-}2$ with $\Delta=1+\Sigma_1{}^2\ \exp(t+\gamma_i x)$. They determine different classes of solutions as well as the associated $l_{q-2}(t)$ operators. (8 refs.)

98780 On the solutions in elliptic functions of integrable nonlinear equations. V.Z.Enol'skii (Inst. for Theoretical Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Phys. Lett. A (Netherlands), vol.96A, no.7, p.327-30 (18 July 1983).
A new solution in elliptic functions for the KdV equation is constructed using the method proposed by the Belokolos and the author (1982). (15 refs.)

98781 Rational solutions of the Korteweg-de Vries equation in wronskian form. J.J.C.Nimmo, N.C.Freeman (Univ. of Newcastle upon Tyne, Newcastle upon Tyne, England).
Phys. Lett. A (Netherlands), vol.96A, no.9, p.443-6 (1 Aug. 1983).
The rational solutions of the Korteweg-de Vries equation are obtained as limits of the soliton solutions in wronskian form and these solutions are verified by direct substitution using a novel determinantal identity. (7 refs.)

98782 Classical scalar solitons in three space dimensions. J.Diaz-Alonso (Dept. d'Astrophys. Fondamentale, Meudon, France).
Phys. Rev. D (USA), vol.28, no.4, p.791-7 (15 Aug. 1983).
A systematic study of a class of covariant scalar field Lagrangians with derivative self-coupling is made. Methods are found which allow for the selection of classes of Lagrangian models with three-space-dimensional soliton solutions. These methods allow, in particular, for the elaboration of models with solutions which are finite-energy confining potentials. (17 refs.)

98783 The motion of solitons and breezers under the action of random forces. F.Kh.Abdullaev.
Sov. Phys.-Lebedev Inst. Rep. (USA), no.10, p.1-5 (1982). Translation of: *Sb. Kratk. Soobshch. Fiz. AN SSSR Fiz. Inst. P.N. Lebedeva*, no.10, p.3-7 (1982).
The author considers the motion of solitons of the sine-Gordon equation, the nonlinear Schrodinger equation, and also the motion of breezers in the field of random forces. The law of stochastic acceleration of solitons and breezers is found. (8 refs.)

98784 Generalised Lamb ansatz. E.D.Belokolos, V.Z.Enol'skii (Inst. of Theoretical Phys., Acad. of Sci., Ukrainian SSR).
Theor. & Math. Phys. (USA), vol.53, no.2, p.1120-7 (Nov. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.2, p.271-82 (Nov. 1982).
For the equation $\phi_{xx}-\phi_{tt}=\sin\phi$, a class of 2-phase solutions is constructed. They can be expressed in terms of Jacobi theta functions and contain the Lamb ansatz (1971) as a special case. An analogous class of solutions can also be obtained for other integrable nonlinear equations that admit solutions in terms of Riemann theta functions. (27 refs.)

98785 Random mechanical vibrations. W.Schiehlen (Inst. B fur Mech., Univ. Stuttgart, Stuttgart, Germany).
Z. Angew. Math. & Mech. (Germany), vol.63, no.4, p.T14-20 (1983). In German.
The excitation of vibrations in buildings or in a running vehicle by random process is considered. The intensity of the process of a given spectral density is deduced through measurements, while the non-white noise is derived from the white noise with a form filter. The simulation of real systems is carried out using the mechanics of continuum, finite-element, and many-body systems. Examples of computation for systems with distributed parameters and with discrete parameters are quoted. (46 refs.) *I.G.*

Stability of acoustic and optical solitons in a diatomic chain . See Entry 99003

Application of inverse scattering method to singular solutions of nonlinear equations. I .... See Entry 99320

Functional integration for kinks and disorder variables .... See Entry 99345

Optical soliton-like surface phenomena .... See Entry 100891

Spherical wave decomposition approach to ultrasonic field calculations .... See Entry 100937

On the propagation of a thermo-elastic plane wave in a thin infinite plate with thermal relaxation .... See Entry 101097

Impedance profile inversion via the first transport equation .. See Entry 101114

Diffraction of elastic waves by a wedge with free boundaries .... See Entry 101123

Diffraction of SH waves by a moving crack .... See Entry 101130

Nonlinear periodic wave and fission of a solitary wave in a slowly varying channel with arbitrary cross-section .... See Entry 101341

03.50 CLASSICAL FIELD THEORY

98786 A boundary element method for an exterior problem for three-dimensional Maxwell's equations. R.C.Maccamy (Carnegie-Mellon Univ., Pittsburgh, PA, USA), E.Stephan.
Appl. Anal. (GB), vol.16, no.2, p.141-63 (1983).
Contains an analysis of a Galerkin procedure for a system of integral equations arising in electromagnetic theory. The boundary value problem is that of Maxwell's equations in air in the exterior of a perfect conductor. The system of equations contains pseudodifferential operators on the obstacle surface. It is shown that the system is coercive and from this asymptotic convergence of Galerkin's method is established together with quasi-optimal estimates on convergence rates. (19 refs.)

98787 Some converse theorems in Newtonian field theory and their applications. D.Galletto (Istituto di Fisica Matematica 'J.-Louis Lagrange', Univ. di Torino, Torino, Italy).
Appl. Anal. (GB), vol.15, no.1-4, p.313-37 (1983).
Two converse theorems related to a family of homogeneous homothetic bodies and connected to the theory of the Newtonian field are proved. In both of them the function characterising the attraction is unknown and it is demonstrated that this function in the first theorem is given by the one characterising the Newtonian field and in the second theorem it is given by this latter function with the addition of a linear function of distance. A second unknown function appears in the second theorem and it is proved that it is a linear function of the volume of the bodies. Moreover, in both the theorems it is proved that the unknown shape of the bodies must be spherical. The conjecture is made that the two theorems are still true without the hypothesis that the unknown function characterising the attraction has a pole. Finally the second theorem is applied to the case of a finite homogeneous fluid. (15 refs.)

98788 Connection between the bremsstrahlung tip and direct radiative recombination: angular distributions and polarization correlations. I.J.Feng, I.B.Goldberg, Young Soon Kim, R.H.Pratt (Dept. of Phys. & Astron., Univ. of Pittsburgh, Pittsburgh, PA, USA).
Phys. Rev. A (USA), vol.28, no.2, p.609-14 (Aug. 1983).
The authors illustrate the possibility for calculation of bremsstrahlung tip angular distributions and polarization correlations from corresponding photoeffect results with an extension of the method for connecting bremsstrahlung tip and direct-radiative-recombination (DRR) cross sections developed by Lee and Pratt (1975). The agreement between results obtained with this method and results from the authors numerical partial-wave calculations is, in general, satisfactory. The authors note features of the distributions and correlations, and once again point out the inadequacies of the nonrelativistic dipole approximation for the evaluation of bremsstrahlung or DRR angular distributions. (17 refs.)

Particle production by accelerated charges moving in condensed matter .... See Entry 99283

Conformal quantisation of electrodynamics .... See Entry 99401

Characteristics of the formation of an electromagnetic wave field with an instantaneous change in the states of charges .... See Entry 100646

03.65 QUANTUM THEORY; QUANTUM MECHANICS

(see also 05.30 Quantum statistical mechanics; for relativistic wave equations, see 11.10)

98789 Stationary states in proper time quantum mechanics. A.Herdegen (Inst. of Phys., Jagellonian Univ., Cracow, Poland).
Acta Phys. Pol. B (Poland), vol.B14, no.7, p.511-15 (July 1983).
The stationary states in proper time quantum mechanics are identified on the basis of physically essential stationarity property. The correspondence with the usual results is established. (2 refs.)

98790 Solution of Schrodinger equation including the two body correlations. M.Fabre de la Ripelle (Weizmann Inst. of Sci., Rehovot, Israel).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.14, p.1027-9 (18 April 1983). In French.
A solution of the Schrodinger equation including the two body correlations is proposed. This equation is transformed into an infinite set of coupled differential equations which can be truncated for the sake of computation. (6 refs.)

98791 Jost functions in the two-potential formalism. J.Dusek (Dept. of Phys., Inst. of Mech. & Electrical Engng., Plzen, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.7, p.745-56 (1983).
For two inhomogeneous Schrodinger equations playing an important role within the framework of the Gell-Mann-Goldberger two-potential formalism the author derives the integral equations for the off-shell solutions and gives the relations between the regular and Jost solutions. He defines the Jost functions fully off the energy shell. The obtained formulae give the possibility to extend the validity of various useful relations derived within the one-potential theory. (11 refs.)

98792 Reconstruction of singularities for solutions of Schrodinger's equation. S.Zelditch (Dept. of Math., Columbia Univ., New York, NY, USA).
Commun. Math. Phys. (Germany), vol.90, no.1, p.1-26 (1983).
Determines the behavior in time of singularities of solutions to some Schrodinger equations on R^n. The author assumes the Hamiltonians are of the form H_0+V, where $H_0=1/2\Delta+1/2\Sigma_{k=1}{}^n\omega_k{}^2x_k{}^2$, and where V is bounded and smooth with decaying derivatives. When all $\omega_k=0$, the kernel $k(t,x,y)$ of exp $(-itH)$ is smooth in x for every fixed (t,y). When all ω_l are equal but non-zero, the initial singularity 'reconstructs' at times $t=m\pi/\omega_l$ and positions $x=(-1)^m y$, just as if $V=0$; k is otherwise regular. In the general case, the singular support is shown to be contained in the union of the hyperplanes $\{x|x_{js}=(-1)^l js_{yjs}\}$, when $\omega_j t/\pi=l_j$ for $j=j_1,\ldots,j_r$. (14 refs.)

98793 On the basic states of one-dimensional disordered structures. L.N.Grenkova, S.A.Molcanov, J.N.Sudarev (Dept. of Math., Moscow State Univ., Moscow, USSR).
Commun. Math. Phys. (Germany), vol.90, no.1, p.101-23 (1983).
The authors study a limit probability distribution of the set of the first κ eigenvalues $\lambda_1(\mathscr{L})<\lambda_2(\mathscr{L})<\ldots<\lambda_\kappa(\mathscr{L})$ (with a fixed κ and $\mathscr{L}\rightarrow\infty$) of the boundary problem on the interval $[0,\mathscr{L}]$ $Hy=-{}^d/_{dt}a(t,\omega)^{dy}/_{dt}+q(t,\omega)y=\lambda y$, $y(0)=y(\mathscr{L})=0$, where $a(t,\omega)$, $q(t,\omega)$ are the random stationary processes. Particularly the question of the repulsion between the first eigenvalues (small energetic levels) is studied. It has been proved that in the 'divergent' case $(q(t,\omega)=0,\ a(t,\omega)\neq 0)$ levels repulsion exists. As for the 'potential' case $(a(t,\omega)\equiv 1, q(t,\omega)\neq 0)$ there is not any repulsion at all. This is one of the main differences between these two cases. (15 refs.)

98794 Quantum set theory. M.van Lambalgen (Dept. of Social Sci., Delft Univ. of Technol., Delft, Netherlands).
Delft Prog. Rep. (Netherlands), vol.8, no.1, p.17-24 (Jan. 1983).
Fusing quantum mechanics and set theory into a single 'quantum set theory' will probably evoke some astonishment, for several reasons. For one who recalls that set theory is supposed to be the foundation of mathematics, it may come as a surprise to learn that different (non-equivalent) set theories exist. And in the particular case, moreover, the alternative set theory is determined in some way by a physical theory, not by mathematical considerations, as would have seemed more appropriate. Before coming to the subject of quantum set theory proper, the author reviews those developments in fundamental research that lend the idea of a quantum set theory some plausibility. (7 refs.)

98795 Extended BRA-KET formalism in off-shell scattering theory illustrated by Coulomb-plus-short-range-potential scattering quantities in maximal-reduced form. W.van Haeringen (Dept. of Math. & Informatics, Delft Univ. of Technol., Delft, Netherlands).
Delft Prog. Rep. (Netherlands), vol.8, no.2, p.110-33 (June 1983).
The author discusses closed expressions for quantum-mechanical scattering quantities in a notation which is an extension of Dirac's bra-ket notation. For the special case of Coulomb plus rational separable potentials the author investigates explicit analytic expressions and defines a class of special functions which comprises all these expressions. The author derives many interesting relations and expressions in a so-called maximal-reduced form, which is useful for standardization and numerical calculations. (16 refs.)

98796 Dissipative quantum dynamics for systems periodic in time. N.Gisin (Dept. de Phys. Theorique, Univ. de Geneve, Geneve, Switzerland).
Found. Phys. (USA), vol.13, no.7, p.643-54 (July 1983).
A model of dissipative quantum dynamics (with a nonlinear friction term) is applied to systems periodic in time. The model is compared with the standard approaches based on the Floquet theorem. It is shown that for weak frictions the asymptotic states of the proposed dynamics are the periodic steady states which are usually postulated to be the states relevant for the statistical mechanics of time-periodic systems. A solution to the problem of nonuniqueness of the 'quasienergies' is proposed. The implication of a nonlinear evolution for Ludwig's axiomatization is briefly outlined. (23 refs.)

98797 The description of preparation and registration of physical systems and conventional probability theory. H.Neumann (Fachbereich Phys., Philipps-Univ., Marburg, Germany).
Found. Phys. (USA), vol.13, no.8, p.761-78 (Aug. 1983).
The connection of the structure of statistical selection procedures with measure theory is investigated. The methods of measure theory are applied in order to analyze a mathematical description of preparation and registration of physical systems that is used by G. Ludwig (1981, 1983) for a foundation of quantum mechanics. (10 refs.)

98798 Statistics of continuous trajectories in quantum mechanics: operation-valued stochastic processes. A.Barchielli, L.Lanz, G.M.Prosperi (Dipartimento di Fisica, Univ. di Milano, Milano, Italy).
Found. Phys. (USA), vol.13, no.8, p.779-812 (Aug. 1983).
A formalism for the description of continual observations of some quantities in the framework of quantum mechanics is reobtained and generalized, starting from a more axiomatic point of view. The statistics of the observations of continuous state trajectories is treated from the beginning as a generalized stochastic process in the sense of Gel'fand. An effect-valued measure and an operation-valued measure on the σ-algebra generated by the cylinder sets in the space of trajectories are introduced. The properties of the characteristic functional for the 'operational-valued stochastic process' are discussed and, through a suitable ansatz, a significant class of such processes is explicitly constructed. (21 refs.)

98799 Realism, operationalism, and quantum mechanics. D.Foulis, C.Piron, C.Randall (Univ. of Massachusetts, Amherst, MA, USA).
Found. Phys. (USA), vol.13, no.8, p.813-41 (Aug. 1983).
A comprehensive formal system is developed that amalgamates the operational and the realistic approaches to quantum mechanics. In this formalism, for example, a sharp distinction is made between events, operational propositions, and the properties of physical systems. (21 refs.)

98800 Properties and operational propositions in quantum mechanics. C.H.Randall, D.J.Foulis (Dept. of Maths. & Statistics, Univ. of Massachusetts, Amherst, MA, USA).
Found. Phys. (USA), vol.13, no.8, p.843-57 (Aug. 1983).
In orthodox quantum mechanics, it has virtually become the custom to identify properties of a physical system with operationally testable propositions about the system. The causes and consequences of this practice are explored mathematically. Among other things, it is found that such an identification imposes severe constraints on the admissible states of the physical system. (4 refs.)

98801 Physical uniformities on the state space of nonrelativistic quantum mechanics. R.Werner (Fachbereich Phys., Univ. Osnabruck, Osnabruck, Germany).
Found. Phys. (USA), vol.13, no.8, p.859-81 (Aug. 1983).
Uniformities describing the distinguishability of states and of observables are discussed in the context of general statistical theories and are shown to be related to distinguished subspaces of continuous observables and states, respectively. The usual formalism of quantum mechanics contains no such physical uniformity for states. Using recently developed tools of quantum harmonic analysis, a natural one-to-one correspondence between continuous subspaces of nonrelativistic quantum and classical mechanics is established, thus exhibiting a close interrelation between physical uniformities for quantum states and compactifications of phase space. General properties of the completions of the quantum state space with respect to these uniformities are discussed. (14 refs.)

98802 Qualitative theory of stochastic differential equations and quantum mechanics of disordered systems. G.Jona-Lasinio (Istituto di Fisica G.Marconi, Univ. di Roma, Roma, Italy).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.61-71 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Reviews some recent applications of ideas and methods from the qualitative theory of stochastic differential equations to problems in quantum mechanics. An interesting phenomenon revealed by this approach is the instability of tunneling states under small deformations of the potential. This result may be relevant for a deeper understanding of localization in random potentials. As a second application it is shown that the theory of small random perturbations allows a direct estimate of the asymptotic behaviour for large negative energies of the density of states in a white noise potential. In addition it provides a description of the local shape of the wave function in such a situation. (5 refs.)

98803 The quantum dynamics of three particles in hyperspherical coordinates. B.R.Johnson (Chem. & Phys. Lab., Aerospace Corp., El Segundo, CA, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.1916-25 (15 Aug. 1983).
A derivation of the quantum mechanical wave equation for the three body problem expressed in hyperspherical coordinates is presented. The coordinates, due to Smith and Whitten and later modified by Johnson [B.R Johnson, ibid., vol.73, p.5051 (1981)], are used in this study. The analysis is presented from a point of view that emphasizes the role of the three-dimensional configuration space that is associated with these coordinates. Three types of motion are analyzed: full three dimensional; motion restricted to a plane surface; and zero angular momentum motion. (32 refs.)

98804 Semigroups associated with analytic Schrodinger operators. C.van Winter (Dept. of Maths. & Phys., Univ. of Kentucky, Lexington, KY, USA).
J. Math. Anal. & Appl. (USA), vol.94, no.2, p.377-405 (July 1983).
If the potential in a two-particle system is the boundary value of an analytic function, the physical Hamiltonian $H(0)$ has an analytic continuation $H(\phi)$. The continuous spectrum of $H(\phi)$ consists of the half-line $Y(0,\phi)$ which runs from 0 to $\infty e^{2i\phi}$. Integrating along lines parallel to $Y(0,\phi)$, this paper examines the Fourier transform of the resolvent $R(\lambda,\phi)$. The integration path passing through $\pm i\epsilon e^{2i\phi}$ yields semigroups $\{U(t,\pm i\epsilon e^{2i\phi},\phi)\}$ ($t>0$ and $t<0$). Under the assumption that the potential is local and belongs to suitable $\mathfrak{L}^p$-spaces, it is shown that the semigroups tend to norm limits as ϵ tends to 0. The proof is based on the Paley-Wiener theorem for functions in a strip. It generalizes to multiparticle systems under conditions on $R(\lambda,\phi)$ that are to be verified with the help of the theory of smooth operators. (22 refs.)

98805 Groups generated by analytic Schrodinger operators. C.van Winter (Dept. of Maths. & Phys., Univ. of Kentucky, Lexington, KY, USA).
J. Math. Anal. & Appl. (USA), vol.94, no.2, p.406-34 (July 1983).
If the potential in a two-particle system is the boundary value of an analytic function, the physical Hamiltonian $H(0)$ has an analytic continuation $H(\phi)$ which is not normal. In case the potential is local and belongs to suitable $\mathfrak{L}^p$-spaces, there is a bounded operator $P(0,\phi)$ projecting onto the continuous subspace of $H(\phi)$. This paper shows that $P(0,\phi)H(\phi)e^{-2i\phi}$ generates a strongly differentiable group. It is proved that $P(0,\phi)H(\phi)$ is spectral, and details of the spectral projection operators are presented. The reasoning is based on the Paley-Wiener theorem for functions in a strip. It applies to larger systems provided the resolvent of the multiparticle operator $H(\phi)$ satisfies certain regularity conditions that come from the theory of smooth operators. There are no smallness conditions on the potential. (13 refs.)

98806 A reformulation of Schrodinger and Dirac equations in terms of observable local densities and electromagnetic fields: a step towards a new interpretation of quantum mechanics?. J.de Clizeaux (SPHT-CEN, Gif-sur-Yvette, France).
J. Phys. (France), vol.44, no.8, p.885-908 (Aug. 1983).
It is shown that the Schrodinger equation, the 3-dimensional Dirac equation and the 4-dimensional Dirac equation can be transformed so as to eliminite all phase and gauge effects. Real local densities are defined and it is shown that these tensors obey real 'probabilistic equations' which are equivalent to the equations of quantum mechanics. These new equations, which are explicitly constructed, involve only local densities and the external electromagnetic field. New boundary conditions are also derived. The Aharonov-Bohm experiment is reinterpreted in the framework of this new formalism. (17 refs.)

98807 Probabilistic solution of Pauli type equations. G.F.De Angelis (Istituto di Fisica, Univ. di Salerno, Salerno, Italy), G.Jona-Lasinio, M.Sirugue.
J. Phys. A (GB), vol.16, no.11, p.2433-44 (1 Aug. 1983).
Extends the Feynman-Kac formula to the case of imaginary time Schrodinger equations (heat equations) for multicomponent wavefunctions. The approach covers in particular the usual Pauli equation for a spin-$^1/_2$ particle in an arbitrary magnetic field. The formula contains, besides the expectation with respect to a Wiener process in ordinary space, an expectation with respect to a jump process over the discrete indices describing the internal degrees of freedom. To illustrate the method the authors evaluate the formula in some special cases and they derive also various inequalities. A detailed comparison is made with a recent work by Gaveau and Vauthier (1981). (9 refs.)

98808 Fast eigenvalue algorithm for central potentials. R.E.Crandall (Dept. of Phys., Reed Coll., Portland, OR, USA).
J. Phys. A (GB), vol.16, no.12, p.L395-9 (21 Aug. 1983).
An algorithm is described that seeks out Schrodinger eigenvalues E_{nl} for a given central potential $V(r)$. The algorithm has, in principle, arbitrary precision. A particular implementation has absolute error $|E-E_{nl}|$ decreasing as T^{-3}, where T is machine computing time. The method is tested on the central Gaussian potential $V(r)=-A\exp(-\lambda r^2)$ of recent interest. (8 refs.)

98809 The local geometric asymptotics of continuum eigenfunction expansions. III. Boundary effects and coefficient singularities. S.A.Fulling (Dept. of Math., Texas A&M Univ., College Station, TX, USA).
J. Phys. A (GB), vol.16, no.12, p.2615-31 (21 Aug. 1983).
For pt.II see SIAM J. Math. Anal., vol.14, no.4, p.780-95 (1983). The effect of a boundary condition on the spectral density of a differential operator in one dimension is computed directly from the asymptotic behaviour of the eigenfunctions. From the properly normalised eigenfunction expansion, the contribution of the boundary to the diagonal value of the heat kernel at a point is obtained, and some properties of the special functions arising thereby are derived. A discontinuity, or other singularity, in the coefficient function of the operator is shown to have spectral effects quite analogous to those of a boundary, and the additional effects due to the coexistence of a boundary and a discontinuity are investigated to lowest order. (28 refs.)

98810 On the stationary phase evaluation of path integrals in the coherent states representation. Y.Weissman (Dept. of Chem., Univ. of California, Berkeley, CA, USA).
J. Phys. A (GB), vol.16, no.12, p.2693-701 (21 Aug. 1983).
The extremal paths that arise in the stationary phase evaluation of coherent state path integrals do not seem to have a simple physical interpretation, in contrast to the extremal paths that occur in the conventional path integrals. On the other hand, a recently derived semiclassical formula for the coherent state propagator involves a path that is determined in exactly the same manner as the extremal paths of the conventional path integrals. Since both the semiclassical and the stationary phase analyses yield asymptotic ($\hbar\to0$) approximations, the stationary phase and the semiclassical expressions for the propagator should be identical. The author presents a simple and direct proof that, in spite of the apparent differences, this is indeed the case. The simplification in the semiclassical formula is due to the utilisation of an appropriate set of canonical variables to describe the classical dynamics. In order to illustrate the usefulness of the semiclassical formula they present an application to the problem of the degenerate parametric amplifier, which had been treated before by operator ordering and path integral methods. The semiclassical approach has a simple classical interpretation that is absent in the alternative treatments. (29 refs.)

98811 On locality, correlation and hidden variables. D.E.Liddy (Dept. of Appl. Math., Univ. of Sydney, Sydney, NSW, Australia).
J. Phys. A (GB), vol.16, no.12, p.2703-8 (21 Aug. 1983).
Locality conditions for hidden-variables descriptions of the Bohm-EPR thought experiment are shown to be unnecessary as the underlying structure is already local. An objective, local hidden-variables theory is given. (11 refs.)

98812 On the specific features of the theory of scattering of two quantum particles by a third massive particle. A.M.Popova, Yu.V.Popov (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
J. Phys. A (GB), vol.16, no.12, p.2743-9 (21 Aug. 1983).
The behaviour of the solution of the Faddeev equations for the three-body problem if one particle mass goes to infinity has been investigated. It is shown that this solution has no continuous passage to the limit considered. It is also shown that for obtaining the required amplitude of scattering of two light particles by an infinitely heavy particle it is necesssary to rearrange the Faddeev equations and to reduce them to the equations of the problem of two particles in a field. (6 refs.)

98813 The analytically continued S matrix for potentials defined as a sum of exponentials. II. The multichannel problem. H.D.Meyer (Phys.-Chem. Inst., Univ. Heidelberg, Heidelberg, Germany).
J. Phys. B (GB), vol.16, no.15, p.2785-800 (14 Aug. 1983).
For pt.I see ibid., vol.16, p.2265 (1983). A method for computing the multichannel S matrix at real and complex energies is proposed. This method is a generalization of the one given previously for single-channel problems. It requires a potential matrix of the form $V_{n,n'}(r)=\Sigma_{j=1}{}^{\infty}U_{n,n'}{}^{(j)}(\alpha)\exp(-\ j\alpha r)$. The algorithm to determine the Jost matrix (and hence the S matrix) is simple and fast. The feasibility and usefulness of the method is demonstrated by applying it to model problems on electronic and vibrational predissociation. (10 refs.)

98814 Symmetry and generating relations for Clebsch-Gordan coefficients arising from automorphisms. R.Dirl (Inst. fur Theoretische Phys., Tech. Univ. Wien, Wien, Austria).
J. Math. Phys. (USA), vol.24, no.8, p.1935-44 (Aug. 1983).
A new class of symmetry and generating relations for Clebsch-Gordan coefficients is derived. It is associated with certain elements of the full automorphism group. The approach turns out to be useful for an efficient computation of Clebsch-Gordan coefficients. (13 refs.)

98815 On a new class of gradient formulas in the angular momentum theory. A.W.Niukkanen (Vernadsky Inst. of Geochem. & Analytical Chem., Acad. of Sci., Moscow, USSR).
J. Math. Phys. (USA), vol.24, no.8, p.1989-91 (Aug. 1983).
Recently B.F. Bayman (1978) has derived for formula for $\mathcal{Y}_{lm}(\nabla)\phi(r)\mathcal{Y}_{LM}(\mathrm{r})$, where $\mathcal{Y}_{lm}(\mathrm{r})$ is a solid spherical harmonic, in terms of the derivatives of the function $\phi(\mathrm{r})$ by the scalar parameter r. This result is clarified and essentially generalized for the case of the tensor product $\{\mathcal{Y}_l{}^m(\nabla)\otimes\phi(r)\mathcal{Y}_L(\mathrm{r})\}_{\lambda\mu}$, where $\mathcal{Y}_{lm}{}^m(\nabla)=\Delta^n\mathcal{Y}_{lm}(\nabla)$. Applications to the Taylor series in the three-dimensional Euclidean space, as well as some other expansions, are discussed briefly. (13 refs.)

98816 On the higher orders of hyperspherical harmonics. E.Arribas, J.Navarro (Dept. de Fisica Teorica, Facultad de Ciencias Fisicas, Burjassot-Valencia, Spain), M.Fabre de la Ripelle.
J. Math. Phys. (USA), vol.24, no.8, p.1992-6 (Aug. 1983).
The authors suggest a procedure to evaluate matrix elements between hyperspherical harmonics of any order. The method is based on the hyperspherical expansion of a Slater determinant constructed with oscillator wavefunctions. Explicit formulae are given for all matrix elements up to order L_m+2. (10 refs.)

98817 On a new hierarchy of Hamiltonian soliton equations. M.Boiti, C.Laddomada, F.Pempinelli, G.Z.Tu (Dipartimento di Fisica, Univ. di Lecce, Lecce, Italy).
J. Math. Phys. (USA), vol.24, no.8, p.2035-41 (Aug. 1983).
A method is suggested for studying the Hamiltonian structure of the nonlinear partial differential equations that can be solved by the use of the spectral transform (soliton equations). The method is applied to a new hierarchy of $N+1$ coupled partial differential equations related to a Schrodinger-like spectral problem. It is shown that these soliton equations are integrable Hamiltonian equations with commuting flows. For $N=1$ and $N=2$ a Miura-like transformation is computed and the corresponding modified equations are explicitly given. (17 refs.)

98818 The rotating harmonic oscillator eigenvalue problem. I. Continued fractions and analytic continuation. D.Masson (Dept. of Maths., Univ. of Toronto, Toronto, Ontario, Canada).
J. Math. Phys. (USA), vol.24, no.8, p.2074-88 (Aug. 1983).
The continued fraction approach to the solution of the rotating harmonic oscillator eigenvalue problem is examined in detail. It is shown how one may obtain eigenvalue information only from an analytic continuation of the continued fraction accomplished with the aid of modified approximants. (19 refs.)

98819 The rotating harmonic oscillator eigenvalue problem. II. Analytic perturbation theory. D.Masson (Dept. of Math., Univ. of Toronto, Toronto, Ontario, Canada).
J. Math. Phys. (USA), vol.24, no.8, p.2089-94 (Aug. 1983).
For pt.I see ibid., vol.24, no.8, p.2074-88 (1983). The theory of self-adjoint analytic families is applied to the rotating harmonic oscillator Hamiltonian in $L^2(0,\infty)$ to obtain weak and strong coupling expansions of the eigenvalues. Various estimates on the radius of convergence of the weak coupling expansion are obtained. The strong coupling expansion is shown to be an asymp-

totic series which, with the neglect of exponentially small terms, is expressible in terms of a simple formal perturbation of the ordinary harmonic oscillator Hamiltonian in $L^2(-\infty,\infty)$. (13 refs.)

98820 Measure for measure: covariant skeletonizations of phase space path integrals for systems moving on Riemannian manifolds. K.Kuchar (Dept. of Phys., Univ. of Utah, Salt Lake City, UT, USA).
J. Math. Phys. (USA), vol.24, no.8, p.2122-41 (Aug. 1983).
The author defines phase space path integrals for systems moving on a Riemannian manifold and subject to a generalized potential by a skeletonization procedure which is manifestly covariant under point transformations. The author achieves this goal by introducing a natural analog $S(x'',t''|x',p',t')$ of the Hamiltonian principal function with phase space initial data. One class of such functions is based on the parallel transport of momentum, a second class is obtained by a modification of the first class, and a third class is based on the geodesic deviation transport of momentum. The third class of principal functions is geometrically privileged. The author skeletonizes the canonical action integral by replacing it by a manifestly covariant chain of phase space principal functions. Different functions lead to the same functional as the author infinitely refines the skeletonization along a smooth path. The phase space path integral is always taken with the natural Liouville measure, but the integration over momentum variables brings down a nontrivial measure to the remaining configuration space path integral. Because nondifferentiable rather than smooth paths dominate the path integral, different phase space principal functions generate different configuration space path measures. Such measures lead to quantum propagators which satisfy Schrodinger's equations with all possible scalar curvature terms $\sim\hbar^2R$. The geometrically privileged phase space principal function (based on the geodesic deviation transport) leads to the Schrodinger equation without any curvature term. (15 refs.)

98821 A description of virtual scattering in the rigged Hilbert space formulation of quantum mechanics. M.Gadella (Facultad de Ciencias, Santander, Spain).
J. Math. Phys. (USA), vol.24, no.8, p.2142-5 (Aug. 1983).
The author defines a pair of Gel'fand triplets $\Phi_i\subset\mathcal{H}_i\subset\Phi'_i, i=1,2$, where the linear spaces Φ_i are formed by suitably chosen entire analytic functions on the Riemann surface associated to the transformation $\omega=z^2$. Virtual scattering states are well defined as pairs of functionals, respectively, in Φ'_1 and Φ'_2. (22 refs.)

98822 The Gel'fand-Levitan equation on a finite interval. H.E.Moses (Center for Atmospheric Res., Univ. of Lowell, Lowell, MA, USA), R.T.Prosser.
J. Math. Phys. (USA), vol.24, no.8, p.2146-51 (Aug. 1983).
It is shown here, by using the methods of Gel'fand and Levitan, that one may alter in certain ways the spectral data (eigenvalues and normalizations) of the Schrodinger equation for a finite interval, by suitably altering the potential. These alterations include the deletion and insertion of a finite number of eigenvalues and/or renormalization of a finite number of eigenfunctions. The deletion of an eigenvalue requires the addition of a singular potential, while the insertion of an eigenvalue requires an adjustment of the boundary conditions resulting in a non-self-adjoint operator. Similarly the insertion of a continuous spectrum leads to non-self-adjoint operators. The non-self-adjoint operators have, nevertheless, complete sets of eigenfunctions and a corresponding spectral decomposition in a suitable subspace. (5 refs.)

98823 Inverse scattering by a local impurity in a periodic potential in one dimension. R.G.Newton (Phys. Dept., Indiana Univ., Bloomington, IN, USA).
J. Math. Phys. (USA), vol.24, no.8, p.2152-62 (Aug. 1983).
Hill's equation, modified by a potential that vanishes as $x\rightarrow\pm\infty$, is considered. The direct scattering problem is studied; analytic and asymptotic properties of solutions of Hill's equation as well as of solutions of the modified equation are established. A new version of Levinson's theorem is proved. The inverse scattering problem is solved by means of a Marchenko-like equation. (20 refs.)

98824 Transmission through a system of potential barriers. I. Transmission coefficient. O.Dammert (Inst. of Theoretical Phys., Univ. of Uppsala, Uppsala, Sweden).
J. Math. Phys. (USA), vol.24, no.8, p.2163-75 (Aug. 1983).
The transmission coefficient for a one-dimensional system of N potential barriers of general shapes (unequal or equal) is expressed exactly, by means of the phase-integral method of N. Froman and P.O. Froman (1965, 1966, 1970, 1974), in terms of quantities characterizing the separate barriers and wells of the system. The exact formula, being of interest for further rigorous studies of transmission properties, can for evaluation readily be converted into a useful approximate formula by insertion of available phase-integral expressions (of an arbitrary order) for the characteristic quantities mentioned above. Error estimates are given. The sub- and superbarrier cases are treated in a unified way. Some key facts about the phase-integral method are given. (33 refs.)

98825 Second quantization in a box with a moving wall. M.Razavy (Dept. of Phys., Univ. of Alberta, Edmonton, Alberta, Canada).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.13, p.449-53 (30 July 1983).
For a system of noninteracting bosons occupying a box with a moving wall, an effective Hamiltonian density is found and the equations of motion for creation and annihilation operators are obtained. (7 refs.)

98826 Comments on microscopic mechanics, generalizations of classical mechanics and Planck's oscillators. M.Yussouff (Internat. Centre for Theoretical Phys., Trieste, Italy).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.13, p.454-8 (30 July 1983).
The new microscopic mechanics removes the dichotomy of physics into classical and quantum phenomena. Its physical picture and connections with generalizations of classical mechanics are discussed. It gives a new meaning to Bohr's frequency relation and Planck's oscillators. (11 refs.)

98827 Are photons essential?. C.Cohen-Tannoudji (Coll. de France, Paris, France).
Phys. Bl. (Germany), vol.39, no.7, p.198-9 (July 1983). In German.
The author discusses to what extent a quantum theory or radiation, using photons, vacuum fluctuations, field commutation relations etc. is essential at low energy (optical domain). (15 refs.)

98828 Bell's inequality and the uncertainty principle. K.M.Hartmann (Sektion Phys., Univ. Munchen, Garching, Germany).
Phys. Lett. A (Netherlands), vol.97A, no.1-2, p.15-17 (8 Aug. 1983).
Based on this definition of 'physical reality', Bell and others have derived certain inequalities between the probabilities for measuring the polarizations of the two spin 1/2 particles along different spatial directions. For certain orientations of the polarizers these inequalities are claimed to be in conflict with the predictions of quantum mechanics. The authors show that, provided the spins of both particles are in principle measurable along all relevant directions, these inequalities are satisfied in quantum mechanics. If however, the spin along one of these directions is in principle unmeasurable these inequalities may be violated in quantum mechanics. (8 refs.)

98829 Significance of a certain restriction in the derivation of Bell's inequality from quantum mechanics. Y.Koc (Bogazici Univ., Istanbul, Turkey).
Phys. Lett. A (Netherlands), vol.97A, no.1-2, p.18-20 (8 Aug. 1983).
It is shown that Bell's inequality can be derived from quantum mechanics if a certain restriction holds on the expectation values of the product of the spins of two correlated particles prepared in the singlet state. Significance of this restriction is discussed. (6 refs.)

98830 Distance between quantum states, statistical inference and the projection postulate. D.Dieks, P.Veltkamp (Fysisch Lab., Rijksuniv. Utrecht, Utrecht, Netherlands).
Phys. Lett. A (Netherlands), vol.97A, no.1-2, p.24-8 (8 Aug. 1983).
The authors discuss the following problem of statistical inference in quantum theory: a statistical operator W_0 is given a priori; one is then asked to determine the best choice W_1 for a statistical operator a posteriori, i.e. after a number of measurement results on the physical system in question have become available. They propose a solution to this problem which minimizes a certain distance between W_0 and W_1 and compare this solution with similar proposals recently made in the literature. They also discuss an alleged connection between statistical inference and the so-called 'projection postulate'. (9 refs.)

98831 Comment on 'Test of the gauge-invariant formulation of quantum mechanics'. S.T.Epstein (Dept. of Phys., Univ. of Wisconsin, Madison, WI, USA).
Phys. Lett. A (Netherlands), vol.97A, no.1-2, p.29 (8 Aug. 1983).
For original paper see K.-H. Yang, ibid., vol.94A, p.259 (1983). It is shown that the gauge-invariant formulation is equivalent to the conventional formulation and that the proposed test tests only the relative accuracy of the rotating-wave approximation within the two formulations. (1 ref.)

98832 New results for scattering on the line. D.Bolle (Inst. voor Theoretische Fysica, Univ. Leuven, Leuven, Belgium), F.Gesztesy, S.F.J.Wilk.
Phys. Lett. A (Netherlands), vol.97A, no.1-2, p.30-4 (8 Aug. 1983).
Low-energy scattering for Schrodinger Hamiltonians on the line is discussed, taking into account explicitly the possibility of zero-energy resonances. Analytic expansion are presented for the reflection and transmission coefficient, the phase shift and the resolvent difference. Furthermore, a set of sum rules is obtained. In particular, it is found that Levinson's theorem completely changes its structure in comparison with its three-dimensional analogue. (21 refs.)

98833 On the nodal behaviour of eigenfunctions. H.J.Korsch (Fachbereich Phys., Univ. Kaiserslautern, Kaiserslautern, Germany).
Phys. Lett. A (Netherlands), vol.97A, no.3, p.77-80 (15 Aug. 1983).
The generic behaviour of the nodal pattern of the eigenfunctions of the Schrodinger equation depending on parameters is discussed. Numerical examples are presented for the case of a hard-walled parallelogram. (20 refs.)

98834 A note on 'Painleve property of anharmonic systems with an external periodic field'. T.C.Bountis (Dept. of Math. & Computer Sci., Clarkson Coll., Potsdam, NY, USA).
Phys. Lett. A (Netherlands), vol.97A, no.3, p.85-6 (15 Aug. 1983).
It is shown, contrary to what was claimed in ibid., vol.95A, p.269 (1983), that the Van der Pol equation does not possess the Painleve property. It has solutions with movable branch points in the complex time plane, and is therefore, most likely, a nonintegrable dynamical system. (9 refs.)

98835 Comment on 'Painleve property of anharmonic systems with an external periodic field'. A.Ramani (Centre de Phys. Theorique, Ecole Polytech., Palaiseau, France), B.Dorizzi, B.Grammaticos.
Phys. Lett. A (Netherlands), vol.97A, no.3, p.87 (15 Aug. 1983).
Shows that the result of Steeb and Kunick (see ibid., vol.95A, p.269, 1983) concerning the singularity structure of the Van der Pot equation is false. (3 refs.)

98836 On the Einstein-Podolsky-Rosen argument: its recent critique and its meaning. N.S.Todorov (Low Temperature Dept., Inst. of Solid State Phys., Sofia, Bulgaria).
Phys. Lett. A (Netherlands), vol.97A, no.3, p.91-4 (15 Aug. 1983).
There is good physics in a recent paper of Page (see ibid., vol.91A, p.57, 1982) on the EPR paradox (1935). This physics, however, does not lead to the inference that the EPR argument is essentially invalid. (10 refs.)

98837 The quantum mechanical Landau equation. A.K.Macpherson (Packard Lab., Lehigh Univ., Bethlehem, PA, USA).
Proc. R. Soc. London Ser. A (GB), vol.388, no.1795, p.393-400 (8 Aug. 1983).
The significance of quantum mechanical effects on the short time development of the Landau equation is examined. The analysis is undertaken using the density diagram technique of Prigogine and Balescu. Owing to the apparent similarity that exists between the density diagrams and the more familiar Feynmann diagrams derived from generalized Green functions a short discussion of both techniques is presented. The solution is undertaken for small h/m and does not necessarily apply to electrons. It is found that quantum mechanical effects may become significant at a number density around 10^{14}, which is the lower bound in density that an earlier analysis suggested. Non-Markovian effects may be significant. (6 refs.)

98838 Do attractive scattering potentials concentrate particles at the origin in one, two and three dimensions? I. Potentials finite at the origin. G.Barton (School of Math. & Phys. Sci., Univ. of Sussex, Brighton, England).
Proc. R. Soc. London Ser. A (GB), vol.388, no.1795, p.401-18 (8 Aug. 1983).
Paradoxically, in beta decay, for instance, the final-state Coulomb forces pulling the electron inwards accelerate to the emission. Quantum mechanics (q.m.) makes the rate proportional to $\alpha\equiv\rho_0/\rho_\infty$; $\rho_{0,\infty}$ (and $v_{0,\infty}$) are the particle densities (and speeds) at $r=0$ and far upstream in the scattering state which describes the electron. Hence, as regards the effects of final-state interactions, one must base one's physical intuition on this ratio α. It is shown that according to (non-relativistic) classical mechanics, if the origin is accessible, then any central potential $U(r)$ where $v_0<\infty$ (i.e. where $U(0)>-\infty$) gives in 1, 2 and 3 dimensions, $\alpha_1=v_\infty/v_0$, $\alpha_2=1$, $\alpha_3=v_0/v_\infty$; the remaining course of $U(r)$ is irrelevant to α. The same results hold also in q.m. in the semiclassical regime, i.e. in the WKB approximation which for such potentials becomes valid at high wavenumbers; in 2D it needs rather careful formulation, and in 3D one must avoid the Langer modification. (The WKB results apply even if dU/dr diverges at $r=0$, provided $U(0)$ remains finite; these cases are covered by a simple extension of the argument.) The square-well and exponential potentials are discussed as examples. (13 refs.)

98839 Do attractive scattering potentials concentrate particles at the origin in one, two and three dimensions? II. Potentials diverging as $-C/r^q$. G.Barton (School of Math. & Phys. Sci., Univ. of Sussex, Brighton, England).

Proc. R. Soc. London Ser. A (GB), vol.388, no.1795, p.419-44 (8 Aug. 1983).

For pt.I see ibid., vol.388, p.401-418 (1983). In classical mechanics (c.m.) and near the semi-classical limit $\hbar \rightarrow 0$ of quantum mechanics (s.c.l.) the enhancement factors $\alpha \equiv \rho_0/\rho_\infty$ are found for scattering by attractive central potentials $U(r)$; here $\rho_{0,\infty}$ (and $v_{0,\infty}$) are the particle densities (and speeds) at the origin and far upstream in the incident beam. For finite potentials ($U(0) > -\infty$), and when there are no turning points, the preceding paper found both in c.m., and near the s.c.l. (which then covers high v_∞), $\alpha_1 = v_\infty/v_0$, $\alpha_2 = 1$, $\alpha_3 = v_0/v_\infty$ respectively in one dimension (1D), 2D and 3D. The argument is now extended to potentials (still without turning points), where $U(r \rightarrow 0) \sim -C/r^q$, with $0<q<1$ in 1D (where $r \equiv |x|$), and $0<q<2$ in 2D and 3D, since only for such q can classical trajectories and quantum wavefunctions be defined unambiguously. (3 refs.)

98840 Do attractive scattering potentials concentrate particles at the origin in one, two and three dimensions? III. High energies in quantum mechanics. G.Barton (School of Math. & Phys. Sci., Univ. of Sussex, Brighton, England).

Proc. R. Soc. London Ser. A (GB), vol.388, no.1795, p.445-56 (8 Aug. 1983).

For pt.II see ibid., vol.388, p.419-444 (1983). The enhancement factor $\alpha_D \equiv 1 + \delta\alpha_D$ is defined (in D dimensions) as the ratio of the particle density at the origin to the density far upstream in the incident beam. At high incident momentum p (and for regular potentials) the first Born approximation is known to be adequate in 3D and 1D, and is assumed to be adequate also in 2D; it entails $\delta\alpha_1 = -\delta\alpha_3$ if $U(r)$ in 3D equals $U(x)$ in 1D when $r = x$. For central potentials $U(r)$ with $U(0)$, finite, previous work implies $\delta\alpha_3 \sim -\delta\alpha_1 \sim -mU(0)/p^2$, and $\delta\alpha_2 = 0$, to the same order $\hbar^0$. It is shown that if $U(r \rightarrow 0) \sim U(0) + rU'(0) + \ldots$, then $\delta\alpha_2 \sim (2mU'(0)\hbar/p^3)\ (\pi/{}^{1}/_{16})$, the value of $U(0)$ being irrelevant. If $U(r \rightarrow 0) \sim -C/r^q$, with $0<q<2$, then $\delta\alpha_3 \sim -\delta\alpha_1 \sim (2mC/\hbar^q p^{2-q})\pi^{1/2}\Gamma(1-{}^{1}/_{2}q)/2\Gamma({}^{1}/_{2}+{}^{1}/_{2}q)$; and, with $-1<q<2$, $\delta\alpha_2 \sim (2mC/\hbar^q p^{2-q})\pi^{1/2}\Gamma^2(1-{}^{1}/_{2}q)2\Gamma({}^{1}/_{2}q)\Gamma({}^{3}/_{2}-{}^{1}/_{2}q)$. The only mathematics needed in 3D and 1D is the standard asymptotic estimation of Fourier integrals; but in 2D one needs to develop corresponding methods for integrals where the sine or cosine has been replaced by a product $J_0 Y_0$ of two Bessel functions. (10 refs.)

98841 Hydrodynamical formalism of quantum mechanics and Aharonov-Bohm effect. T.Takabayasi (Dept. of Phys., Nagoya Univ., Nagoya, Japan).

Prog. Theor. Phys. (Japan), vol.69, no.5, p.1323-44 (May 1983).

Hydrodynamical formalism of quantum mechanics is revisited for a particle under external electromagnetic field, with detailed explanations as to its subtle aspects such as the role of singular vortex lines with quantized circulation. The theory is applied to several problems where a charged particle moves under certain new configurations of external magnetic field, which are suitable to provide examples of Aharonov-Bohm effect in different situations. A remarkable consequence is given about the flow in the case of string magnetic field and is employed to obtain solutions explicitly for the movement under the field of a circular magnetic string. (11 refs.)

98842 Chaotic response of a self-interacting pseudo-spin model. M.Inoue, H.Koga (Dept. of Phys., Kagoshima Univ., Kagoshima, Japan).

Prog. Theor. Phys. (Japan), vol.69, no.5, p.1403-15 (May 1983).

A new model for a conservative semi-quantum system is presented to study quantum aspects of chaotic behavior. The model is made up of a pseudo-spin which interacts with an external field and the reaction field of the polarization of the pseudo-spin. The reaction field is superimposed upon the external field in the equations of motion and it brings nonlinear terms. Two isolating integrals, whose intersection curve gives an orbit, are obtained analytically in a static external field case, and phase plane plots are drawn using the integrals. The phase plane plots have three elliptic fixed points and one hyperbolic fixed point for a strong reaction field case and it has two elliptic ones and no hyperbolic one for a weak reaction field case. Only one single finite separatrix emanates from the hyperbolic fixed point in the strong reaction field case. Chaotic motion is observed in a periodic external field case, and Poincare mappings, Lyapunov exponents and power spectra of the polarization are calculated with the aid of computer simulations. The spectrum of 1-dimensional Lyapunov exponents takes a hyperbolic type (+, 0, −), namely the model has C-system like property. (16 refs.)

98843 Large-N quantum mechanics and classical limits. L.G.Yaffe (Princeton Univ., Princeton, NJ, USA).

Phys. Today (USA), vol.36, no.8, p.50-7 (Aug. 1983).

Discusses a particular approximation scheme, commonly referred to as the method of 'large-N expansions'. The method is based on the possibly surprising fact that increasing the number of degrees of freedom can simplify the analysis of a theory. Specifically, if N is some measure of the number of degrees of freedom, or dimensionality, of a theory, then the theory may have a natural large-N generalization that one can solve explicitly in the limit $N \rightarrow \infty$. Such a solution allows one to calculate physical observables in the original finite-N theory by expanding them systematically in powers of $1/N$. This approach turns out to be applicable to a wide class of theories, including many for which conventional approximation techniques are inapplicable. (10 refs.)

98844 Liouvillian Green's functions and self-energies for energy-shift and decay phenomena. M.D.Girardeau (Dept. of Phys. & Inst. of Chem. Phys. & Theoretical Sci., Univ. of Oregon, Eugene, OR, USA).

Phys. Rev. A (USA), vol.28, no.2, p.1056-71 (Aug. 1983).

Green's functions and transition self-energies of dissipative quantum-mechanical manybody systems are formulated in terms of operator-basis expansions of Heisenberg equations of motion in Liouville space. Matrix elements of the Liouvillian with respect to arbitrary nonorthogonal operator bases play a primary role in the analysis. The self-energies are expressed as functionals of initial statistical ensemble averages which are presumed known and not restricted to systems at or near equilibrium; this provides a first-principles approach to use of spectral line shapes as a diagnostic of the nonequilibrium state of a dense gas, plasma, and/or radiation field. A perturbation expansion of the self-energy is derived and the general term is interpreted in terms of a subtraction of reducible parts. A separation into resonant and nonresonant contributions plays a crucial role in the analysis. The first-order resonant contribution yields a generalized statistical Hartee-Fock approximation, whereas the second-order contribution generalizes the Weisskopf-Wigner theory of decaying states to include thermal and, more generally, nonequilibrium environmental effects on transition-energy shifts and widths. Off-diagonal contributions to the self-energy are shown to be essential for inclusion of environmental contributions. (31 refs.)

98845 Transmission in a self-similar Schrodinger equation. Y.Avron (Dept. of Phys., California Inst. of Technol., Pasadena, CA, USA).

Phys. Rev. B (USA), vol.28, no.4, p.2225 (15 Aug. 1983).

The transmission in certain self-similar Schrodinger equations may be a pathological function of the energy. (2 refs.)

98846 Projector fields in formulation of coupled dynamics. I. Lagrangian dynamics. C.M.Do Amaral, P.Pitanga (Inst. de Fisica, Univ. Federal do Rio de Janeiro, Rio de Janeiro, Brazil).

Rev. Bras. Fis. (Brazil), vol.12, no.3, p.473-95 (Sept. 1982). In Portuguese.

With aid of a configuration-velocity-dependent projector field, constructed with the constraint conditions, the authors establish the fundamentals of a geometric model for classical constrained Lagrangian dynamics. The projector behaves as a singular metric field. Only constraints which are homogeneous of the first degree in the velocities are considered. A generalized variational Hamiltonian principle is established as a function of the projector field. The formalism developed can be the starting point for the construction of Hamiltonian constrained formalisms. (8 refs.)

98847 Integral representations and addition theorems for product of confluent hypergeometric functions derived by Green's function. J.Bellandi Filho, E.C.de Oliveira (Inst. de Fisica 'Gleb Wataghin', UNICAMP, Sao Paulo, Brazil).

Rev. Bras. Fis. (Brazil), vol.12, no.4, p.611-18 (Dec. 1982).

Integral representations and addition theorems for the product of confluent hypergeometric functions can be obtained by means of isotropic harmonic oscillator Green's functions. (6 refs.)

98848 Inverse problem for the Schrodinger equation with a linearly increasing potential-asymptotic behavior. A.R.Frenkin (M.V. Lomonosov Moscow State Univ., Moscow, USSR).

Sov. Phys. J. (USA), vol.25, no.11, p.1046-9 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.81-4 (Nov. 1982).

Asymptotic formulas for the correction to a linearly increasing potential are found without solving the Gel'fand-Levitan equation for a change in the number of states and a shift in the energy levels within an arbitrary finite region on the spectrum. The method is generalized for arbitrary restraining potentials V(r) ($r \rightarrow \infty \lim V(r) = \infty$) for which in general the radial Schrodinger equation with fixed orbital angular momentum l cannot be solved exactly. (7 refs.)

98849 Completeness of derivatives of squared Schrodinger eigenfunctions and explicit solutions of the linearized KdV equation. R.L.Sachs (Maths. Res. Center, Univ. of Wisconsin-Madison, Madison, WI, USA).

SIAM J. Math. Anal. (USA), vol.14, no.4, p.674-83 (July 1983).

Explicit solutions to that Cauchy problem for the linearized KdV equation are constructed when the initial data is integrable. The method is analogous to the Fourier decomposition for a constant coefficient equation and uses the connection between the one-dimensional Schrodinger equation and the KdV equation, as discovered by Gardner, Greene, Kruskal and Miura (1974). An expansion theorem expressing any integrable function in terms of derivatives of squared Schrodinger (generalized) eigenfunctions is proved. These functions evolve according to the linearized KdV equation, hence the expansion of the initial data leads to a generalized solution of the linearized KeV equation. Under suitable restrictions on the initial data, the solution constructed is classical. The proof of the expansion theorem may be interpeted as the skew-adjoint analogue of the more familiar process of simultaneously diagonalizing two self-adjoint operators. (16 refs.)

98850 The local geometric asymptotics of continuum eigenfunction expansions. II. One-dimensional systems. S.A.Fulling (Inst. for Theoretical Phys., Univ. of California, Santa Barbara, CA, USA).

SIAM J. Math. Anal. (USA), vol.14, no.4, p.780-95 (July 1983).

For pt.I see ibid., vol.13, p.891-912, 1982. For the solutions of a system of ordinary differential equations of the type $\psi''(x) + [E(x) + \rho^2]\psi(x) = 0$, where ψ is vector valued and $E(x)$ is an Hermitian matrix, the author constructs a phase-integral expansion, valid as $|\rho| \rightarrow \infty$, of the form $\psi(x) \sim A(x)\nu(x)$, where $\nu(x)$ is a unit vector and $A(x)$ is a positive number depending only on E and its derivatives at x. The terms in the series expansions of $A(x)$ and of the first-order differential equations determining $\nu(x)$ can be obtained as elements of a matrix series $N(x)$, which relates the basic solutions to their derivatives. If E vanishes at infinity, initial data consisting of a basis of eigenvectors of $N(x_0)$ are mapped by the phase-integral approximation into an orthogonal set of vectors at $x = \infty$. It follows that the spectral densities (normalization factors) in the eigenfunction expansion associated with the operator $-d^2/dx^2 - E(x)$ and the point x_0, and hence the corresponding heat-kernel series, can be simply expressed in terms of $N(x_0)$. The recursive calculation of the numerical coefficients in all these series can be efficiently computerized. (16 refs.)

98851 Initial boundary value problem for one class of system of multidimensional nonlinear Schrodinger equations with wave operator. Guo Boling.

Sci. Sin. (China), vol.26, no.6, p.561-75 (June 1983).

The author proves the existence and uniqueness of the generalized and strong solutions for the initial-boundary value problem of one class of the system of multidimensional nonlinear Schrodinger equations with wave operator by means of the Galerkin method, and discusses the regularity of the solution. For one-dimensional case, the existence of the smooth solution under weaker assumptions is obtained. (6 refs.)

98852 Clebsch-Gordan coefficients of the SU_3 group that satisfy boundary conditions. S.J.Alisauskas (Inst. of Phys., Acad. of Sci., Lithuanian SSR).

Sov. Phys.-Collect. (USA), vol.22, no.2, p.9-14 (1982). Translation of: *Litov. Fiz. Sb. (USSR)*, vol.22, no.2, p.13-19 (1982).

A unified analytical expression is constructed for the isoscalar factors of the Clebsch-Gordan coefficients of the canonical basis of the SU_3 group, that satisfied the simplest conditions in the boundary region with a power equal to the multiplicity of irreducible representations in the expansion of the direct product. An optimal expression is given for the overlap matrices required to orthonormalize the system of isofactors under consideration. (5 refs.)

98853 Solution of the Schroedinger equation in the potential representation for Coulomb interactions. A.J.Janavicius.

Sov. Phys.-Collect. (USA), vol.22, no.2, p.15-22 (1982). Translation of: *Litov. Fiz. Sb. (USSR)*, vol.22, no.2, p.20-9 (1982).

The two-particle and multiparticle problems for bound states are solved by the potential representation method. It is shown that the radial wave function can be represented as the product of the solution without centrifugal forces and a function that takes account of the centrifugal potential. In the case of the multiparticle problem it is shown that the wave function can be represented as the product of an additional function that takes account of interelectron interactions and a function that takes account of the interaction between electron and nucleus. The resultant equations are used to compute the energy of the ground state of the helium atom. (7 refs.)

98854 Fractals and quantum mechanics. A.D.Allen (Algorithms Inc., Northridge, CA, USA).
Speculations Sci. & Technol. (Switzerland), vol.6, no.2, p.165-70 (June 1983).
Abbott and Wise (1981) have described the path of a quantum mechanical particle as a fractal of dimensionality two. A particle path cannot literally be a fractal, but the underlying idea, first proposed by Schrodinger, is interesting. Here this idea is used to derive the uncertainty principle as a consequence of a real particle's interactions with vacuum particles. The speculation that arises is that the uncertainty principle might be violated for a particle that is decoupled from the vacuum. (7 refs.)

98855 Quantum-mechanical Goryachev-Chaplygin top in a strong field. I.V.Komarov.
Theor. & Math. Phys. (USA), vol.53, no.2, p.1136-41 (Nov. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.2, p.296-304 (Nov. 1982).
It is shown that in a strong field the Goryachev-Chaplygin top behaves like a two-dimensional harmonic oscillator with frequency ratio 1:2. Moreover, the second integral of the motion of the top goes over into the separation constant for the 2-oscillator in parabolic coordinates in the momentum space. The diagram correlating the energy levels of the top in the limits of weak and strong fields is found. (9 refs.)

98856 Quantization of symplectic manifolds with conical points. M.V.Karasev, V.P.Maslov (Moscow Inst. of Electronic Engng., Moscow, USSR).
Theor. & Math. Phys. (USA), vol.53, no.3, p.1186-95 (Dec. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.3, p.374-87 (Dec. 1982).
Quantization of a general nonlinear phase manifold X in the quasiclassical approximation leads to the two-dimensional analog of the Bohr-Sommerfeld conditions, in which the form pdq is replaced by $dp \wedge dq$ and the vacuum energy h/2 by hν/2, where ν is the index of two-dimensional noncontractable cycles in X. A study is made of smooth manifolds X on which the index ν is integral and manifolds with conical singularities, on which ν can take half-integral values. Smooth functions f on X are associated with operators $\hat{f}$ that act on the sections of a certain sheaf and locally have the form $\hat{f}=f(q,-ih\partial/\partial q)$, $h \rightarrow 0$. (31 refs.)

98857 Quantum dynamics. B.A.Huberman (Xerox Palo Alto Res. Center, Palo Alto, CA, USA).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.79-90
The author considers that it is appropriate for a conference devoted to Nonlinear Dynamics and Chaos to include a set of lectures on the problem of quantum dynamics. For although the interest of the past few years has been mainly focused on classical chaotic dynamics, the quantum problem still poses both intriguing questions and tantalizing applications, problems which have not been the focus of much activity until now. He shows that quantum dynamics still presents unresolved problems; problems whose resolution in a crisp and unambiguous way might lead to insights into the way the classical limit obtains, as well as a deeper understanding of quantum ergodicity. (13 refs.)

98858 Analysis of comparison of different ways of identification of spin functions variables. Z.Maric, M.Bozic (Inst. of Phys., Beograd, Yugoslavia).
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.486-91 (8 refs.)

98859 On the algebraic properties of the Luttinger model. K.A.Rustamov (Inst. of Phys., Acad. of Sci., Baku, Azerbaijan SSR).
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.549-52
The system of differential equations for the elements of the tangent vector field corresponding to the Lie group of equivalence of the Schrodinger equations family with the Luttinger type Hamiltonian depending on an arbitrary potential function are analyzed. The absence of any operator of the first order in linear momentum operator in the Lie algebra of invariance of the problem has been proved. The obtained equations in the limit $\sigma=0$ of the parameters enable one to get the Lie groups of equivalence of a various problems of quantum mechanics. In the case of $\sigma=O$ the kernel of the basic groups of the mentioned family of equations is demonstrated to be physically trivial. (10 refs.)

98860 Quantum scattering transformation. L.D.Faddeev (Steklov Math. Inst., Acad. of Sci., Leningrad, USSR).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.93-114
In one-dimensional mathematical physics three successful lines of development—the Bethe-Hulthen theory of quantum magnetics, the Onsager-Baxter theory of planar models in statistical mechanics, and the Gardner-Greene-Kruskal-Miura-Zakharov-Shabat inverse scattering method in classical field theory—are known. Recently it has been realized that after quantization of the latter method, a unified approach to all three of these lines emerges. This new method—the quantum inverse method or quantum scattering transformation (QST)—is now three years old and continues to develop rapidly in several centers (Leningrad Steklov Institute, Fermilab, Batavia, Freiburg University, etc.). The author mentions some very recent developments made in the Leningrad group. (39 refs.)

On the phases of atomic eigenfunctions .... See Entry 98694

Dirac-bracket quantisation of a constrained nonlinear system: the rigid rotator .... See Entry 98695

Angular momentum in quantum mechanics as a group study topic .... See Entry 98697

The spinning photon .... See Entry 98760

Canonical quantization of local scalar fields over quantum space-time .... See Entry 98865

Some remarks on gravity and quantum mechanics .... See Entry 98903

Quantum mechanical origin of the sandwich theorem in classical gravitation theory .... See Entry 98905

A formulation of quantum stochastic processes and some of its properties .... See Entry 98950

Quantum Brownian motion .... See Entry 98951

Microscopic derivation of the stochastic process for the quantum Brownian oscillator .... See Entry 98968

Darboux transformations for non-Abelian and nonlocal equations of the Toda chain type .... See Entry 99034

Connection between the sine-Gordon model and the massive Bose Thirring model .... See Entry 99325

Space and time reversals. III. Pseudo-linear wave equations; special broken symmetries .... See Entry 99354

Clebsch-Gordan coefficients for SU(5)⊃SU(3)×SU(2)×U(1) theories .... See Entry 99358

On an inverse method in one dimension .... See Entry 99429

Configuration space Faddeev calculations. VI. Triton wave function .... See Entry 99510

On H_2^+ for small internuclear separation .... See Entry 100243

On the Franck-Condon factor evaluation in harmonic approximation .... See Entry 100457

Is magnetic flux quantized in a toroidal ferromagnet? .... See Entry 100652

Three non-degenerate wave processes .... See Entry 100714

First direct observation of the quantum mechanical behaviour of a truly macroscopic object .... See Entry 102576

03.70 THEORY OF QUANTIZED FIELDS

(see also 11.10 Field theory)

98861 Radiation gauge covariance. II. Quantization of free electromagnetic field. J.Krause (Inst. de Fisica, Univ. Catolica de Chile, Santiago, Chile).
J. Math. Phys. (USA), vol.24, no.8, p.2208-11 (Aug. 1983).
For pt.I see ibid., vol.22, p.1759 (1983). The 'substratum' of the electromagnetic field is defined as a two-dimensional duality isovector, satisfying the homogeneous wave equation. The components of the substratum are two Lorentz scalar fields that carry the two degrees of freedom of the field. It is then shown that the free Maxwell field becomes effectively quantized by the canonical quantization of the substratum. The equal-time canonical commutator thus obtained is precisely the same commutator one gets while quantizing the electromagnetic field within the Coloumb gauge. The whole approach is manifestly relativistic. (14 refs.)

98862 Stochastic quantization method of fermion fields. T.Fukai, H.Nakazato, I.Ohba, K.Okano, Y.Yamanaka (Dept. of Phys., Waseda Univ., Tokyo, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1600-16 (May 1983).
Stochastic quantization of fermion fields is formulated, where the probability distribution P and the expectation value in P can be defined properly. The equivalence between the stochastic quantization and the path integral in Euclidean field theory is shown in free case. The general treatment of interacting case is also discussed. (7 refs.)

98863 On the interaction of quantum spinor fields with extended objects. H.Matsumoto, G.Semenoff, H.Umezawa (Theoretical Phys. Inst., Univ. of Alberta, Edmonton, Alberta, Canada).
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1631-46 (May 1983).
In scalar quantum field theory with an extended object it has been shown that the space-time c-numbers (x,t) and the quantum mechanical operators associated with the extended object appear only through a particular combination called the generalized coordinates. The authors study the structure of a spinor field interacting with an extended object. It will be shown that the spinor field becomes a product of a kind of spinor operator and a scalar-like field. This spinor operator turns out to be the Lorentz boost operator with the quantum velocity $Q=p/H$. The scalar-like field describes the quantum particles in reference to a coordinate system which is attached to the extended object. (10 refs.)

98864 The rotational mode of asymmetric objects in quantum field theory. N.J.Papastamatiou (Dept. of Phys., Univ. of Wisconsin-Milwaukee, Milwaukee, WI, USA), H.Matsumoto, H.Umezawa.
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1647-65 (May 1983).
Nonspherical extended objects in (2+2)-dimensional quantum field theory are studied. The nonspherical nature creates a new set (ω, S) of quantum mechanical operators in addition to the quantum coordinate (and its canonical conjugate) of an extended object and the usual creation and annihilation operators for quantum particles. These new operators are closely associated with the rotational quantum modes. The invariance of the theory under Poincare group transformations specifies the way in which the quantum mechanical operators appear in the Heisenberg fields. The Wigner rotation induced by a Lorentz boost is naturally absorbed by a transformation of the angle operator ω. (7 refs.)

98865 Canonical quantization of local scalar fields over quantum space-time. M.Banai.
Report KFKI-1983-51, Hungarian Acad. Sci., Budapest (1983), 18 pp.
Canonical quantization of a classical local field theory (CLFT) consisting of N real scalar fields is formulated in the Hilbert space $H \otimes \hat{A}$ over the *-algebra $\hat{A}$ of linear operators of $L^2(R^3)$. The canonical commutation relations (CCR) have an irreducible solution in $H \otimes \hat{A}$, unique up to $\hat{A}$-unitary equivalence. The canonical equations as operator eq.'s are equivalent to the classical field eq.'s. The interaction picture can be introduced in a well-defined manner. The main advantage of this treatment is that the corresponding S-matrix is free of divergences. The Feynman's graph technique is adaptable in a straightforward manner. This approach is a natural extension of the conventional canonical quantization method of quantum mechanics. (21 refs.)

Polyacetylene: a real material linking condensed matter and field theory .... See Entry 99039

Some new integrable models in field theory and statistical mechanics .... See Entry 99341

03.80 GENERAL THEORY OF SCATTERING

(see also 11.20 S-matrix theory, and 11.80 Relativistic scattering)

98866 Interaction of a light particle with a system of heavy particles. D.A.Kirzhnits, F.M.Pen'kov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
JETP Lett. (USA), vol.37, no.3, p.155-7 (5 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.3, p.129-31 (5 Feb. 1983).
When a light particle interacts with a bound complex, the decay over distance is described by a $1/r^2$ law instead of a $1/r^4$ law. The corresponding force is unusual in several respects. It is proportional to the mass of the particle; it acts only in the s state of the particle; it generates a series of bound states similar to Efimov (1970) levels, etc. (2 refs.)

04.00 RELATIVITY AND GRAVITATION

(for special relativity, see 03.30; for relativistic astrophysics, see 95.30; for relativistic cosmology, see 98.80)

04.20 GENERAL RELATIVITY

(see also 02.40 Geometry and topology)

98867 An inhomogeneous cosmological solution of Einstein's equations. G.Siemieniec-Ozieblo (Astron. Obs., Jagellonian Univ., Cracow, Poland).
Acta Phys. Pol. B (Poland), vol.B14, no.7, p.465-9 (July 1983).
The construction of the conformally flat and inhomogeneous solution of Einstein's equations is presented. The Bondi type energy tensor has been used as a source. (3 refs.)

98868 Note of positions of particles in classical relativistic mechanics. V.Pazma (Ustav Fyziky a Biofyziky UK, Bratislava, Czechoslovakia).
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.4, p.217-23 (1983).
The relation between world-lines and the position vector of a particle is studied from the gauge theoretical point of view. The expressions for the position vector of a free relativistic particle as well as of two interacting particles described by the Todorov-Komar model are derived under plausible assumptions. The relation between the physical meaning of basic canonical variables and the choice of a gauge is also discussed. (7 refs.)

98869 All vacuum metrics with space-like symmetry and shearing geodesic eigenrays. B.Lukacs (Central Res. Inst. for Phys., Budapest, Hungary).
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.4, p.225-33 (1983).
The paper contains the general solution of the Einstein equation for space-like symmetric vacuum having shearing geodesic eigenrays. The result is that the rotation of the eigenrays vanishes (except the Minkowski space-time), and the solutions belong to two groups. One of them contains solutions with functional dependence among some field quantities (the Papapetrou solutions and the Kasner solution). The other group contains new solutions. (10 refs.)

98870 Noether's theorem for a nonholonomic system. M.Hussain (Dept. of Math., Government Coll., Lahore, Pakistan).
Arch. Mech. (Poland), vol.34, no.4, p.409-17 (1982).
The purpose of the paper is to extend Noether's theorem to a conservative linear nonholonomic system whose position is specified by generalised coordinates. This extension is based upon the concept of admissible infinitesimal symmetry transformation under which the Lagrangian is divergence invariant. The existence of first integrals depends on the existence of solutions of a system of partial differential equations the so-called Killing equations. All known results regarding the first integrals are deduced as special cases. Finally, an example is given to illustrate of the theory. (10 refs.)

98871 A constructive-axiomatic approach to the Lie structure in general spacetime by the principle of approximative reproducibility. D.Mayr (Sektion Phys., Univ. Munchen, Munchen, Germany).
Found. Phys. (USA), vol.13, no.7, p.731-43 (July 1983).
The author presents a constructive-axiomatic approach to general spacetime, guided by Ludwig's conception (1978) of an axiomatic base. The leading idea of axiomatization is a generalized version of the equivalence principle—the principle of approximative reproducibility. As fundamental concepts the author uses processes and reproductions of processes. On the universe of processes the point space of events is founded which carries the familiar properties of spacetime topology. a general contact relations for reproductions is the key structure to build up a group of tangential germs (pre-jets). Finally, using Yamabe's characterization the Lie structure is obtained. (16 refs.)

98872 Energy loss due to small-angle scattering in general relativity. A.Rosenblum (Max-Planck-Inst. fur Phys. und Astrophys., Munich, Germany).
J. Phys. A (GB), vol.16, no.12, p.2751-6 (21 Aug. 1983).
The equations of motion in general relativity using a 'fast motion approach' are worked out explicitly to second order. The derivation from first principles with the assumptions made is given. The application of these equations to small-angle scattering will be given in a later paper. (20 refs.)

98873 Completely integrable relativistic Hamiltonian systems and separation of variables in Hermitian hyperbolic spaces. C.P.Boyer (IIMAS, Univ. Nacional Autonoma de Mexico, Mexico City, Mexico), E.G.Kalnins, P.Winternitz.
J. Math. Phys. (USA), vol.24, no.8, p.2022-34 (Aug. 1983).
The Hamilton-Jacobi and Laplace-Beltrami equations on the Hermitian hyperbolic space HH(2) are shown to allow the separation of variables in precisely 12 classes of coordinate systems. The isometry group of this two-complex-dimensional Riemannian space, SU(2,1), has four mutually nonconjugate maximal Abelian subgroups. These subgroups are used to construct the separable coordinates explicitly. All of these subgroups are two-dimensional, and this leads to the fact that in each separable coordinate system two of the four variables are ignorable ones. The symmetry reduction of the free HH(2) Hamiltonian by a maximal Abelian subgroup of SU(2,1) reduces this Hamiltonian to one defined on an O(2,1) hyperboloid and involving a nontrivial singular potential. Separation of variables on HH(2) and more generally on HH(n) thus provides a new method of generating nontrivial completely integrable relativistic Hamiltonian systems. (29 refs.)

98874 Tetrads and arbitrary observers. J.R.Urani (Phys. Dept., Univ. of Missouri, Kansas City, MO, USA), M.H.Kemp.
J. Math. Phys. (USA), vol.24, no.8, p.2061-4 (Aug. 1983).
Recent results concerning globally isometric mappings for arbitrary observers in flat space-time are generalized to space-times admitting a time orientation. Critical to the method is the use of an orthonormal tetrad which, when it is defined globally, allows the construction of a global isometry which generalizes the pointwise boost on flat space-time. Connection coefficients are obtained, thereby defining acceleration covariant differentiation for both particle and tensor field equations. An application to orbiting observers in exterior Schwarzschild geometries is presented. (18 refs.)

98875 Dynamical symmetries: an approach to Jacobi fields and to constants of geodesic motion. G.Caviglia (Istituto Matematico, Univ. di Genova, Genova, Italy).
J. Math. Phys. (USA), vol.24, no.8, p.2065-9 (Aug. 1983).
It is shown that every dynamical symmetry (DS) of the Euler-Lagrange equations derived from the Lagrangian $L={}^1/_2\, g_{ab}\dot{q}^a\dot{q}^b$ identifies a Jacobi field on each geodesic of the configuration manifold. Using the connections between Jacobi fields and DSs, it is proved that DSs always possess associated conserved quantities, whose expression is explicitly written down. An additional constant of motion concomitant with 'pairs' of DSs, independently of the choice of L, is also determined. Applications to general relativity are emphasized in the course of the discussion. (16 refs.)

98876 Static conformally invariant scalar field. A.J.Accioly, A.N.Vaidya, M.M.Som (Inst. de Fisica, Univ. Federal do Rio de Janeiro, Rio de Janeiro, Brazil).
J. Math. Phys. (USA), vol.24, no.8, p.2176-7 (Aug. 1983).
For a massless conformally invariant scalar field, a class of solutions is obtained to the Einstein equations for which the geometry of the space-time admits one timelike and two spacelike Killing vectors. The class of solutions admit plane-symmetric and conformally flat solutions as special cases. The metrics can be interpreted as static cylindrically symmetric solutions if one of the spacelike Killing vectors is associated with rotational motion. (5 refs.)

98877 Unification of Ernst-equation Backlund transformations using a modified Wahlquist-Estabrook technique. B.K.Harrison (Dept. of Phys. & Astron., Brigham Young Univ., Provo, UT, USA).
J. Math. Phys. (USA), vol.24, no.8, p.2178-87 (Aug. 1983).
The three known Backlund transformations for the Ernst equation are derived using a modification of the Wahlquist-Estabrook prolongation procedure. The modification requires that the equation to be studied be cast into a set of differential forms and their exterior derivatives, such that all coefficients are constant (a 'CC ideal'). Analysis of the resulting equations produces 16 solutions composed of the three basic transformations combined with identity and other essentially trivial transformations. The group structure of the transformations is discussed. A Backlund transformation (already known) for the Ernst-Maxwell equations can be found by the same method. Promising generalizations are mentioned. (22 refs.)

98878 On apparent horizons and the Schwarzschild surface for a uniform fluid sphere in general relativity. H.Knutsen (Inst. of Theoretical Phys., Univ. of Warsaw, Warsaw, Poland).
J. Math. Phys. (USA), vol.24, no.8, p.2188-90 (Aug. 1983).
The time history of the marginally trapped surfaces, i.e. the apparent horizons for a spherically symmetric nonstatic fluid of uniform density are studied. Generally it is found that apparent horizons may or may not exist dependent upon the choice of arbitrary functions of integration. However, it is shown in this paper that if the metric is conformally flat or if the circumference of the sphere is an increasing function of a radial coordinate, apparent horizons exist if and only if the surface is inside the Schwarzschild surface. Then there exist in fact at least two horizons: The absolute Schwarzschild surface and an apparent horizon in the interior of the fluid matter. (15 refs.)

98879 Symmetries of the nontwisting type-N solutions with cosmological constant. H.Salazar I., A.Garcia D., J.F.Plebanski (Dept. de Fisica, Centro de Investigacion y de Estudios Avanzados, IPN, Mexico City, Mexico).
J. Math. Phys. (USA), vol.24, no.8, p.2191-6 (Aug. 1983).
The conformal homothetic, and isometric symmetries of all nontwisting type-N solutions are established. All solutions with λ allow at most the existence of two Killing vectors. All vacuum solutions, except the Robinson metric, permit maximally the existence of two (isometric and homothetic) symmetries. The Robinson solutions are the only ones which allow conformal symmetries. (5 refs.)

98880 A scalar-tensor theory of gravity incorporating Mach's principle. N.A.Batakis (Dept. de Phys. Theorique, Univ. de Geneve, Geneva, Switzerland).
Phys. Lett. A (Netherlands), vol.96A, no.7, p.331-4 (18 July 1983).
A solution to the long-standing problem involving the incorporation of Mach's principle into general relativity is proposed in terms of a new scalar-tensor theory of gravity, which seems to introduce no change in the predictions of general relativity for any of its existing tests. (5 refs.)

98881 Some examples of Penrose's quasi-local mass construction. K.P.Tod (Math. Inst., Univ. of Oxford, Oxford, England).
Proc. R. Soc. London Ser. A (GB), vol.388, no.1795, p.457-77 (8 Aug. 1983).
Penrose's quasi-local mass (ibid., vol.381, p.215 (1982)) is calculated for a variety of two-surfaces in particular space-times. The results are compared with other definitions of mass where these are available. (18 refs.)

98882 A new self-consistent solution of the Einstein equations with one-loop quantum-gravitational corrections. L.A.Kofman (Inst. of Astrophys. & Atmosphere Phys., Acad. of Sci., Tartu, Estonian SSR), V.Sahni.
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.197-200 (28 July 1983).
Vacuum averages of quantized fields in the Bertotti-Robinson (1959) space-time are calculated. It is shown that the Bertotti-Robinson space-time is a self-consistent solution of the Einstein equation with one-loop quantum-gravitational corrections induced by fields of large mass. (12 refs.)

98883 Thermal ambience of expanding event horizon in Minkowski space-time. U.H.Gerlach (Dept. of Math., Ohio State Univ., Columbus, OH, USA).
Phys. Rev. D (USA), vol.28, no.4, p.761-71 (15 Aug. 1983).
It is shown that in flat space-time the thermal ambience of accelerated observers is not associated exclusively with flat event horizons, but arises also with (observer-dependent) event horizons that are light cones. The quanta of this ambience are characterized by a generalized frequency which identifies the representation of the Lorentz group. Global and local model detectors, capable of responding to quanta of any given generalized frequency, are exhibited. The discussion of the thermal ambience is implemented in terms of a partial-wave analysis using a set of harmonics on the hyperboloid $x^2+y^2+z^2-t^2=1$. (20 refs.)

98884 Detector error and Einstein-Podolsky-Rosen correlations. A.Garg (Lab. of Atomic & Solid State Phys., Cornell Univ., Ithaca, NY, USA).
Phys. Rev. D (USA), vol.28, no.4, p.785-90 (15 Aug. 1983).
The question of how data collected in the spin-${}^1/_2$ Einstein-Podolsky-Rosen experiment become compatible with local realism for increasing detector error is investigated in two ways. (1) It is shown that data obtained in any experiment with three settings of one detector axis and any number of settings of the other will be compatible with local realism if the detector error is such that data obtained with any two settings of each detector axis are compatible with local realism. (The error rate must be more than 7.96% for this to be so.) (2) It is shown that a detector error rate of 14.64% is enough to mask nonclassical correlations in any experiment with any number of settings of both detector axes; this improves on the figure of 21.13% given by Mermin and Schwarz. (20 refs.)

98885 The structure of the space of solutions of Einstein's equations coupled with scalar fields. R.V.Saraykar (Dept. of Math., Nagpur Univ., Nagpur, India).
Pramana (India), vol.20, no.4, p.293-303 (April 1983).
Following the work of Arms, Fischer, Marsden and Moncrief (1980, 1981, 1982) it is proved that the space of solutions of Einstein's equations coupled with self-gravitating massless scalar fields has conical singularities at each spacetime possessing a compact Cauchy surface of constant mean curvature and a nontrivial set of simultaneous Killing fields either all spacelike or including one (independent) timelike. (20 refs.)

98886 On Cartan's equations on complex manifolds. L.C.Garcia De Andrade (Inst. de Fisica, Univ. Federal do Rio de Janeiro, Rio de Janeiro, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.3, p.497-500 (Sept. 1982).
The author discusses Cartan's structure equations on complex manifolds and deduce holomorphic expressions for curvature defined over this manifold. It is possible to construct complex versions of the Einstein field equations by contractions of this curvature. (4 refs.)

98887 Cauchy problem for the Einstein equations. III. A.N.Temchin.
Sov. Phys. J. (USA), vol.25, no.11, p.1068-72 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.105-9 (Nov. 1982).
The equations of small perturbations of the metric in synchronous coordinates are equivalent to a first-order system for which the Cauchy problem is correct only upon the satisfaction of several conditions imposed on the lowest symbols of the operator. (28 refs.)

On the mathematical uniqueness of Minkowski space ....See Entry 98693

Projector fields in formulation of coupled dynamics. I. Lagrangian dynamics ....See Entry 98846

Motion of an ideal fluid in the field of a plane gravitational wave ....See Entry 98889

Ideal fluid with the equation of state $\epsilon=p$ in the field of a plane gravitational wave ....See Entry 98890

Einstein's formula for gravitational radiation is not a consequence of the general theory of relativity ....See Entry 98891

Spin fluid in Einstein-Cartan theory: A variational principle and an extension of the velocity potential representation ....See Entry 98895

Indefinite-metric quantum field theory of general relativity. XVI. Extension of tensorlike commutation relations ....See Entry 98899

Strong coupling quantum gravity: an introduction ....See Entry 98907

Neutron interference: general theory of the influence of gravity, inertia and space-time torsion ....See Entry 98928

Structure of the energy-momentum tensor and the spin tensor in a covariant theory of a spinor field ....See Entry 99323

On the general vacuum solution with a cosmological constant for Bianchi type-VI_0 ....See Entry 104989

The stability of general relativistic cosmological theory ....See Entry 104995

Vacuum field, modified cosmical term and non-singular cosmology ....See Entry 104996

04.30 GRAVITATIONAL WAVES AND RADIATION: THEORY

98888 Gravitational radiation from a particle with zero orbital angular momentum plunging into a Kerr black hole. Y.Kojima, T.Nakamura (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
Phys. Lett. A (Netherlands), vol.96A, no.7, p.335-8 (18 July 1983).
The authors have computed the energy ΔE, the momentum ΔP and the angular momentum ΔJ of gravitational radiation induced by a particle of mass μ and of zero orbital angular momentum plunging in the $\theta=\pi/2$ plane into a Kerr black hole of mass $M(\gg\mu)$ and angular momentum Ma. It is found that ΔE for $a=0.99$ M is 4.45×10^{-2} $(\mu^2/M)c^2$, which is 4.27 times larger than that for the $a=0$ case. (13 refs.)

98889 Motion of an ideal fluid in the field of a plane gravitational wave. Yu.G.Ignat'ev (V.I. Ul'yanov-Lenin State Univ. Kazansk, USSR).
Sov. Phys. J. (USA), vol.25, no.11, p.1060-2 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.96-9 (Nov. 1982).
An exact solution of the equations of relativistic hydrodynamics is found which describes the motion of an initially uniform ideal fluid in the field of a plane gravitational wave of arbitrary amplitude and polarization. For all solutions the author finds that the pressure and energy density develop singularities on the singular surface, and the velocity of the fluid in the direction of propagation of the gravitational wave approaches the speed of light. In the case of the equation of state $\epsilon=p$, the solution becomes intrinsically unstable and describes the generation of sound waves. (4 refs.)

98890 Ideal fluid with the equation of state $\epsilon=p$ in the field of a plane gravitational wave. Yu.G.Ignat'ev (V.I. Ul'yanov-Lenin State Univ., Kazansk, USSR).
Sov. Phys. J. (USA), vol.25, no.11, p.1063-5 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.99-102 (Nov. 1982).
An exact solution of the equations of relativistic hydrodynamics is obtained for a semiinfinite ideal fluid with the equation of state $\epsilon=p$ in the field of a plane gravitational wave. (1 ref.)

98891 Einstein's formula for gravitational radiation is not a consequence of the general theory of relativity. A.A.Vlasov, V.I.Denisov (Moscow State Univ., Moscow, USSR).
Theor. & Math. Phys. (USA), vol.53, no.3, p.1208-16 (Dec. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.3, p.406-18 (Dec. 1982).
It is shown that the intensity of gravitational radiation and the total intensity determined in the general theory of relativity in accordance with Einstein's formulas depend on the choice of the coordinate system, so that they can be made to vanish or even become negative. Therefore, Einstein's well-known quadrupole formula, which is usually employed in general relativity for calculations, is not a consequence of general relativity and is not contained in it. This result is a particular consequence of the general assertion to the effect that in general relativity there are no energy-momentum conservation laws for a system consisting of matter and the gravitational field. (10 refs.)

04.40 CONTINUOUS MEDIA; ELECTROMAGNETIC AND OTHER MIXED GRAVITATIONAL SYSTEMS

98892 Effects of a $\lambda\Phi^4$ interaction on black-hole evaporation in two dimensions. D.A.Leahy, W.G.Unruh (Dept. of Phys., Univ. of British Columbia, Vancouver, British Columbia, Canada).
Phys. Rev. D (USA), vol.28, no.4, p.694-702 (15 Aug. 1983).
This paper examines the effects of interactions on particle emission by black holes. The model used is the $\lambda\Phi^4$ interaction for a massless scalar field Φ in a two-dimensional model for a black-hole space-time and is compared with the calculation of a flat-space model with spatially varying λ. Although the models suffer from infrared divergences, a number of features of the effect of the interaction on the particle spectrum are discernible. In the absence of any interactions the state of the field is that of a thermal flux of outgoing particles with temperature $T=1/8\pi M$ (the Hawking temperature). If the ingoing state is the vacuum state, the interaction destroys the thermal nature of the outgoing flux. However, if the ingoing flux is thermal with the same temperature as the black hole, detailed balance maintains the thermal character of the outgoing flux. One can regard the ingoing and outgoing fluxes as two separate thermal baths which are coupled by the interaction. If they are at different temperatures, the interaction will destroy the thermal nature of both. (17 refs.)

98893 Collision of two black holes: An analytic nonlinear approximation technique. M.Bovyn (Phys. Dept., Univ. of Texas, Austin, TX, USA).
Phys. Rev. D (USA), vol.28, no.4, p.703-12 (15 Aug. 1983).
Using geodesical and antisymmetric slicing the author calculates in lowest order the three-metric for the problem of two colliding black holes. It is also shown how the appropriate choice of the lapse and shift functions influences the coordinate shear and the smoothness of the three-metric. (20 refs.)

Radiation gauge covariance. II. Quantization of free electromagnetic field ....See Entry 98861

On apparent horizons and the Schwarzschild surface for a uniform fluid sphere in general relativity ....See Entry 98878

A new self-consistent solution of the Einstein equations with one-loop quantum-gravitational corrections ....See Entry 98882

Gravitational radiation from a particle with zero orbital angular momentum plunging into a Kerr black hole ....See Entry 98888

Motion of an ideal fluid in the field of a plane gravitational wave ....See Entry 98889

Ideal fluid with the equation of state $\epsilon=p$ in the field of a plane gravitational wave ....See Entry 98890

A note on electromagnetism and the new cosmology ....See Entry 98894

Spin fluid in Einstein-Cartan theory: A variational principle and an extension of the velocity potential representation ....See Entry 98895

Spontaneous symmetry breaking near a black hole ....See Entry 98912

04.50 UNIFIED FIELD THEORIES AND OTHER THEORIES OF GRAVITATION

98894 A note on electromagnetism and the new cosmology. A.H.Klotz, E.J.Vlachynsky (Dept. of Appl. Math., Univ. of Sydney, Sydney, NSW, Australia).
Acta Phys. Pol. B (Poland), vol.B14, no.7, p.471-7 (July 1983).
It is shown that in the absence of an electric charge, the cosmology arising from the generalised field theory (nonsymmetric theory of electromagnetism and gravitation, GFT) collapses into a static, Einstein universe. The observed expansion is a direct consequence of the presence of a net charge which is shown to be necessarily negative. The implications for GFT are discussed. (15 refs.)

98895 Spin fluid in Einstein-Cartan theory: A variational principle and an extension of the velocity potential representation. R.de Ritis (Istituto di Fisica Teorica, Univ. di Napoli, Napoli, Italy), M.Lavorgna, G.Platania, C.Stornaiolo.
Phys. Rev. D (USA), vol.28, no.4, p.713-17 (15 Aug. 1983).
The authors propose a variational principle describing a spin fluid in Einstein-Cartan theory. They also give a potential representation of the Taub current vector. They show that the dynamical description of the spin fluid obtained via this representation is equivalent to the standard equations, and that the material Lagrangian is the pressure. (16 refs.)

98896 Teleparallelism—a viable theory of gravity?. F.Muller-Hoissen, J.Nitsch (Inst. for Theoretical Phys., Univ. of Gottingen, Gottingen, Germany).
Phys. Rev. D (USA), vol.28, no.4, p.718-28 (15 Aug. 1983).
The teleparallelism theory of gravity is presented as a constrained Poincare gauge theory. Arguments are given in favor of a two-parameter family of field Lagrangians quadratic in torsion. The inclusion of a 'parity violating' term in the field Lagrangian avoids difficulties with the initial-data problem, recently discussed in the literature. Several new exact solutions of the corresponding teleparallelism theory give considerable insight into its physical consequences. The resulting general field equations are analyzed in the weak-field approximation excluding ghosts and tachyons. The physical meaning of the six additional components of the tetra field (as compared with the metric) appears naturally from the authors' theory and is made clear. (31 refs.)

98897 Quantum dynamics of Kaluza-Klein theories. T.Appelquist, A.Chodos (J.W. Gibbs Lab., Yale Univ., New Haven, CT, USA).
Phys. Rev. D (USA), vol.28, no.4, p.772-84 (15 Aug. 1983).
Some of the quantum properties of Kaluza-Klein theories are studied. The classical features of these theories are reviewed, and the quantization of the gravitational field in an arbitrary number of dimensions is described. These results are then applied to a detailed analysis of the five-dimensional Kaluza-Klein model. The fifth dimension is taken to be compact and a quantum effective potential, as a function of the five-five component of the metric, is constructed. It is argued that the one-loop computation is reliable as long as the distance around the fifth dimension is large compared to the Planck length. The effective potential separates into two pieces: an induced cosmological constant, independent of the size of the fifth dimension, and a distance-dependent 'Casimir' energy. The cosmological term is subtracted, leaving an attractive Casimir potential which will contract the fifth dimension to a size on the order of the Planck length. Consequences of this result are discussed and some of the ways in which it can be generalised are outlined. (29 refs.)

98898 Magnetic monopole in the general theory of relativity. V.K.Shchigolev (Beshkir Pedagogical Inst., Beshkir, USSR).
Sov. Phys. J. (USA), vol.25, no.11, p.1053-6 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.89-93 (Nov. 1982).
Equations of motion are obtained for Yang-Mills and Higgs fields using the Georgi-Glashow SO(3)-model in a curved spherically symmetric space-time. Magnetic monopole and dion solutions and the space-time metric are found in the intrinsic gravitational field. A particlelike solution of the magnetic monopole and dion type is constructed in the external field of a static universe in the Bogomol'nyi-Prasad-Sommerfield limit. (15 refs.)

Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop ....See Entry 98651

Some converse theorems in Newtonian field theory and their applications ....See Entry 98787

A scalar-tensor theory of gravity incorporating Mach's principle ....See Entry 98880

$N=1$ supergravity with nonminimal coupling: a class of models ....See Entry 98914

Geometry of multidimensional universes ....See Entry 104994

04.60 QUANTUM THEORY OF GRAVITATION

98899 Indefinite-metric quantum field theory of general relativity. XVI. Extension of tensorlike commutation relations. N.Nakanishi (Res. Inst. for Math. Sci., Kyoto Univ., Kyoto, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1617-30 (May 1983).
For pt.XI see ibid., vol.68, no.3, p.847-59 (1982). The tensorlike four-dimensional commutation relation between a tensor and the gravitational B field b_ρ is extended to the 'geometric' four-dimensional commutation relation between a more general local operator and b_ρ. Correspondingly, the tensorlike equal-time commutation relations also are generalized. The mechanism under which nongeometric terms appear is analyzed in detail, and the conditions for their absence are found. (6 refs.)

98900 Strong-coupling quantum gravity. II. Solution without gauge fixing. M.Pilati (Blackett Lab., Imperial Coll., London, England).
Phys. Rev. D (USA), vol.26, no.4, p.729-44 (15 Aug. 1983).
For pt.I see ibid., vol.26, p.2645 (1982). The quantization of a strong-coupling limit of general relativity begun in a previous paper is continued. The theory is quantized without fixing a gauge since in this form the problem of properly taking into account the gauge degrees of freedom can be directly attacked in the perturbation theory. The formalism of the scattering theory on $\mathbf{R}\times SL(3,\mathbf{R})/SO(3)$ is developed with strong use made of analysis on that space. (32 refs.)

98901 An approach to quantum gravity. T.Padmanabhan (Tata Inst. of Fundamental Res., Bombay, India).
Phys. Rev. D (USA), vol.28, no.4, p.745-55 (15 Aug. 1983).
A model for quantum gravity is presented by treating the light-cone structure of space-time as classical and the conformal factor as a quantum degree of freedom. The motivation and the details of the formalism are discussed. The approach is used to discuss the question of singularities in the cosmological models. It is shown that one can introduce the concept of stationary states for the quantum geometry, in analogy with the stationary states of simple quantum systems. The quantum stationary geometries (QSGs) avoid the classical singularities. The light-cone structure is determined by a set of equations involving the expectation values in the QSG concerned. The cosmological implications of the formalism, especially to matter creation, flatness, etc., are discussed. The theory is conformally invariant in the quantum level. (34 refs.)

98902 Universe before Planck time: A quantum gravity model. T.Padmanabhan (Tata Inst. of Fundamental Res., Bombay, India).
Phys. Rev. D (USA), vol.28, no.4, p.756-60 (15 Aug. 1983).
A model for quantum gravity can be constructed by treating the conformal degree of freedom of spacetime as a quantum variable. An isotropic, homogeneous cosmological solution in this quantum gravity model is presented. The spacetime is nonsingular for all the three possible values of three-space curvature, and agrees with the classical solution for time scales larger than the Planck time scale. A possibility of quantum fluctuations creating the matter in the universe is suggested. (5 refs.)

98903 Some remarks on gravity and quantum mechanics. R.Penrose (Math. Inst., Oxford, England).
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.3-10
Reviews the nature of a union between gravitation theory and quantum mechanics. The author discusses the quantisation of gravity and the motivation for doing it. (9 refs.)

98904 An experimental test of quantum gravity. D.N.Page (Dept. of Phys., Pennsylvania State Univ., University Park, PA, USA), C.D.Geilker.
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.11-21
The authors performed an experiment to make a test of semiclassical gravity. A quantum-mechanical decision and amplification process was used to set the position of certain macroscopic masses. As amplitudes for different decisions occurred, ψ the wavefunction of the matter, developed simultaneous components in which the masses were in macroscopically different configurations. The gravitational field induced by the masses was measured in their component and was found to be highly correlated with the mass distribution in our component alone. There was no indication of any gravitational coupling with other components of ψ. This was consistent with quantum gravity but inconsistent with the semiclassical Einstein equations. (29 refs.)

98905 Quantum mechanical origin of the sandwich theorem in classical gravitation theory. C.Teitelboim (Center for Theoretical Phys., Univ. of Texas, Austin, TX, USA).
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.23-36
The idea that the sandwich theorem is only a classical notion is already present in the writings by Wheeler (1964), where an illuminating analogy with the harmonic oscillator is given. However, the precise way in which the theorem emerges from quantum theory could not be spelled out at that time due to the lack of an appropriate expression for the quantum mechanical propagation amplitude. It is the purpose of this article to fill in that gap in the light of some results in a proper-time approach to quantized gravitation theory (Teitelboim 1980, 1981). Thus it is shown precisely how the semiclassical approximation to the quantum propagation amplitude from one three-geometry to another brings the sandwich theorem into play. Particular attention will be paid to the case when the two faces of the sandwich intersect each other. (11 refs.)

98906 θ-states induced by the diffeomorphism group in canonically quantized gravity. C.J.Isham (Blackett Lab., Imperial Coll., London, England).
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.37-52
Studies of the effects of spatial or spacetime topology in quantum gravity are an interesting part of the whole quantization programme. In particular, investigations of this type seem a natural prerequisite to the attainment of one of the ultimate goals—to subject the topology itself to some sort of quantization. There are several possible approaches to the problem so the author concentrates on developing an analogue of the vacuum θ-structure that arises in Yang-Mills theory. The decomposition of the vector space of quantum states into θ-sectors is a direct consequence of specific topological properties of the local gauge group. These, in turn, reflect certain aspects of the topological structure of space and/or spacetime which are thereby coded into the quantum field theory. (26 refs.)

98907 Strong coupling quantum gravity: an introduction. M.Pilati (Blackett Lab., Imperial Coll., London, England).
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.53-69
In recent years strong coupling quantum field theory has excited much interest. The problem that has been of most interest is that of strong coupling Yang-Mills as applied to the strong interactions. A strong coupling limit of general relativity is considered to study strong coupling gravity. (26 refs.)

98908 Quantizing fourth order gravity theories. S.M.Christensen (Dept. of Phys. & Astron., Univ. of North Carolina, Chapel Hill, NC, USA).
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.71-86
Fourth order gravity theories provide a 'laboratory' for investigating nearly every pathological feature that can occur in a quantum field theory without being hopelessly non-renormalizable. The author presents an overview of the important features of the one-loop calculations involved in quantizing fourth order gravity. (23 refs.)

98909 Green's functions, states and renormalisation. M.R.Brown (Dept. of Astrophys., Univ. of Oxford, Oxford, England), A.C.Ottewill.
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.87-103
Examines the significance that is to be attached to different operator orderings of free quantum field theories in curved space-time. By so doing the authors hope to cast some light on the now standard, albeit ad hoc, renormalisation of such theories. They argue that, as in flat space, these theories should be rendered finite by normal ordering with respect to a local geometrical vacuum state. (20 refs.)

98910 Introduction to quantum Regge calculus. M.Rocek (California Inst. of Technol., Pasadena, CA, USA), R.M.Williams.
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.105-16
The authors look at some rudimentary aspects of an approach to the quantization of gravity using Regge's discrete description of general relativity (Regge 1961). (8 refs.)

98911 Spontaneous symmetry breaking in curved space-time. D.J.Toms (Imperial Coll., London, England).
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.117-29
Discusses an approach which deals with some of the complications which arise when one attempts to study spontaneous symmetry breaking beyond the tree-graph level in situations where the effective potential may not be used. These situations include quantum field theory on general curved backgrounds or in flat space-times with non-trivial topologies. One example discussed briefly here is a report of some work which the author has done in collaboration with L.H. Ford (Ford and Toms 1981). (50 refs.)

98912 Spontaneous symmetry breaking near a black hole. M.S.Fawcett, B.F.Whiting (Dept. of Appl. Math. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.131-54
Describes the calculation of $<\phi^2>$ in a scalar theory, which determines the effective action at the one loop level. The authors compute values of $<\phi^2>$ for a black hole in thermal equilibrium and for an incoming flux of thermal radiation at infinity, and take their difference to obtain results for a black hole radiating into empty space, since this more nearly approximates the situation for small black holes radiating at the present time. It turns out that $<\phi^2>$ differs significantly from the flat space result only in a rather small region around the black hole. They then also discuss phase transitions, spontaneous symmetry breaking, $<\phi^2>$ regularisations and the evaluation of $<\phi^2>$. (15 refs.)

98913 Yang-Mills vacua in a general three-space. G.Kunstatter (Dept. of Phys., Univ. of Toronto, Toronto, Ontario, Canada).
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.155-68
Illustrates with a few simple examples the effect that the non-trivial topology of three-space might have on the vacuum structure of a canonically quantized Yang-Mills theory. The present discussion is based on a more detailed analysis done recently by Isham and Kunstatter (1981). (17 refs.)

Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop .... See Entry 98651

A new self-consistent solution of the Einstein equations with one-loop quantum-gravitational corrections .... See Entry 98882

Gravitation and symmetry breaking .... See Entry 98917

Dimensional reduction, spinor fields and characteristic classes .... See Entry 99334

Fermion fractionization in physics .... See Entry 99335

Geometry of multidimensional universes .... See Entry 104994

The stability of general relativistic cosmological theory .... See Entry 104995

Energy, stability and cosmological constant .... See Entry 105003

Phase transitions in the early Universe .... See Entry 105004

Complete cosmological theories .... See Entry 105005

The cosmological constant and the weak anthropic principle .... See Entry 105006

04.65 SUPERGRAVITY

98914 $N=1$ supergravity with nonminimal coupling: a class of models. Ngee-Pong Chang, S.Ouvry, Xizeng Wu (Dept. of Phys., City Univ. of New York, New York, NY, USA).
Phys. Rev. Lett. (USA), vol.51, no.5, p.327-30 (1 Aug. 1983).
The component formulation of the Wess-Zumino superspace action leads, when compared with the general results of Cremmer et al. (1979, 1982, 1983) to a nonminimal version of $N=1$ supergravity. A new superpotential, $g_2(z)$, has been found that gives a scalar potential $V(z)$ that is even in z and which breaks supersymmetry inside the circle of radius $\sqrt{6}/\mathbf{k}$ in the complex $\langle z\rangle$ plane. (9 refs.)

98915 Octonionic torsion on S^7 and Englert's compactification of $d=11$ supergravity. F.Gursey, Chia-Hsiung Tze (Dept. of Phys., Yale Univ., New Haven, CT, USA).
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.191-6 (28 July 1983).
In an octonionic realisation of the Cartan-Schouten parallelism on S^7 the authors exhibit the algebraic nature and Hopf topology of Englert's solutions for spontaneously compactified $d=11$ supergravity. The S^7 torsion and its dual, the index 4 gauge field are given locally by the Cayley structure constants and the associator of the imaginary octonion units, respectively. (26 refs.)

98916 Consistent supergravity in six dimensions without action invariance. R.D'Auria, P.Fre (Istituto di Fisica, Univ. di Turin, Turin, Italy), T.Regge.
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.44-50 (18 Aug. 1983).
The authors show by an explicit example with a model of $D=6$ supergravity, containing the sechsbein, a Weyl gravitino and a two-index photon, that a consistent theory on the group-manifold might have no counterpart in the usual Noether approach. In this model the self-duality of the Maxwell field strength F_{abc}, necessary to match the Bose-Fermi on-shell degrees of freedom, follows from group-manifold variational equations but not from their x space restriction. As a consequence, the theory is consistent, although the x space lagrangian is not supersymmetric invariant. (5 refs.)

98917 Gravitation and symmetry breaking. R.Anishetty, P.Jetzer (Theoretical Phys., ETH-Honggerberg, Zurich, Switzerland), J.-M.Gerard, D.Wyler.
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.51-4 (18 Aug. 1983).
Among the possible vacua, quantum gravity within the stationary phase approximation selects the vacuum with vanishing cosmological constant. Classical background gravity coupled to matter renders the highest Higgs potential minimum stable, allowing for spontaneous supersymmetry breaking. The influence of the non-renormalizability of supergravity on the symmetry breaking pattern is studied. (13 refs.)

98918 Graded bundles in the Ogievetsky-Sokatchev supergravity. J.Czyz.
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.481-5
The trivial smooth graded bundles and the trivial and non-trivial analytic ones are presented. The applications of graded bundles in supergravity are discussed. (10 refs.)

98919 The new minimal formulation of N=1 supergravity and its tensor calculus. M.F.Sohnius (Blackett Lab., Imperial Coll., London, England), P.C.West.
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.187-222
Non-extended supergravity is the generally relativistic field theory of a graviton with spin 2 and a massless spin-$^3/_2$ Majorana particle, the gravitino. It therefore describes 2 (bosonic)+2 (fermionic) degrees of freedom for physical states. In terms of fields, the graviton is described by the vierbein $e_\mu{}^a$ with 16 real field components and the gravitino by a Majorana vector-spinor $\psi_{\mu\alpha}$ with also 16 real components. The gauge-invariances of the theory are four general coordinate transformations and six local Lorentz rotations, both bosonic, and the four components of an N=1 local supersymmetry transformation which is fermionic in nature. This leaves 6+12 off-shell field components for $e_\mu{}^a$ and $\psi_{\mu\alpha}$. Since supersymmetry requires matching numbers of bosonic and fermionic degrees of freedom, one can see that an off-shell formulation must have 6+0, modulo 4+4, auxiliary field. A version with no fermionic and six bosonic ones is called a 'minimal' off-shell supergravity. (40 refs.)

98920 A new deteriorated energy-momentum tensor. M.J.Duff (Phys. Dept., Imperial Coll., London, England), P.K.Townsend.
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.223-37
It is well known that the stress-tensor $_{\mu\nu}$ of a scalar field theory is not unique because of the possibility of adding an 'improvement' term, e.g. for the model $\mathcal{L}=-^1/_2(\partial_\mu\phi)^2$ there is a family of stress-tensors $T_{\mu\nu}(\xi)=-[\partial_\mu\phi\partial_\nu\phi-{}^1/_2\eta_{\mu\nu}(\partial\phi)^2]-\xi(\Box\eta_{\mu\nu}-\partial_\mu\partial_\nu)\phi^2$ parameterized by the constant ξ, which is the coefficient of an identically conserved addition to $T_{\mu\nu}$. The ξ-term does affect the trace $T_\mu{}^\mu$, however, and for $\xi={}^1/_6$ we have $T_\mu{}^\mu=0$. The $T_{\mu\nu}$ for this value of ξ is called the 'new-improved' stress tensor (Callan et al. 1970). The authors refer to it as the conformally improved stress-tensor and the parameter ξ as the improvement coefficient. If $\xi\neq{}^1/_6$, so that $T_\mu{}^\mu\neq0$, they refer to the corresponding $T_{\mu\nu}$ as a 'deteriorated' stress-tensor, hence the title. The gravitational coupling of the scalar field ϕ with stress-tensor $T_{\mu\nu}(\xi)$ corresponds to an extra term $\xi R\phi^2/2$ in the curved space Lagrangian. The action is then Weyl (local scale) invariant for the special value $\xi={}^1/_6$ and it was in this context that the ξ parameter was first introduced (Penrose 1965). (31 refs.)

98921 Off-shell N=2 and 4 supergravity in five dimensions. P.Howe (CERN, Geneva, Switzerland).
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.239-53
Currently available x-space Lagrangians for supergravity theories with $N\geq3$ (Ferrara et al. 1977; Freedman and Schwarz 1978; Cremmer et al. 1978; Cremmer and Julia 1979) do not contain auxiliary fields so that the supersymmetry algebra only closes if the field equations are satisfied. In order to quantize these theories it is therefore desirable to know the auxiliary fields and, if possible, to have a superspace formulation, since in the latter case one might hope to be able to use supergraph techniques. The author discusses the auxiliary field problem for N=2 and 4 supergravities in five dimensions from a superspace point of view. (24 refs.)

98922 Supergravity in high dimensions. P.van Nieuwenhuizen (Inst. for Theoretical Phys., State Univ. of New York, Stony Brook, NY, USA).
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.255-81
Discusses the quantisation of supergravity in d=11 dimensions which leads to the termination of ghost couplings. The author constructs the N=1 gauge action and the supersymmetric Yang-Mills action in d=10 and then uses the method of currents to find information on the auxiliary fields. (21 refs.)

98923 Building linearised extended supergravities. J.G.Taylor (Dept. of Math., King's Coll., London, England).
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.283-98
Describes show candidates for auxiliary field multiplets may be discovered for unextended and extended supergravities using field redefinition rules. These may then be supplemented by component transformation rules to select nonlinearisable supergravities. The existence of a barrier at N=3 is demonstrated and candidate auxiliary multiplets with central charges presented for N=4 supergravity. The extension of this analysis to N=8 and N=4 Yang-Mills is finally discussed. (20 refs.)

98924 (Super)gravity in the complex angular momentum plane. M.T.Grisaru (Dept. of Phys., Brandeis Univ., Waltham, MA, USA).
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.299-315
Discusses the complex angular momentum plane, relations between the Kronecker delta singularities and counterterms, and Regge poles in N=8 supergravity. (12 refs.)

98925 The multiple structure of solitons in the O(2) supergravity theory. G.W.Gibbons (Univ. of Cambridge, Cambridge, England).
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.317-21
The notion of a black hole soliton in Quantum Gravity has recently been clarified by Hajicek (1981a) and the relevance of these ideas to supergravity theories has been discussed by Gibbons (1981). In the present report the author expands on these ideas a little and to describe in more detail the fermion zero mode structure. (13 refs.)

98926 Ultraviolet properties of supersymetric gauge theories. S.Ferrara (Theory Div., CERN, Geneva, Switzerland).
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.323-35
Discusses the UV properties of N=1 supersymmetric Yang-Mills theories and then proceeds to look at N=1 to N=8 extended supergravities. (53 refs.)

98927 Duality rotations. B.Zumino (Dept. of Phys., Univ. of California, Berkeley, CA, USA).
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.363-73
Discusses the properties of theories admitting duality rotations in connection with extended supergravity. (11 refs.)

Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop .... See Entry 98651

Dimensional reduction, spinor fields and characteristic classes .... See Entry 99334

Extended supercurrents and the ultraviolet finiteness of N=4 supersymmetric Yang-Mills theory .... See Entry 99367

Branching rules and even-dimensional rotation groups SO_{2k} ....See Entry 99378

Energy, stability and cosmological constant .... See Entry 105003

04.80 EXPERIMENTAL TESTS OF GENERAL RELATIVITY AND OBSERVATIONS OF GRAVITATIONAL RADIATION

98928 Neutron interference: general theory of the influence of gravity, inertia and space-time torsion. J.Audretsch, C.Lammerzahl (Fakultat fur Phys., Univ. Konstanz, Konstanz, Germany).
J. Phys. A (GB), vol.16, no.11, p.2457-77 (1 Aug. 1983).
The general theory of the influence of gravity, inertia (i.e. interferometer motion) and space-time torsion on the outcome of neutron interference experiments is presented. The exact results are obtained in a general relativistic treatment based on the description of a stationary working interferometer in Riemann-Cartan space-time and on the WKB approximation for the neutron waves. Particular attention is paid to the influence on the spinor amplitude. There are two types of resulting amplitude effects; one originates in the non-integrability of the spinor connection and represents the influence of a modified Riemann-Cartan curvature; the other is caused by the influence of the interferometer rotation and acceleration and of space-time torsion during the time interval between the emission of the two coherent neutron waves. For practical purposes small effects are treated in an approximation. Two examples of a global evaluation of the expressions are given. Applications including a gravitational Aharonov-Bohm effect are discussed. (31 refs.)

98929 How to detect the gravitationally induced phase shift of electromagnetic waves by optical-fiber interferometry. K.Tanaka (Dept. of Electrical Engng., Gifu Univ., Gifu, Japan).
Phys. Rev. Lett. (USA), vol.51, no.5, p.378-80 (1 Aug. 1983).
Attention is called to a laboratory experiment of an optical-fiber interferometer which can show the gravitationally induced phase shift of optical waves. A phase shift of $\sim10^{-6}$ rad is anticipated for the Earth's gravitational potential difference of 1 m when a He-Ne laser and two multiple-turn optical-fiber loops of length 5 km are used. The phase shift can be varied by rotating the loops about an axis parallel to the Earth's surface. This order of phase shifts can be detected by current optical-fiber interferometric techniques. (10 refs.)

04.90 OTHER TOPICS IN RELATIVITY AND GRAVITATION

Newtonian cosmology (problems of didactics of cosmology) .. See Entry 104997

05.00 STATISTICAL PHYSICS AND THERMODYNAMICS

(see also 02.50 Probability theory, stochastic processes, and statistics)

Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS .... See Entry 98627

05.20 STATISTICAL MECHANICS

98930 One-dimensional hard rod caricature of hydrodynamics. C.Boldrighini (Istituto Matematico, Univ. di Camerino, Camerino, Italy), R.L.Dobrushin, Yu.M.Sukhov.
J. Stat. Phys. (USA), vol.31, no.3, p.577-616 (June 1983).
The authors give a rigorous deduction of the 'hydrodynamic' equation which holds in the hydrodynamic limit, for a model system of one-dimensional identical hard rods interacting through elastic collisions. The main result is the proof that if $\{P^\epsilon, \epsilon>0\}$ is a class of initial states which are homogeneous on a scale much less than ϵ^{-1}, and if the corresponding particle densities tend, as $\epsilon \rightarrow 0$, in the proper scale, to the initial hydrodynamic density $g_0(q, v)$, then, under some general assumptions on the states P^ϵ and on g_0, the particle densities of the evolved states at time $\epsilon^{-1}t$ tend as $\epsilon \rightarrow 0$ to the unique solution of the hydrodynamic equation with initial condition g_0. The proof is completed by exhibiting a large class of initial families $\{P^\epsilon, \epsilon>0\}$ which possess the required properties. (16 refs.)

98931 A note on the asymptotic master equations for systems with bound states. A.Di Prisco, G.Gutierrez (Dept. de Fisica, Univ. Central de Venezuela, Caracas, Venezuela).
J. Stat. Phys. (USA), vol.31, no.3, p.617-21 (June 1983).
It is shown that, within the convolutionless formalism of Fulinski (1978), the asymptotic form (in time) of the Liouville equation does not change with the existence of bound states in the energy spectrum of the system under consideration. (6 refs.)

98932 A new proof of the Stillinger-Lovett complete shielding condition. P.A.Martin, C.Gruber (Inst. de Phys. Theorique, Ecole Polytech. Federale, Lausanne, Switzerland).
J. Stat. Phys. (USA), vol.31, no.3, p.691-710 (June 1983).
It is shown that any equilibrium state of classical charged particles with correlation having a spatial decay faster than $1/|x|^{\nu+2}$ in dimension $\nu=2, 3$ obeys the Stillinger-Lovett second moment condition. Under the same clustering hypothesis, arbitrary localized external charge distributions are completely shielded. (17 refs.)

98933 Twenty-five years of the maximum-entropy principle. J.N.Kapur (Dept. of Math., Indian Inst. of Technol, Kanpur, India).
J. Math. & Phys. Sci. (India), vol.17, no.2, p.103-57 (April 1983). (Proceedings of the Conference on Mathematical Analysis and Applications, Madras, India, 12-13 Nov. 1982).
During the last twenty-five years the maximum-entropy principle has had very important applications in statistical mechanics, statistics, geography, spatial and urban structures, economics, marketing, systems analysis actuarial science, finance, computer science, spectrum analysis, pattern recognition, search theory, operations research, biological sciences, risk analysis and even in the analysis of deterministic systems. While in some areas it has been universally accepted as a great breakthrough, in others it has not been accepted by the Establishment and regarded as just another possible alternative approach, the use of which can be left to personal preferences of individual scientists. In the present survey both its strengths and weaknesses are examined and some challenging problems that remain outstanding at the end of the first quarter century of the principle are discussed. (141 refs.)

98934 Absence of long-range order above two dimensions. F.C.Alcaraz, L.Jacobs (Inst. for Theoretical Phys., Univ. of California, Santa Barbara, CA, USA), R.Savit.
Phys. Rev. Lett. (USA), vol.51, no.6, p.435-8 (8 Aug. 1983).
It is shown that a d-dimensional statistical system of a single U(1) variable, $\exp(i\phi)$, whose Hamiltonian is invariant under the transformation $\phi(x_1, \ldots, x_d) \rightarrow \phi(x_1, \ldots, x_d) + \Lambda(x_3, \ldots, x_d)$, with λ an arbitrary function, has no long-range order, so that $\langle \exp(i\phi) \rangle = 0$ for all nonzero temperatures. Moreover, the full planar symmetry reflected in the above transformation law is also unbroken for all $T>0$. When $d=2$ the usual Mermin-Wagner result is recovered. Various extensions and physical implications of this theorem are briefly discussed. (7 refs.)

98935 Statistical mechanics of cellular automata. S.Wolfram (Inst. for Advanced Study, Princeton, NJ, USA).
Rev. Mod. Phys. (USA), vol.55, no.3, p.601-44 (July 1983).
Cellular automata are used as simple mathematical models to investigate self-organization in statistical mechanics. A detailed analysis is given of 'elementary' cellular automata consisting of a sequence of sites with values 0 or 1 on a line, with each site evolving deterministically in discrete time steps according to definite rules involving the values of its nearest neighbors. With simple initial configurations, the cellular automata either tend to homogeneous states, or generate self-similar patterns with fractal dimensions $\simeq 1.59$ or $\simeq 1.69$. With 'random' initial configurations, the irreversible character of the cellular automaton evolution leads to several self-organization phenomena. Statistical properties of the structures generated are found to lie in two universality classes, independent of the details of the initial state or the cellular automaton rules. More complicated cellular automata are briefly considered, and connections with dynamical systems theory and the formal theory of computation are discussed. (184 refs.)

98936 Cluster expansion for ion-dipole systems. A.L.Rebenko (Inst. of Theoretical Phys., Acad. of Sci., Ukrainian SSR).
Theor. & Math. Phys. (USA), vol.53, no.3, p.1224-34 (Dec. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.3, p.429-43 (Dec. 1982).
The result of Brydges and Federbush (1980) is generalized to the case of ion-dipole systems of classical statistical mechanics. The author establishes more accurate values for the parameters for which there is convergence of these cluster expansions, and also establishes the existence and exponential clustering of the correlation functions for infinite volume. It is established that if the ion concentration is not equal to zero, not only the ion-ion but also the dipole-dipole interactions are screened. (16 refs.)

Proceedings of the Conference on Mathematical Analysis and Applications ....See Entry 98633

Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981 ....See Entry 98660

The Fokker-Planck equation as a dynamical system .... See Entry 98998

Essential spectrum of an N-particle additive cluster operator . See Entry 99033

On the stability of a class of kinetic equations ....See Entry 99044

Elementary methods for statistical systems, mean field, large n, and duality ....See Entry 99339

Some new integrable models in field theory and statistical mechanics ....See Entry 99341

05.30 QUANTUM STATISTICAL MECHANICS

(see also 67. Quantum fluids, and 71. Electron states in condensed matter)

98937 The potential of zero charge of jellium. W.Schmickler (Inst. fur Phys. Chem., Univ. Dusseldorf, Dusseldorf, Germany).
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.135-9 (29 July 1983).
A model of the interface metal/electrolyte is presented in which the metal is represented as jellium, the solvent as an ensemble of dipoles. The potential of zero charge of the interface is calculated for various electronic densities of the jellium. The results are discussed with respect to experimental data. (13 refs.)

98938 Quantum statistical mechanics as a construction of an embedding scheme. O.Melsheimer (Fachbereich Phys., Philipps-Univ., Marburg, Germany).
Found. Phys. (USA), vol.13, no.7, p.745-58 (July 1983).
The author shows that the formalism of equilibrium quantum statistical mechanics can fully be incorporated into Ludwig's embedding scheme (1977, 1979, 1984) for classical theories in many-body quantum mechanics. A construction procedure based on a recently developed reconstruction procedure for the so-called macro-observable is presented which leads to the explicit determination of the set of classical ensembles compatible with the embedding scheme. (10 refs.)

98939 Sufficient conditions for convergence of antinormally ordered expansions of boson number operator functions $f(\hat{a}^+\hat{a})$. R.Baltin (Dept. of Theoretical Chem., Univ. of Ulm, Ulm, Germany).
J. Phys. A (GB), vol.16, no.12, p.2721-42 (21 Aug. 1983).
From previous work on ordering expansions of the boson number operator $\exp(-\mu\hat{a}^+\hat{a})$ formulae are derived for normally and antinormally ordered forms of arbitrary boson number operator functions $f(\hat{a}^+\hat{a})$ in terms of the Fourier transform $g(\lambda)$ of $f(x)$. When the antinormally ordered form $f^{(a)}(\hat{a}^+\hat{a})$ is applied to states belonging to the domain of definition of $f(\hat{a}^+\hat{a})$, the result differs in general from the action of $f(\hat{a}^+\hat{a})$ on these states or is not even defined. For the number operator eigenstates $|m\rangle$ two criteria are derived which give conditions on the Fourier transform $g(\lambda)$ ensuring validity of $f^{(a)}(\hat{a}^+\hat{a})|m\rangle = f(m)|m\rangle$. The general considerations are demonstrated by two examples for functions f. (23 refs.)

98940 On condensation in the free-boson gas and the spectrum of the Laplacian. M.van den Berg (Dublin Inst. for Advanced Studies, Dublin, Ireland).
J. Stat. Phys. (USA), vol.31, no.3, p.623-37 (June 1983).
The author proves the convergence of the thermodynamic functions of a free boson gas for a d-dimensional ($d=3, 4, \ldots$) van Hove sequence of convex regions. The thermodynamic functions behave singularly at a critical density ρ_c which is independent of the geometrical details of the sequence. One is led to define a second critical density ρ_m depending on the geometrical details of the sequence. For densities between ρ_c and ρ_m none of the single particle states is macroscopically occupied. The author derives a sufficient condition on the sequence such that $\rho_m = \rho_c$. (15 refs.)

98941 Are 2π rotations observable?. T.F.Jordan (Dept. of Phys., Univ. of Minnesota, Duluth, MN, USA).
Phys. Lett. A (Netherlands), vol.96A, no.9, p.457-9 (1 Aug. 1983).
Two beams of indistinguishable fermions from independent sources cannot produce an interference pattern that changes when the wavefunction of each single-fermion state for one beam is multiplied by -1; they cannot produce interference the way photons from independent sources can. This means the changes in neutron interference caused by magnetic field applied to one of the beams cannot be interpreted as equivalent to changes that could be made by rotating the source of one beam by 2π radians. If it is assumed that rotation by 2π radians cannot be observed, the argument made here becomes a simple proof that particles with half-integral spin cannot be bosons. (9 refs.)

98942 Charge displaced by a one-body potential in a fermion assembly in terms of the highest occupied state. K.A.Dawson, N.H.March (Dept. of Theoretical Chem., Univ. of Oxford, Oxford, England).
Phys. Lett. A (Netherlands), vol.96A, no.9, p.460-2 (1 Aug. 1983).
For (i) a slowly varying potential $V(r)$ in a Fermi gas and (ii) N particles moving in a linear harmonic-oscillator potential, the total displaced charge and the particle density are respectively written in terms of the highest occupied state. (8 refs.)

98943 A geometrical approach to Bose and Fermi statistics. L.P.Hughston (Lincoln Coll., Oxford, England), T.R.Hurd.
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.201-3 (28 July 1983).
The paper introduces a new approach to Bose and Fermi statistics, based on twistor theory. The authors treat the case of massless free fields, and show how 2-particle states (containing either two fermions or two bosons) can be characterised as sheaf cohomology elements on the space of pairs of symmetrised projective twistors. (12 refs.)

98944 Divergences and long-time tails in two- and three-dimensional quantum Lorentz gases. T.R.Kirkpatrick (Inst. for Phys. Sci. & Technol., Univ. of Maryland, College Park, MD, USA), J.R.Dorfman.
Phys. Rev. A (USA), vol.28, no.2, p.1022-46 (Aug. 1983).
The authors discuss divergences in the density expansion of the mobility of a quantum-mechanical particle moving in either two and three dimensions through a random array of hard-core scatterers. The most important divergences at low temperatures are of quantum-mechanical origin and involve the ratio of the de Broglie wavelength of the moving particle to its mean free path. When these divergent contributions are resummed they lead to both of the following: (1) logarithmic terms in the virial expansion of the mobility and (2) long-time tails in the integrand of the Green-Kubo formula for the mobility. In d dimensions for long-time tails have the form $-\alpha^{(d)}/t^{d/2}$, where $\alpha^{(d)}$ is a positive constant. For $d=2$, the long-time tail is not integrable and the implications of this are discussed. Similar results have been obtained by Abraham et al. (1980). For $d=3$, the long-time tails lead to corrections to the zero-frequency mobility of $O(\omega^{1/2})$, where ω is the frequency. This result should be detectable in electron-mobility experiments in gases at low temperatures. (33 refs.)

98945 Rotation generators in two-dimensional space and particles obeying unusual statistics. G.A.Goldin (Dept. of Phys., Princeton Univ., Princeton, NJ, USA), D.H.Sharp.
Phys. Rev. D (USA), vol.28, no.4, p.830-2 (15 Aug. 1983).
The authors describe systems of particles obeying unusual statistics in two-dimensional space, as well as solenoid-charged-particle composites, in terms of a complete set of local gauge-invariant currents. (16 refs.)

98946 Para-bosons and para-fermions in quantum mechanics. M.Cattani, N.C.Fernandes (Inst. de Fisica, Univ. de Sao Paulo, Sao Paulo, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.4, p.585-98 (Dec. 1982).
The authors have performed, within the framework of the ordinary quantum mechanics, a detailed study of the energy eigenfunctions of N identical particles using the irreducible representations of the permutation group in the Hilbert space. The para-states, as with the boson and fermion states, are compatible with the postulates of quantum mechanics and with the principle of indistinguishability. The paper gives a mathematical support for the existence of para-bosons and para-fermions and justifies, in a certain sense, Gentile's quantum statistics (1942). (25 refs.)

98947 Gauge invariance in the strong coupling BCS-model. A.Rieckers (Inst. fur Theoretische Phys., Univ. Tubingen, Tubingen, Germany).
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.546-8
The author describes some results of an ab initio treatment of the strong coupling BCS-model by means of C^*-algebraic methods which covers also single electron excitations. (3 refs.)

Self-triality in statistical mechanics and field theory ....See Entry 98723
Second quantization in a box with a moving wall ....See Entry 98825
Stochastic quantization method of fermion fields ....See Entry 98862
A formulation of quantum stochastic processes and some of its properties ....See Entry 98950
Dynamic groups and coexistence phenomena ....See Entry 99069
Thomas-Fermi theory in a weak, slowly varying vector potential ....See Entry 100262
The non-equilibrium condensation of spin$^1/_2$ lattice bosons ...See Entry 102092
Bose spectrum of superfluid systems of the He^3-He^4 type .....See Entry 102108

05.40 FLUCTUATION PHENOMENA, RANDOM PROCESSES, AND BROWNIAN MOTION

98948 Brownian motion in a system with plane or spherical symmetry and an elastic boundary: approximate solutions of the stationary Fokker-Planck equation. S.Waldenstrom, K.R.Naqvi, K.J.Mork.
Ark. Fys. Semin. Trondheim (Norway), no.8, p.1-62 (1983).
The stationary version of the generalized Fokker-Planck equation is presented for the cases of spherical and plane symmetry in terms of the coordinates entering the actual problem and with a view to stressing the similarity of the two geometries; it is shown that the same expression for the (velocity-space) Fokker-Planck operator applies in both cases and that eigenfunctions of this operator can be constructed by forming products of Legendre and generalized Laguerre polynomials. These equations are solved, within a common framework, by the method of moments, using full-range expansions (in eigenfunctions) of the distribution functions and Marshak-type boundary conditions to describe the situations in which the sphere at $r=R$ and the wall at $x=0$ are elastic (i.e. partially absorbing) boundaries. (21 refs.)

98949 The diffusion limit for reversible jump processes on Z^d with ergodic random bond conductivities. R.Kunnemann (Inst. fur Angewandte Math., Heidelberg, Germany).
Commun. Math. Phys. (Germany), vol.90, no.1, p.27-68 (1983).
Considers a reversible jump process on Z^d whose jump rates themselves are random. The author shows mean square convergence of this process under diffusion scaling to a limiting Brownian motion with a certain diffusion matrix, characterizing effective conductivity. (14 refs.)

98950 A formulation of quantum stochastic processes and some of its properties. K.-E.Hellwig, W.Stulpe (Inst. fur Theoretische Phys., Tech. Univ. Berlin, Berlin, Germany).
Found. Phys. (USA), vol.13, no.7, p.673-99 (July 1983).
Elements of discrete quantum stochastic processes which arise when the classical probability space is replaced by quantum theory have been considered by Hellwig (1981). The authors give a general formulation and its properties are compared with those of classical stochastic processes. It is considered whether such processes can be Markovian. An example is given and similarities to methods in quantum statistical thermodynamics are pointed out. (5 refs.)

98951 Quantum Brownian motion. H.Grabert, P.Talkner (Inst. fur Theoretische Phys., Univ. Basel, Basel, Switzerland).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.797-802 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The authors propose a new master equation describing the irreversible process of a quantum-Mechanical Brownian particle. The master equation is shown to obey the symmetry of detailed balance leading to a quantum analogue of the reciprocity relations, and the fluctuation-dissipation theorem is obtained. The relation to previous approaches is discussed. (8 refs.)

98952 Scenarios for the onset of chaos. P.H.Coullet, C.Vanneste (Lab. de Phys. de la Matiere Condensee, Nice, France).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.813-23 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The authors' aim is to give a simple and qualitative description of the transition to temporal chaos observed in experiments and dynamical systems. They present a classification of these routes according to the number of independent frequencies present just before the transition. Landau proposed a scenario in which the destabilization of an infinite number of independent frequencies would lead to turbulence. Ruelle, Takens and Newhouse (1971, 1978) showed that after the appearance of at most three independent frequencies in a given physical system, there exist arbitrary small deterministic perturbations which could give rise to chaotic behavior, described by some stable solutions of ordinary differential equations: the so called 'strange attractors'. The picture which emerges from this result seems to be compatible with experimental results and numerical simulations. This does not mean that the transition to chaos consists in a scenario where three frequencies necessarily appear. On the contrary, the transition has been observed many times after periodic and biperiodic states. The authors describe the one and two-frequencies scenarios with some details. The three frequencies cases are discussed in the conclusion. (29 refs.)

98953 Stability and relative stability in nonlinear driven systems. R.Landauer (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.847-61 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Fluctuation activated escape from a metastable state to a more likely state has been long been a subject of theoretical attention. The author illustrates the existing methods by application to noise induced errors in underdamped Josephson junction circuits. Concern with escape from the metastable state has been extended, during the last two decades, to include a concern with relative stability in open systems. The sophistication of some of the recent theories may have obscured the simpler and more important physical aspects which are reviewed. The author emphasizes the simplicity of transport in the most common one-dimensional situations. Two different forms for the diffusion current, $D\partial n/\partial x$ and $\partial(Dn)/\partial x$, commonly found in the literature, are discussed. The more likely of several competing locally stable states cannot be identified by simple criteria which are only concerned with the states being compared. The detailed kinetics along the pathways connecting such states, where the system is rarely found, cannot be ignored. As a consequence one cannot expect to discuss the origin of life, or evolution, by reliance on thermodynamic or information theoretic criteria, without attention to the detailed pathways for the process. (32 refs.)

98954 Microstructure of two-phase random media. II. The n-point matrix probability functions for fully penetrable spheres. S.Torquato (Dept. of Mech. & Aerospace Engng., North Carolina State Univ., Raleigh, NC, USA), G.Stell.
J. Chem. Phys. (USA), vol.79, no.3, p.1505-10 (1 Aug. 1983).
For pt.II, see ibid., vol.78, no.6, p.3262 (1983). The authors examine the n-point matrix probability functions S_n (which give the probability of finding n points in the matrix phase of a two-phase random medium), for a model in which the included material consists of fully penetrable spheres of equal diameter (i.e., a system of identical spheres such that their centers are randomly distributed in the matrix). Exploiting the special simplicity of the model they give an explicit closed-form expression for S_3 as well as sharp bounds on S_3 and S_4. sharp bounds on S_3 and S_4. on S_3 and their corresponding upper bound on S_4 satisfy certain asymptotic forms (for both small and large separation of points) that are satisfied by the exact S_3 spheres, even though the bounding properties of their expressionscan only be guaranteed for penetrable spheres. and S_4 for impenetrable as well as penetrable These expressions (and the resulting approximation for S_4 in terms of S_1 and S_2 obtained from them) are thus highly appropriate approximants for both systems to be used in composite-media transport-coefficient expressions that involve integrals over the S_n. The S_3 expression has in fact been suggested some time ago by Weissberg and Prager (1970); the authors' methods here provide further justification for this expression as well as one means of systematically generalizing it to S_n for higher n. (17 refs.)

98955 On the position-space renormalisation group approach to diffusion-limited cluster growth problems. M.Sahimi, G.R.Jerauld (Dept. of Chem. Engng. & Materials Sci., Univ. of Minnesota, Minneapolis, MN, USA).
J. Phys. A (GB), vol.16, no.12, p.L419-25 (21 Aug. 1983).
The authors investigate the application of position-space renormalisation group methods to the Witten-Sander (1981) model of diffusion-limited cluster growth. They show that this method cannot be used to investigate the asymptotic behaviour of the Witten-Sander model in three and higher dimensions, even though it yields satisfactory results in two dimensions with small cells. (24 refs.)

98956 On some Gaussian ensembles of Hermitian matrices. M.L.Mehta, A.Pandey (CENS, Gif-sur-Yvette, France).
J. Phys. A (GB), vol.16, no.12, p.2655-84 (21 Aug. 1983).
A Gaussian ensemble of Hermitian matrices with an arbitrary ratio of their symmetric and anti-symmetric parts is studied. Similarly a Gaussian ensemble of Hermitian quaternion matrices with an arbitrary ratio of their self-dual and anti-self-dual parts is studied. Analytical expressions for the correlation and cluster functions as well as their limits when the order of the matrices is large, are derived for both ensembles. (19 refs.)

98957 Scaling analysis for random walk properties on percolation clusters. J.C.Angles d'Auriac, R.Rammal (Centre de Recherches sur les Tres Basses Temperatures, CNRS, Grenoble, France).
J. Phys. C (GB), vol.16, no.23, p.L825-30 (20 Aug. 1983).
A scaling analysis for some random walk properties (range, renewal theory) on percolation clusters is outlined. Numerical simulations performed in the Bethe lattice case are in good agreement with the predictions of the scaling theory. The values $\tilde{d}={}^4/_3$ and $\bar{d}=4$ for the spectral and fractal dimensions are also confirmed. (7 refs.)

98958 The asymptotic evaluation of a class of path integrals. II.. J.M.Luttinger (Dept. of Phys., Columbia Univ., New York, NY, USA).
J. Math. Phys. (USA), vol.24, no.8, p.2070-3 (Aug. 1983).
For pt.I see ibid., vol.23, p.1011 (1982). The asymptotic behavior of a class of Wiener-like path integrals (functions of the 'local time') is determined. These integrals are of interest in themselves and also arise very naturally in the theory of disordered systems. The author shows that by making use of a Grassman algebra (i.e. a set of anticommuting variables), the earlier treatment of this problem can be greatly simplified. In particular, the previous use of 'replica trick' (which involves a difficult to justify analytic continuation in the number of field components) is thus avoided. (6 refs.)

98959 On the relation between white shot noise, Gaussian white noise, and the dichotomic Markov process. C.Van Den Broeck (Dept. Natuurkunde, Vrije Univ. Brussel, Brussel, Belgium).
J. Stat. Phys. (USA), vol.31, no.3, p.467-83 (June 1983).
It is shown that the dichotomic Markov process converges to a white shot noise (interpreted according to the Stratonovich integration rule) in the joint limit in which the average duration of one of the states goes to zero and the value at this state goes to infinity. A further limit procedure allows one to obtain Gaussian white noise from white shot noise. These results are applied to the problem of noise-induced transitions. It is shown that white shot noise can give rise to transitions which do not occur for Gaussian white noise. The above results are finally generalized in introducing compound dichotomic Markov processes. (14 refs.)

98960 What can we learn from homoclinic orbits in chaotic dynamics?. P.Gaspard, G.Nicolis (Faculte des Sci., Univ. Libre de Bruxelles, Bruxelles, Belgium).
J. Stat. Phys. (USA), vol.31, no.3, p.499-518 (June 1983).
State diagrams of two model systems involving three variables are constructed. The parameter dependence of different forms of complex nonperiodic behavior, and particularly of homoclinic orbits, is analyzed. It is shown that the onset of homoclinicity is reflected by deep changes in the qualitative behavior of the system. (15 refs.)

98961 Physical kinetics of quantum electrodynamic $(1/\omega)$-noise. A.Widom, G.Megaloudis (Dept. of Phys., Northeastern Univ., Boston, MA, USA), T.D.Clark, R.J.Prance.
Phys. Lett. A (Netherlands), vol.96A, no.9, p.449-50 (1 Aug. 1983).
The physical kinetics of soft photon emission in electronic quantum brownian motion is invoked to give a simple picture of the quantum electrodynamic sources of '$(1/\omega)$-noise' in conducting systems. (5 refs.)

98962 Stochastic motion of the propagating front in bistable media. A.S.Mikhailov, L.Schimansky-Geier, W.Ebeling (Sektion Phys., Humboldt-Univ. Berlin, Berlin, Germany).
Phys. Lett. A (Netherlands), vol.96A, no.9, p.453-6 (1 Aug. 1983).
The authors investigate the problem of front propagation in bistable media with fluctuating properties. The explicit formulas for the induced variations of the propagating speed and the dispersion of the front position are derived under the assumption that fluctuations in the properties of the medium are weak but can have arbitrary spatial and temporal correlation ranges. (8 refs.)

98963 Transition from quasi-periodicity to chaos in a system of coupled nonlinear oscillators. M.Sano, Y.Sawada (Res. Inst. of Electrical Communication, Tohoku Univ., Sendai, Japan).
Phys. Lett. A (Netherlands), vol.97A, no.3, p.73-6 (15 Aug. 1983).
The global bifurcation structure for a model of coupled nonlinear oscillators has been analysed numerically. It is shown that destruction of the two-torus preceding chaos is usually observed in this system. The critical surface of the invariant two-torus and its collapse in the course of rotation are firstly observed in a realistic differential equation system. A scaling property for the fine structure of phase-locking regions has also been confirmed. (17 refs.)

98964 Ito versus Stratonovich revisited [noise-induced phase transitions]. J.Smythe, F.Moss (Dept. of Phys., Univ. of Missouri-St. Louis, St. Louis, MO, USA), P.V.E.McClintock, D.Clarkson.
Phys. Lett. A (Netherlands), vol.97A, no.3, p.95-8 (15 Aug. 1983).
It is shown that a digital simulation of a noise induced phase transition using an algorithm consistent with the Ito stochastic calculus is in agreement with the prediction of that theory, whereas experiments with an analogue simulator yield measured results in agreement with the predictions of the Stratonovich theory. (9 refs.)

98965 Generalization of Baker's transformation—chaos and stochastic process on a Smale's horse-shoe. Y.Aizawa, C.Murakami (Dept. of Phys., Univ. of Kyoto, Kyoto, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1416-26 (May 1983).
The area-preserving baker's transformation is extended in order to include the area nonpreserving one, which is the model for a simple horse-shoe structure. The random motion on the horse-shoe is studied precisely, and the invariant density and the correlation function are obtained analytically and numerically. The random walk on the horse-shoe structure is transformed into the generalization Brownian motion with the attractor, and the non-analytic density of the generalized baker's transformation is approximated by an analytic function. The topological similarity between the Lorenz chaos and the generalized baker's transformation is briefly discussed. (8 refs.)

98966 Transition from torus to chaos accompanied by frequency lockings with symmetry breaking—in connection with the coupled-logistic map. K.Kaneko (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1427-42 (May 1983).
Transition from torus to chaos is studied using the coupled-logistic map. The author observes the period-adding sequence, which obeys the critical phenomena of a one-dimensional mapping. The fixed Lyapunov exponent is also obtained. The locking that appears after the sequence breaks the symmetry of the system. Self-similar stripe structure of basins is also found. Various properties and a phase diagram of the map are given. The mechanism of the distortion of torus and transition to chaos is also discussed. (23 refs.)

98967 Are three-frequency quasiperiodic orbits to be expected in typical nonlinear dynamical systems?. C.Grebogi, E.Ott, J.A.Yorke (Univ. of Maryland, College Park, MD, USA).
Phys. Rev. Lett. (USA), vol.51, no.5, p.339-42 (1 Aug. 1983).
The current state of theoretical understanding related to the question posed in the title is incomplete. This paper presents results of numerical experiments which are consistent with a positive answer. These results also bear on the problem of characterizing possible routes to chaos in nonlinear dynamical systems. (11 refs.)

98968 Microscopic derivation of the stochastic process for the quantum Brownian oscillator. P.Ruggiero (Istituto di Fisica, Univ. degli Studi di Salerno, Salerno, Italy), M.Zannetti.
Phys. Rev. A (USA), vol.28, no.2, p.987-93 (Aug. 1983).
The microscopic model of Ford et al. (1965) for the interaction of an oscillator with a thermal reservoir is considered within the framework of stochastic quantization. The process executed by the Brownian particle is derived exactly and it is analyzed in detail. The phenomenological equations for the dynamics of the quantum oscillator in the equilibrium state, which the authors have previously derived, and recovered as the weak coupling limit of the exact theory. (18 refs.)

98969 External noise and the dynamics of Ginzburg-Landau systems far from equilibrium. M.Kerszberg (Dept. of Phys., Harvard Univ., Cambridge, MA, USA).
Phys. Rev. A (USA), vol.28, no.2, p.1198-200 (Aug. 1983).
The dynamics of Ginzburg-Landau (or 'potential') systems driven away from equilibrium and subjected to noise is simulated numerically. It is found that the Fourier spectrum does not always have its peak at the wave number corresponding to the absolute minimum of the potential. This is explained heuristically on the basis of an entropy type of argument. (11 refs.)

98970 Functional renormalization-group theory of universal $1/f$ noise in dynamic systems. I.Procaccia, H.Schuster (Dept. of Chem. Phys. & Electronics, Weizmann Inst. of Sci., Rehovot, Israel).
Phys. Rev. A (USA), vol.28, no.2, p.1210-12 (Aug. 1983).
The functional renormalization group is used to show that a wide class of dynamical systems displays spectra with a $1/f^{\delta}$ divergence. Cutoffs introduced by stochastic or deterministic perturbations have universal features as well. Numerical support is presented. (12 refs.)

98971 Diffusion in concentrated lattice gases. V. Particles with repulsive nearest-neighbor interaction on the face-centered-cubic lattice. R.Kutner, K.Binder, K.W.Kehr (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).
Phys. Rev. B (USA), vol.28, no.4, p.1846-58 (15 Aug. 1983).
The diffusion of particles in concentrated lattice gases is studied by Monte Carlo methods, assuming a FCC lattice with repulsive nearest-neighbor interaction. Particular attention is paid to the influence of ordering on the diffusion properties, since the model has ordered superstructures at low temperatures T near the stoichiometric concentrations $c={}^1/_4$, ${}^1/_2$, and ${}^3/_4$. Both the self-diffusion of tagged particles and the collective diffusion by which concentration fluctuations decay are obtained. In the ordered regions both diffusivities are rather small due to a strong decrease of the effective jump rate of the particles. The correlation factor $f(T,c)$ for self-diffusion has a pronounced nonmonotonic concentration dependence for low temperatures. This is interpreted by reducing the problem near $T=0$ and the limits $c \to {}^1/_4-$, ${}^1/_2-$ to an effective single-vacancy problem, and $c \to {}^1/_4+$, ${}^1/_2+$ to an effective single-particle problem. Other lattices are briefly discussed. (38 refs.)

98972 Correlators of processes in very simple systems with strange attractors. R.L.Stratonovich (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.942-4 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.355-9 (Nov. 1982).
Systems with strange attractors have recently aroused great interest among physicists. A large number of systems with stochastic behavior have now been described. The statistical properties of processes are calculated or estimated analytically. The goal is to determine correlators for several very simple particular cases. (7 refs.)

98973 Some ideas about strange attractors. L.Garrido (Univ. de Barcelona, Barcelona, Spain), C.Simo.
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.1-28
The authors give a working definition of strange attractors, some results about their origin, structure and several examples. They also provide a survey of types of attractors. (221 refs.)

98974 Chaotic dynamics in Hamiltonian systems with divided phase space. B.V.Chirikov (Inst. of Nuclear Phys., Novosibirsk, USSR).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.29-46
The subject of this lecture is related to a peculiar dynamical phenomenon in classical mechanics commonly termed among physicists as the chaotic, or stochastic, motion. (27 refs.)

98975 Periodic and quasi-periodic orbits for twist maps. A.Katok (Dept. of Math., Univ. of Maryland, College Park, MD, USA).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.47-65
The author presents a motivation for and a survey of recent results which in a certain sense fill the gap between the classical work of G.D. Birkhoff (1950) on periodic orbits for mechanical systems with two degrees of freedom and celebrated KAM theory which deals with the existence of invariant tori for small perturbations of integrable Hamiltonian systems. (28 refs.)

98976 Marcroscopic behavior in a simple chaotic Hamiltonian system. O.E.Rossler (Inst. for Phys. & Theoretical Chem., Univ. of Tubingen, Tubingen, Germany).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.67-77
Nonlinear Hamiltonian systems of only two degrees of freedom readily produce complicated Poincare-type (or, synonymously, chaotic) behavior. Nonlinear Hamiltonian systems of many degrees of freedom, on the other hand, produce not only chaos but also modulate systematic motions (so-called dissipative structures). A two-degrees-of-freedom system is described which shows two types of 'macroscopic' behavior. On one hand, there is a 'main regime' which is characterized by a random distribution of both positional variables. From this 'equilibrium' the system only very rarely departs once it has come close to it. On the other hand, when the system is started sufficiently far away, it spends a certain time in a characteristic 'transient regime' which too (like the main regime) is the same for both time directions. One of the two particles hereby shows a statistical directional preference. This preference is the same as when the system is run as an open system ('temporarily open regime'). The simple nature of the system encourages further quantitative and qualitative investigations. (15 refs.)

98977 A universal transition from quasi-periodicity to chaos. E.D.Siggia (Lab. of Atomic & Solid State Phys., Cornell Univ., Ithaca, NY, USA).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.91-2
A common route to chaos in dissipative systems proceeds from periodic to quasi-periodic flow (with two independent frequencies). Then, in the absence of rotational symmetry, the system generally mode locks before becoming turbulent. Beyond these qualitative features, the numerous experiments that have examined this regime differ in detail. Dynamical system theory had made the occurrence of the above transitions plausible but has provided no non-trivial quantitative and model independent information. This situation, on the theoretical side, has recently changed with a proposal on how to modify the experiments so as to make the transition to chaos occur in a quantitatively universal manner. The essence of the proposal follows from KAM theory which is the weak coupling limit of the strong coupling problem relevant to the turbulent transition. In addition to the Rayleigh number, the experimenter must control a second parameter so as to maintain the frequency ratio in the quasi-periodic state at a fixed irrational value. The golden mean, $(\sqrt{5}-1)/2$, is the optimal ratio experimentally. (2 refs.)

98978 Self-generated diffusion and universal critical properties in chaotic systems. T.Geisel, J.Nierwetberg (Inst. fur Theoretische Phys., Univ. Regensburg, Regensburg, Germany).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.93-114
Reviews the universal critical properties exhibited by some 1d discreted dynamical systems: period-doubling systems and systems generating diffusive motion. While the period-doubling bifurcations have the universal asymptotic bifurcation rate $\delta=4.6692...$, the tangent bifurcations present within the chaotic region do not follow this rate. The authors show that the tangent bifurcations giving rise to a fine structure of periodic windows have bifurcation rates γ_k which can be calculated analytically. They converge to a universal constant $\gamma=2.94805...$ The authors have found that a class of dynamical systems show the onset of a diffusive motion in addition to period-doubling. The diffusion is self-generated and does not rely on the presence of random external forces. The onset of diffusion has strong analogies with a phase-transition. The diffusion coefficient is the order parameter and has a universal critical exponent. The dependence on random external fluctuations is also universal and can be expressed in terms of a universal scaling function which is calculated analytically. (16 refs.)

98979 Subharmonics and the transition to chaos. J.Rudnick (Dept. of Phys., Univ. of California, Santa Cruz, CA, USA).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.115-29
The author looks at a system having both simple and complex subharmonic response, the parametrically driven pendulum. The behavior of this pendulum is formulated in terms of a two-dimensional map. Some simple properties of the map will be investigated and others will be pointed to. Then he considers the spectral signature of period doubling and the structure of the invariant map and its compositions at the accumulation point of the period doubling cascade. (25 refs.)

98980 Low dimensional dynamics and the period doubling scenario. M.Feigenbaum (Lab. of Atomic & Solid State Phys., Cornell Univ., Ithaca, NY, USA).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.131-48
A strategy has been developed to quantitatively determine the nature of the onset of chaotic motion in deterministic systems. This strategy incorporates two main ingredients. The first is a serious consequence of dissipation—in general only dissipative systems are to be considered. The special role of dissipation is that although the systems considered generally possess a large or infinite number of degrees of freedoms, the onset regime is characterized by the excitation of only a few of them. Thus, there exists an effective model of the system in this regime much simpler than the basic local description. The other main ingredient is that a scaling phenomenon for these systems, near the transition to chaos, is governed by a renormalization group theory, so that any low modal model in the same universality class serves as an appropriate model to determine quantitative properties of the actual system. Thus, a general class of one dimensional discrete-time models serves to determine the onset behavior of some real fluid configurations. (no refs.)

98981 Entropy and smooth dynamics. S.E.Newhouse (Dept. of Math., Univ. of North Carolina, Chapel Hill, NC, USA).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.165-79
It is a matter of common experience that simple nonlinear differential equations often have many solutions which exhibit complicated and erratic time dependence. For low dimensional systems there has recently been considerable progress made on the problem of describing such motion. This gives one optimism for understanding physical systems whose principal qualities can be described by a small number of modes. (20 refs.)

98982 Imbedding of a one-dimensional endomorphism into a two-dimensional diffeomorphism. Implications. C.Mira (INSA, Toulouse, France).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.180-7
This paper considers the properties of the diffeomorphism T_b, $x_{n+1}=y_n+f(x_n,a)$, $y_{n+1}=bx_n$, $n=0, 1, 2, \ldots$ x, y, being real variables, a, b, real parameters, in relation with those of the endomorphism T_o: $x_{n+1}=f(x_n,a)$ T_b has a constant Jacobian $J=-b$. For $b=0$, $n=1, 2, 3, \ldots$, the sequence of points, the solutions are identical. (15 refs.)

98983 Strange attractors for differential delay equations. C.Simo (Facultat de Matematiques, Univ. de Barcelona, Barcelona, Spain).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.188-91 (10 refs.)

98984 Stochastic perturbations of some strange attractors. G.Keller (Inst. fur Angewandte Math., Univ. Heidelberg, Heidelberg, Germany).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.192-3
For a class of 2-dimensional, time-discrete dynamical systems including generalized Baker's transformations and similar mapping the author shows that the asymptotic measure has an exponential mixing rate and is stable under small stochastic perturbations. The approximation of arbitrary systems by Markov systems is a special case. (9 refs.)

98985 Solutions of stochastic differential equations and fractal trajectories. B.J.West (La Jolla Inst., La Jolla, CA, USA).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.194-203 (21 refs.)

98986 On the characterization of chaotic motions. I.Procaccia, P.Grassberger, H.G.E.Hentschel (Dept. of Chem. Phys., Weizmann Inst. of Sci., Rehovot, Israel).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.212-22
The authors demonstrate that scaling ideas and fractal statistics can be very useful in dealing with chaotic motions. In particular they concentrate on two topics. The characterization of strange attractors. They offer a method of analyzing and characterizing chaotic experimental signals which stem from motions on strange attractors. The method can distinguish between these and random 'noisy' signals, and can be applied also to very high (or infinite) dimensional systems which possess lower dimensional attractors. The assessment of the fractal nature of fully developed turbulence. It is shown how ideas similar to those treated in part 1 can be applied to the important process of turbulent diffusion, and how to infer from it the fractal dimension of fluid turbulence. (21 refs.)

98987 Complex bifurcations in a periodically forced normal form. C.Baesens (Univ. Libre de Bruxelles, Bruxelles, Belgium).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.223-4
The author shows that in certain classes of systems controlled by two parameters, chaotic motion can be viewed as a local problem both in parameter and in phase space. (5 refs.)

98988 Topological entropy and scaling behaviour. J.Dias de Deus, R.Dilao, J.Taborda Duarte (Centro de Fisica da Materia Condensada, Lisboa, Portugal).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.225-6
In one dimensional maps $f_\mu:[-1,1]$ with fixed end points and depending monotonically on $\mu\epsilon[0,1]$, the growth number (GN) A takes the constant value 1 in the first Feigenbaum region and values between 1 and 2 in the chaotic region, $\mu\epsilon[\mu_\infty,1]$. The authors analyze the behaviour of the GN and of the topological entropy (TE) h in $[\mu_\infty,1]$. (3 refs.)

98989 On the analytic structure of chaos in dynamical systems. T.Bountis (Dept. of Math. & Computer Sci., Clarkson Coll. of Technol., Potsdam, NY, USA).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.227-36
A number of new and exciting results on the chaotic properties of dynamical systems have been recently obtained by studying their movable singularities in the complex time plane. New, integrable systems were indentified by requiring that their solutions admit only poles. Allowing for logarithmic singularities, it has been possible to distinguish between 'strongly' and 'weakly' chaotic Hamiltonian systems, while in some cases natural boundaries with self-similar structure have been found. The analysis is direct, widely applicable and is illustrated here on some simple examples. (36 refs.)

98990 Type-III-intermittency in a smooth perturbation of the logistic system. G.Mayer-Kress, H.Haken (Inst. fur Theoretische Phys., Univ. Stuttgart, Stuttgart, Germany).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.237-8
The authors introduce a two-parameter family of convex maps, which acts as a smooth perturbation of the logistic parabola and for which the Schwarzian derivative can become positive. It is given by: $f_{r,b}(x):=32rx(1-x)(1+bx(1-3x+2(2-x)x^2))/(b+8)$ where r is the value of $f_{r,b}$ at its critical value x_c and b measures the perturbation of the logistic parabola $f_{r,0}$. For this system they additionally observe type-III-intermittency, where a flip-bifurcation of a fixed point is not followed by a doubling of the period, but by a transition to a chaotic attractor, which contains the unstable fixed-point. (11 refs.)

98991 Irreversible evolution of dynamical systems. S.Martinez, E.Tirapegui (Facultad de Ciencias Fisicas y Matematicas, Univ. de Chile, Santiago, Chile).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.239-44
Following some basic ideas of the theory of irreversibility of Prigogine et al. (1973) the group of Brussels has recently developed a canonical method to associate a Markov process 'equivalent' to the reversible evolution of certain dynamical systems exhibiting intrinsic randomness. The authors study this process working for simplicity with the Baker transformation. (5 refs.)

98992 Homoclinic and heteroclinic points in the Henon map. G.Gomez (Univ. Autonoma de Barcelona, Barcelona, Spain), C.Simo.
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.245-7
This communication is devoted to study the role of the homoclinic and heteroclinic points of the Henon mapping in order to explain the capture escape boundary for the Henon attractor previously studied numerically by Hitzl (1981). (3 refs.)

98993 The simple periodic orbits in the unimodal maps. L.Alseda (Dept. de Teoria Economica, Univ. Autonoma de Barcelona, Barcelona, Spain), R.Serra.
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.248-9 (7 refs.)

98994 Modulation properties in decaying processes of the correlation in a family of 1-D maps. T.Nagashima (Inst. fur Theoretische Phys., Univ. Stuttgart, Stuttgart, Germany).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.250-1
Since the work of Ruelle-Takens (1971) on turbulence generation properties of the correlation function in dynamical systems have received a great concern. The author gives an exact analysis of the correlation function for a certain family of 1-D maps. (3 refs.)

98995 Relaxation times and randomness for a nonlinear classical system. M.Casartelli (Istituto di Fisica, Univ. di Parma, Parma, Italy).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.252-3
The author describes numerical experiments on a classial nonlinear system possessing a stochastic transition, showing that a 'memory' of the ordered region survives in the stochastic region, and can be revealed through the analysis of the relaxation times. (3 refs.)

98996 Anharmonic systems in external periodic fields with chaotic behaviour. W.-H.Steeb, A.Kunick, W.Erig (Univ. Paderborn, Paderborn, Germany).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.260-1
The authors investigate the chaotic behaviour of the equations for the potential $V(x)=-\beta\cos x$, where $\beta>0$. They mention that the limiting case where $f=\alpha=0$ is the completely integrable equation of the pendulum. Whether or not chaotic behaviour occurs depends on the parameters f, Ω, α, and β. There are several possibilities to characterize the chaotic state (decay of the autocorrelation functions, one-dimensional Lyapunov exponent, Poincare mapping, Hausdorff dimension and so on). They apply the one-dimensional Lyapunov exponent. If the one-dimensional Lyapunov exponent is positive, then chaotic behaviour is indicated. (no refs.)

98997 The second order Melnikov integral applied to detect quasi-randomness. A.Aubanell (Facultat de Matematiques, Univ. de Barcelona, Barcelona, Spain).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.266-7
The crossing of invariant manifolds in a dynamical system allows use to consider the Bernoulli Shift as a subsystem, and as a consequence, to have quasi-randomness. The Melnikov integral (which the author calls of first order: FOMI) was used by Holmes and Marsden, Mallet-Paret, Chow, Hale, etc., in order to detect quasi-randomness. In some cases this information cannot be obtained from the FOMI. The author introduces the second order (and higher order if necessary) Melnikov Integral to study these problems. (5 refs.)

98998 The Fokker-Planck equation as a dynamical system. A.Munoz Sudupe, R.F.Alvarez-Estrada (Dept. Fisica Teorica, Univ. Complutense, Madrid, Spain).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.268-9 10 3
In dealing with nonequilibrium Statistical Mechanics it is useful to consider, as starting point, the phenomenological stochastic equations of the Langevin or Fokker-Planck types. In order to understand the properties of such dynamical equations, it is quite natural to use, in analogy with statics, the path integral formalism and field-theory techniques. Up to now the most extended formalism is the one introduced by Martin, Siggia and Rose (1973) (MSR) which has been applied with good results by various authors. The authors present an alternative formulationwhich seems more powerful not only in perturbative calculations but also regarding rigorous results. (3 refs.)

98999 Feasibility of calculating dimension and topological entropy. T.Pignataro (Joseph Henry Lab. of Phys., Princeton Univ., Princeton, NJ, USA).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.287-9
Presented here is a summary of some previous work on the application, to several numerical models displaying chaos, of an algorithm suggested by Takens (1981) to calculate the capacity of attractors from the time series of a single observable, the description of some new preliminary results on using the algorithm to calculate topological entropy. (5 refs.)

99000 Non-linear mechanics of a string in a viscous noisy environment. W.G.Faris (Dept. of Math., Univ. of Arizona, Tucson, AZ, USA), G.Jona-Lasinio.
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.171-8
Stochastic partial differential equations constitute a relatively new subject. There have been a number of interesting papers in the last few years, but the field is still in its infancy if compared with the highly developed theory of stochastic ordinary differential equations. The authors report on a study of a nonlinear heat equation in a finite interval of space subject to a white noise forcing term. Due to the nonlinearity the equation, without the forcing term, exhibits several equilibrium configurations two of which are stable, actually asymptotically stable. The solution of the complete forced equation is a stochastic process in space and time with continuous sample paths whose behaviour is studied in the limit of small noise. The authors obtain lower and upper bounds for the probability of large fluctuations and then apply their estimates to the calculation of the transition probability between the stable configurations (tunneling). (8 refs.)

Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics .... See Entry 98650

Quantum theory of light. Second edition .... See Entry 98678

Some aspects of random walks on groups .... See Entry 98722

Chaotic modulation of correlation functions .... See Entry 98732

The nature and correlation of random distributions .... See Entry 98733

Strange attractors in fluid dynamics .... See Entry 98774

Experimental aspects of the period doubling scenario .... See Entry 98775

On the basic states of one-dimensional disordered structures ... See Entry 98793

Qualitative theory of stochastic differential equations and quantum mechanics of disordered systems .... See Entry 98802

Chaotic response of a self-interacting pseudo-spin model .... See Entry 98842

Quantum dynamics .... See Entry 98857

A long-range Domany-Kinzel model of directed percolation .... See Entry 99011

Singular behaviour of certain infinite products of random 2×2 matrices .... See Entry 99014

The percolation of fibres with random orientations: a Monte Carlo study .... See Entry 99015

The asymptotic behaviour of directed self-avoiding walks .... See Entry 99017

Velocity and diffusion constant of a periodic one-dimensional hopping model .... See Entry 99022

Coarse-grained quantities and local environment effects in disordered systems .... See Entry 99029

Closed similarity solutions for a class of stationary nonlinear Boltzmann-like equations .... See Entry 99045

Diffusions generated from dynamical systems .... See Entry 99054

On a third-order phase transition .... See Entry 99057

Self-pulsing and chaos in inhomogeneously broadened single mode lasers .... See Entry 100724

Routes to chaotic emission in a CW He-Ne laser .... See Entry 100733

Self-pulsing and chaos in acoustooptic bistability .... See Entry 100832

Chaos and nonlinear optics: a chaotic Raman attractor .... See Entry 100836

Chaos in coherent two-photon processes in a ring cavity .... See Entry 100841

Stochastic dynamics of polymers .... See Entry 101522

Magnetic properties of superconducting or normal networks and random walks on percolating clusters .... See Entry 102561

Non-nearest neighbor random walks in reaction-diffusion processes .... See Entry 103511

05.50 LATTICE THEORY AND STATISTICS; ISING PROBLEMS

(see also 75.10H Ising models)

99001 Coherent memory functions for finite molecular systems. A direct method of calculation. I.Barvik, V.Szocs (Inst. of Phys., Charles Univ., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.7, p.802-9 (1983).
A new direct method for calculation of coherent memory functions (MFs) entering the Nakajima-Zwanzig (or GME) equation is presented for rigid molecular chains with natural boundary conditions. The method is illustrated on chains with three and five molecules and various kinds of imperfections. Obtained results imply a necessity of a more careful interpretation of experimental data (e.g. diffusivity). (5 refs.)

99002 Correlation functions of the transverse Ising chain at the critical field for large temporal and spatial separations. B.M.McCoy, J.H.H.Perk, R.E.Shrock (Inst. for Theoretical Phys., State Univ. of New York, Stony Brook, NY, USA).
Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B220(FS8), no.3, p.269-82 (25 July 1983).
The authors study the behavior of $\langle\sigma_0{}^x(t)\sigma_n{}^x(0)\rangle$ and $\langle\sigma_0{}^y(t)\sigma_n{}^y(0)\rangle$ for the transverse Ising chain at the critical magnetic field at $T=0$. Explicit results are obtained for the three distinct regions where $t\rightarrow\infty$ and $n\rightarrow\infty$ with $0\leq n/t<1$, $1<n/t$, or $t=n+n^{1/3}\ (z/2)$ where z is fixed of order one. In this latter region the general Painleve V solution is shown to reduce to a Painleve II function. They use their results to discuss the general problem of long-time behavior of Toda equations with slowly decaying initial values. (15 refs.)

99003 Stability of acoustic and optical solitons in a diatomic chain. S.Pnevmatikos, M.Remoissenet (Univ. of Dijon, Dijon, France), N.Flytzanis.
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.569-74 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The authors study the propagation of solitons of the compressive and rarefactive type in nonlinear atomic chains, i.e. they look for permanent profile solutions that preserve their form under collisions (except for a possible phase shift) or they are long lived. For interatomic potentials that can be expanded in a Taylor series in the relative atomic displacements (keep the first few terms) approximate analytic results can be combined with computer experiments if they consider smoothly varying waves. (10 refs.)

99004 Monte Carlo methods for quantum lattice models. H.De Raedt (Dept. of Phys., Univ. of Antwerp, Wilrijk, Belgium), A.Lagendijk.
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.593-603 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The authors discuss a Monte Carlo technique to calculate the thermodynamic properties of quantum lattice models. They use Suzuki's generalized Trotter formula to reformulate the problem in terms of path integrals. Applications treated in detail include the influence of quantum fluctuations on the generalized 1-dimensional classical Wigner lattices introduced by Hubbard and super-localization in Holstein's 1-, 2- and 3-dimensional molecular crystal model. (30 refs.)

99005 A new type of cluster expansion and time-dependent adiabatic perturbation theory on finite and infinite lattices. W.J.Briels (Inst. of Theoretical Chem., Univ. of Nijmegen, Nijmegen, Netherlands).
J. Chem. Phys. (USA), vol.79, no.2, p.969-75 (15 July 1983).
A new type of cluster expansion is proposed, which is used to calculate the properties of the lower part of the spectrum of a general lattice Hamiltonian. The method does not involve power series in the number of lattice sites. Surface effects are easily incorporated into the theory in a natural way. Application to the 1-*d* Ising model in a transverse magnetic field demonstrates that good results can be obtained with moderate computational effort. (18 refs.)

99006 A microscopic model for ordered chain systems. A.Baram, I.Goldhirsch (Dept. of Chem. Phys., Weizmann Inst. of Sci., Rehovot, Israel).
J. Chem. Phys. (USA), vol.79, no.2, p.992-6 (15 July 1983).
A microscopic model for a system of ordered chains is presented. The statistics of a single chain is calculated in a quadratic mean field potential that approximates the steric repulsions between the hydrocarbon chains. The partition function of the problem that contains long range interaction between segments, is transformed to a mathematically tractable Markovian form. Statistical averages and correlations are calculated showing a constant chain alignment near the interface that decays only towards the end of the chain. (30 refs.)

99007 Critical exponents of directed self-avoiding walks. J.L.Cardy (Dept. of Phys., Univ. of California, Santa Barbara, CA, USA).
J. Phys. A (GB), vol.16, no.11, p.L355-7 (1 Aug. 1983).
It is argued that directed self-avoiding random walks are in the same universality class as directed unrestricted random walks, and therefore should exhibit mean-field exponents $\gamma=1$, $\nu_\parallel=1$, $\nu_\perp={}^1/_2$ in all dimensionalities. (4 refs.)

99008 On the critical exponent γ for four common three-dimensional lattices. J.L.Gammel, D.C.Power (Dept. of Phys., Saint Louis Univ., St. Louis, MD, USA).
J. Phys. A (GB), vol.16, no.11, p.L359-63 (1 Aug. 1983).
The rational approximation method is used to examine the critical exponent for the susceptibility in the $S={}^1/_2$ Ising model on the face centred cubic (FCC), body centred cubic (BCC), simple cubic (SC) and diamond lattices. A variation of the method of critical point renormalisation is used to eliminate bias due to uncertainty in the location of the critical point. The results are in agreement with the renormalisation group and with recent series analysis of the BCC series. (13 refs.)

99009 Field theoretic approaches to biconnectedness in percolating systems. A.B.Harris (Schlumberger-Doll Res., Ridgefield, CT, USA), T.C.Lubensky.
J. Phys. A (GB), vol.16, no.11, p.L365-73 (1 Aug. 1983).
Two field theoretic formulations for the percolation problem are presented from which the critical exponents describing the 'backbone' of the infinite cluster at the percolation threshold are obtained. At high spatial dimension, d, the order-parameter exponent for the backbone $\beta^{(2)}$ is given by $\beta^{(2)}=2\beta+\psi^{(2)}\nu$, where β is the critical exponent for the density of the infinite cluster and $\psi^{(2)}$ is a new crossover exponent. In mean-field theory $\psi^{(2)}=0$ and for $d=6-\epsilon$, $\psi^{(2)}=2\epsilon^2/49+O(\epsilon^3)$. Presumably, $\psi^{(2)}(d)$ is a smooth function of d for $d>d^*$, where numerical and theoretical work indicates that d^* is about 3. The result indicates that the fractal dimensionality of the backbone is given in terms of the percolation exponents as γ/ν-$\psi^{(2)}$. (27 refs.)

99010 Real-space renormalisation group study of selective site percolation on triangular lattice. T.Idogaki, N.Uryu (Dept. of Appl. Sci., Kyushu Univ., Fukuoka, Japan).
J. Phys. A (GB), vol.16, no.11, p.2501-14 (1 Aug. 1983).
The selective site percolation is studied on three kinds of triangular lattice, TC, TK and TH lattices, by using renormalisation groups. The recursion relations on occupation probabilities are solved to give global phase diagrams with scaling factor $b=\sqrt{3}$, 2 and 3 for the TC lattice, and with $b=\sqrt{3}$ and $\sqrt{7}$ for TK and TH lattices respectively. The phase boundaries are obtained correctly with the flow direction towards a single isotropic fixed point. This result is in accordance with the anisotropic bond result and consistent with the universality hypothesis. In the extreme anisotropy limit of site preference, these boundaries give good estimates of the critical concentration p_c of chain, Kagome and honeycomb lattices. Especially, in the chain limit for the TC lattice, the critical exponents of both the correlation length $\nu=1$ and the dimensionality crossover $\phi=1$ are reproduced exactly. The dependence of total p_c on site selectivity is also discussed. (30 refs.)

99011 A long-range Domany-Kinzel model of directed percolation. T.C.Li, Z.Q.Zhang (Inst. of Phys., Chinese Acad. of Sci., Beijing, China).
J. Phys. A (GB), vol.16, no.12, p.L401-6 (21 Aug. 1983).
A long-range Domany-Kinzel (1981) model proposed by Wu and Stanley (1982) is solved using random-walk formulations. In this model, for every site (i,j) in a two-dimensional lattice there is a directed bond present from site (i,j) to $(i+1,j)$ with probability one. There are also $m+1$ directed bonds present from (i,j) to $(i-k,\ j+1)$, $k=-1,\ 0,\ 1,\ 2,\ 3\ldots m-1$ with respective probabilities p_{k+1} where m is any positive integer. An exact expression is obtained to determine the critical percolation angle θ_c for any distribution of p_n. The system percolates in the region $\theta_c>\theta\geq0$ with probability one and zero outside this region where θ is the angle measured from the x axis. If the authors let m go to infinity and p_n varies as p_1n^{-s}, they find that when $s\leq2$,

$\theta_c=\pi$. A closed form expression of θ_c is obtained for $s\gtrsim 2$. When m is large but finite, θ_c is also obtained for the following two distributions: (a) $p_n=a/(a+n)$ with $a>0$, (b) $p_n=\beta/m$ and $\beta>0$. (16 refs.)

99012 Duality on planar fractal and hierarchical lattices. J.R.Melrose (Dept. of Phys., Univ. Coll. Cardiff, Cardiff, Wales).
J. Phys. A (GB), vol.16, no.12, p.L407-11 (21 Aug. 1983).
Duality constructions are presented for the classes of planar fractal and hierarchical lattices. Interesting results include the interpretation of dual Sierpinski gasket and carpets as fractal domain models, that the constructions take a lattice, L, with intrinsic dimension D and connectivity Q to a dual, $\tilde{L}$, with $\tilde{D}=D/Q$ and $\tilde{Q}=1/Q$, and a novel, but trivial, dual for the one-dimensional lattice. (16 refs.)

99013 Time continuous limit for the Baxter model. V.Libero, J.R.Drugowich de Felicio (Dept. de Fisica e Ciencia dos Materiais, Inst. de Fisica e Quimica de Sao Carlos, Sao Carlos, Brazil).
J. Phys. A (GB), vol.16, no.12, p.L413-17 (21 Aug. 1983).
The authors obtain the associated Hamiltonian for the symmetric eight-vertex model by taking the time-continuous limit in an equivalent Ashkin-Teller (1943) model. The result is a Heisenberg Hamiltonian with coefficients J_x, J_y and J_z identical to those found by Sutherland (1970) for choices of the parameters a, b, c and d that bring the model close to the transition. The change in the operators is accomplished explicitly, the relation between the crossover operator for the Ashkin-Teller model and the energy operator for the eight-vertex model being obtained in a transparent form. (12 refs.)

99014 Singular behaviour of certain infinite products of random 2×2 matrices. B.Derrida, H.J.Hilhorst (CENS, Gif-sur-Yvette, France).
J. Phys. A (GB), vol.16, no.12, p.2641-54 (21 Aug. 1983).
The authors consider an infinite product of random matrices which appears in several physical problems, in particular the Ising chain in a random field. The random matrices depend analytically on a parameter ϵ in such a way that for $\epsilon=0$ they all commute. Under certain conditions they find that the Lyapunov index of this product behaves approximately as $C\epsilon^{2\alpha}$ for $\epsilon\rightarrow 0$. Their approach is based on the decomposition of an exact integral equation for this problem into two reduced equations. They give an expression for the exponent α in terms of the probability distribution of the matrices, and for the proportionality constant C in terms of the solutions of the reduced integral equations. In cases where exact results are available, agreement is obtained. The physical consequences for disordered one-dimensional systems are pointed out. (15 refs.)

99015 The percolation of fibres with random orientations: a Monte Carlo study. J.Boissonade, F.Barreau, F.Carmona (Centre de Recherche Paul Pascal, Domaine Univ., Talence, France).
J. Phys. A (GB), vol.16, no.12, p.2777-87 (21 Aug. 1983).
Monte Carlo numerical simulations of the percolation of sticks with random orientations on a cubic lattice are reported. Finite size scaling and the position space renormalisation group are used. As the length of the sticks is increased it is found that the critical probability decreases whereas the correlation length exponent remains, within experimental errors, the same as in classical 3D percolation. Comparison with previous experimental and numerical results on related systems leads to the emphasis of the importance of the excluded-volume condition. (27 refs.)

99016 Interface properties of the two-dimensional Blume-Emery-Griffiths model. W.Selke (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany), J.Yeomans.
J. Phys. A (GB), vol.16, no.12, p.2789-800 (21 Aug. 1983).
The authors study the interface behaviour of the two-dimensional Blume-Emery-Griffiths model (1971) which is described by the Hamiltonian $H=-J\Sigma_{\langle ij\rangle}S_iS_j=K\Sigma_{\langle ij\rangle}S_i^2S_j\ ^2+D\Sigma_iS_i^2$ $S_i=1,\ 0,\ -1$. An interface is introduced into the system by fixing the spins on opposite boundaries in two different states, +1 and −1. They pay particular attention to the appearance of an excess of the third state, 0, in the vicinity of the interface. The net adsorption of the non-boundary state is studied near critical, first-order and tricritical transitions. Two methods have been used to attack this problem, the Monte Carlo technique and a modified version of the interface free energy approximation of Muller-Hartmann and Zittartz (1977) which is seen to give a surprisingly good description of interface properties in three-state systems. (31 refs.)

99017 The asymptotic behaviour of directed self-avoiding walks. A.M.Szpilka (Baker Lab., Cornell Univ., Ithaca, NY, USA).
J. Phys. A (GB), vol.16, no.12, p.2883-5 (21 Aug. 1983).
Chakrabarti and Manna (1983) have made a numerical study of 'directed' self-avoiding walks on a square lattice, in which the random walker is forbidden to move upward: extrapolating from an enumeration of N-step walks up to $N=14$, they claimed that the mean end-to-end displacement, R_N, behaves asymptotically for large N as N^{ν} with $\nu=0.86\pm0.02$. It is shown that a simple application of the generating function method yields the behaviour of N-step walks of this type exactly (for all N), and the result $\nu=1$ is rigorously proved. (4 refs.)

99018 The falsity of a conjecture concerning the percolation threshold. A.B.Harris (Schlumberger-Doll Res., Ridgefield, CT, USA).
J. Phys. A (GB), vol.16, no.12, p.2887-8 (21 Aug. 1983).
A recent conjecture relating the critical concentration for bond percolation and a lattice Green function is shown to be false. (2 refs.)

99019 Phenomenological renormalisation group through the moments of the pair correlation function. M.J.de Oliveira (Inst. de Fisica, Univ. de Sao Paulo, Sao Paulo, Brazil).
J. Phys. C (GB), vol.16, no.23, p.L853-5 (20 Aug. 1983).
The author investigates the use of the phenomenological renormalisation group transformation in the nearest-neighbour square Ising model by means of correlation lengths defined by the moments of the pair correlation function. (9 refs.)

99020 On the group structure, GKS and FKG inequalities for Ising models. B.Baumgartner (Dept. of Math., Univ. of Virginia, Charlottesville, VA, USA).
J. Math. Phys. (USA), vol.24, no.8, p.2197-9 (Aug. 1983).
The FKG inequality is applied to a lattice of states of the Ising model which are related to subgroups of the group of spin variables. The resulting correlation inequalities are exactly the GKS inequalities. (17 refs.)

99021 A generalization of the proof of the triviality of scalar field theories. T.Hattori (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).
J. Math. Phys. (USA), vol.24, no.8, p.2200-3 (Aug. 1983).
The proof of the triviality of ϕ^4 theory in $d>4$ dimensions is generalized. The author shows that the triviality of scalar field theories holds for a wide class of potentials. (9 refs.)

99022 Velocity and diffusion constant of a periodic one-dimensional hopping model. B.Derrida (Div. de la Phys., CENS, Gif-sur-Yvette, France).
J. Stat. Phys. (USA), vol.31, no.3, p.433-50 (June 1983).
The velocity and the diffusion constant are obtained for a periodic one-dimensional hopping model of arbitrary period N. These two quantities are expressed as explicit functions of all the hopping rates. The velocity and the diffusion constant of random systems are calculated by taking the limit $N\rightarrow\infty$. One finds by varying the distribution of hopping rates that the diffusion constant and the velocity are singular at different points. Lastly, several possible applications are proposed. (15 refs.)

99023 Localized excitation transport on substitutionally disordered lattices. G.Korzeniewski, R.Friesner, R.Silbey (Dept. of Chem., MIT, Cambridge, MA, USA).
J. Stat. Phys. (USA), vol.31, no.3, p.451-65 (June 1983).
Average-T-matrix and coherent medium theories are used to study the motion of localized excitations on substitutionally disordered lattices. The authors derive equations which relate coherent medium results for bond and site averaging and show how these reduce to the two-body solution results of Gochanour, Andersen, and Fayer (1979). Numerical results for $P_0(t)$, the probability of remaining at the origin for two-dimensional nearest-neighbor lattices are presented. (17 refs.)

99024 Kinetics of a finite one-dimensional mixture of hard rods with different masses. J.Masoliver, J.Marro (Dept. de Fisica Teorica y de Ecuaciones Funcionales, Univ. de Barcelona, Barcelona, Spain).
J. Stat. Phys. (USA), vol.31, no.3, p.565-75 (June 1983).
A one-dimensional binary mixture of impenetrable (hard core) particles with different mass ratios, $m_2/m_1=1$, 1.05, 1.2, 2, 3, and 4, was simulated to evolve in a computer by the molecular dynamics method. The systems with $m_2>m_1$ and initial velocity distribution $\pm\nu_0$ show a clear tendency to the equipartition of energy and relaxation toward a Maxwellian velocity distribution unlike the nonergodic system with $m_2=m_1$. Several quantities have been monitored during the evolution to investigate its dependence on the mass ratio m_2/m_1. (7 refs.)

99025 Study of Monte Carlo methods for generating self-avoiding walks. C.Brender (Dept. of Chem., Bar-Ilan Univ., Ramat-Gan, Israel), D.Ben-Avraham, S.Havlin.
J. Stat. Phys. (USA), vol.31, no.3, p.661-70 (June 1983).
The concept of fractal dimensionality is used to study different statistical methods for generating self-avoiding walks (SAWs). The reliability of SAWs traced by the enrichment technique and the dynamic Monte Carlo technique is verified. The number of dynamic cycles which represent a single independent SAW of N_0 steps is found to be about $0.1N_0^3$. The authors show that the enrichment process for generating SAWs may be presented as a critical phenomenon. (21 refs.)

99026 On Malcev varieties. V.R.Chandran, V.Varalakshmi (Ramanujan Inst. for Advanced Study of Math., Chepauk, Madras, India).
J. Math. & Phys. Sci. (India), vol.17, no.2, p.201-2 (April 1983). (Proceedings of the Conference on Mathematical Analysis and Applications, Madras, India, 12-13 Nov. 1982).
Proves that the class of Boolean lattices form a Malcev variety. (3 refs.)

99027 Bond percolation threshold in the simple cubic lattice. S.Wilke (Inst. of Theoretical Phys., Cologne Univ., Cologne, Germany).
Phys. Lett. A (Netherlands), vol.96A, no.7, p.344-6 (18 July 1983).
In the simple cubic lattice for bond-percolation the author's Monte Carlo simulation gives a value of $p_{\infty}=0.2492\pm0.0002$, in contradiction to a recent speculation of Sahimi et al. (1983) ($p_{\infty}=0.25273$) and to the possibility $p_{\infty}=1/4$. (12 refs.)

99028 Three-dimensional Ising model with two- and four-particle interaction. M.P.Zhelifonov, R.Z.Uritskaya (Kazan Phys.-Tech. Inst., Acad. of Sci., Kazan, USSR).
Phys. Lett. A (Netherlands), vol.96A, no.9, p.467-70 (1 Aug. 1983).
The three-dimensional Ising model is investigated by the method of interdependent pfaffians. It is shown that this model may be represented as two independent planar lattices. (3 refs.)

99029 Coarse-grained quantities and local environment effects in disordered systems. M.Goda (Faculty of Engng., Niigata Univ., Niigata, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1396-402 (May 1983).
It is proved that the effective 'distance' $\bar{m}(\epsilon+i\Gamma)$, proposed first by Matsuda for a linear chain model with nearest-neighbour interaction, exists in any dimensional disordered systems described by a bounded Hamiltonian with short-range interaction. Thus the local situation or short-range order plays an essential role in determining various physical quantities in the sense that the Green function $G_{l,l'}(\epsilon+i\Gamma)$ is almost determined by the local situation of the system at and around the sites l and l'. (22 refs.)

99030 Confirmation of dynamical scaling at the percolation threshold. R.B.Pandey, D.Stauffer (Inst. of Theoretical Phys., Cologne Univ., Koln, Germany).
Phys. Rev. Lett. (USA), vol.51, no.7, p.527-9 (15 Aug. 1983).
In contrast to some earlier studies, good agreement has been found between the asymptotic random-walk exponent for particles restricted to the occupied sites of a simple-cubic lattice, and the dynamical scaling prediction of Gefen et al. (1983). For the first time, up to 10^7 steps were used in the Monte Carlo study, which moreover employed larger lattices (180^3) than earlier studies. (18 refs.)

99031 Anisotropic bond percolation in two dimensions. D.Arovas (Dept. of Phys., Princeton Univ., Princeton, NJ, USA), R.N.Bhatt, B.Shapiro.
Phys. Rev. B (USA), vol.28, no.3, p.1433-7 (1 Aug. 1983).
A new single-parameter renormalization-group equation is formulated for anisotropic bond percolation in two dimensions using a position-space renormalization approach. The new equation yields the exact critical line $P_x+P_y=1$ within both the Migdal-Kadanoff decimation and cell renormalization schemes. For large anisotropy, however, an additional critical line appears leading to a spurious divergence in the correlation-length critical exponent. An alternative scheme, which does not preserve the exact critical surface, but yields a correlation-length exponent relatively independent of anisotropy, is also examined. (13 refs.)

99032 Evidence for classical critical behavior in long-range site percolation. M.Gouker, F.Family (Dept. of Phys., Emory Univ., Atlanta, GA, USA).
Phys. Rev. B (USA), vol.28, no.3, p.1449-52 (1 Aug. 1983).
A new large-cell Monte Carlo renormalization group following the approach of Reynolds et al. (1980) is developed to study site percolation with long-range interaction. The results show that site percolation with a long, but finite, range of interactions has the same correlation-length exponent ν_P approaches its mean-field value of $^1/_2$ indicating that infinite-range percolation exhibits classical critical behavior. (11 refs.)

99033 Essential spectrum of an N-particle additive cluster operator. H.Zoladek (Moscow State Univ., Moscow, USSR).
Theor. & Math. Phys. (USA), vol.53, no.2, p.1085-91 (Nov. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.2, p.216-26 (Nov. 1982).
An N-particle additive cluster operator is considered. An analogue of the Hunziger-van Winter-Zhislin theorem (1960) on the structure of the essential spectrum for fixed total momentum is proved for it. (4 refs.)

99034 Darboux transformations for non-Abelian and nonlocal equations of the Toda chain type. M.A.Sall' (Inst. of Precision Mech. & Optics, Leningrad, USSR).
Theor. & Math. Phys. (USA), vol.53, no.2, p.1092-9 (Nov. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.2, p.227-37 (Nov. 1982).
Darboux transformations are used to construct explicit solutions for the two-dimensionalised Toda chain, sine-Gordon equations and their non-Abelian analogues, the nonlinear Schrodinger equation, the nonlocal Toda equation, and non-Abelian equations of Langmuir oscillations. (19 refs.)

99035 Ising model on finitely presented groups. M.Rasetti (Dipartimento di Fisica, Politecnico di Torino, Torino, Italy).
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.513-33K
In statistical mechanics the study of critical phenomena and phase transitions has long been, to a large extent, centered around lattice systems. Space-time lattices were recently introduced as a technical device to obtain cut-off field theories, whose solution would give some insight in field theories defined in continuum Minkowski space-time. Once a lattice field theory has been formulated, the problem can be formally reduced to one of statistical mechanics. The general philosophy is that at the critical point the theory should loose memory of the lattice structure, and the continuous space time results be recovered. Lattice gauge theories are especially remarkable for their relation to the classical spin systems of statistical mechanics. Exactly solvable models are very few in number, and the Ising model still stands at the very frontiers of our present knowledge. So far no exact general solution has been found for it in more than two dimensions. (14 refs.)

99036 Influences of lattice dimension d and character of spin-interactions on the thermodynamics of Ising models. H.Nencka-Ficek (Inst. of Molecular Phys., Polish Acad. of Sci., Poznan, Poland).
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.543-5
An exact solution is obtained for hypercubic d-dimensional Ising model with multi-spin interactions. (3 refs.)

99037 Connectivity: a primer in phase transitions and critical phenomena for students of particle physics. H.E.Stanley (Dept. of Phys., Boston Univ., Boston, MA, USA).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.1-42
The author describes briefly three of the principal approaches used to study connectivity phenomena: (a) exact enumeration procedures, (b) Monte Carlo computer simulation, and (c) renormalization group. He concludes with a brief mention of some of the tantalizing relations between connectivity phenomena and various models of thermal critical phenomena such as the Ising model, the Potts model, and a 'polychromatic' generalization of the Potts model. (35 refs.)

99038 Algebraic aspects of exact models. M.Gaudin (Service de Phys. Theorique, CENS, Gif-sur-Yvette, France).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.43-60
Several statistical or dynamical systems modelling a variety of physical phenomena, such as spin chains, two dimensional spin lattices and chemical crystals, or particles in δ function interaction, share the same momentous underlying structures, which are essentially the applicability of Bethe's superposition ansatz for wave functions, the commutativity of transfer matrices, and the existence of an important ternary operator algebra. Their close relationship among each other, and with features like integrability and S matrix factorization discussed in field theoretical context, became familiar in the course of time. The author outlines algebraically the appearance of these structures and interrelations among them, exemplarily for the eight vertex model and for δ function interacting particles of general spin and spin 1/2. (11 refs.)

99039 Polyacetylene: a real material linking condensed matter and field theory. D.K.Campbell (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.217-28
One of the most active subjects of recent research at the interface between field theory and statistical mechanics concerns a real material that seems more properly to belong to the arcana of organic chemistry than to either field theory or statistical mechanics. The material is polyacetylene ($(CH)_x$), a quasi-one dimensional organic polymer with some very interesting and potentially exotic properties. The author gives a pedagogical introduction to some of the recent theoretical studies of polyacetylene and conveys some of the reasons for the intense excitement in this area. (24 refs.)

99040 Finite-size scaling theory. V.Rittenberg (Phys. Inst., Bonn Univ., Bonn, Germany).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.249-58
Fisher's finite-size scaling describes the cross-over from the singular behaviour of thermodynamic quantities at the critical point to the analytic behaviour of a finite system. The author presents the method and then proceeds to show how it is applied to the specific example of a Z_3 symmetric quantum chain. (13 refs.)

99041 Anderson transition and nonlinear σ-models. F.Wegner (Inst. fur Theoretische Phys., Ruprecht-Karls-Univ., Heidelberg, Germany).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.259-60
The author covers the behaviour of a quantum mechanic particle moving in a random potential with special emphasis on the critical behaviour near the mobility edge. Symmetry arguments are reviewed which allow the mapping of such a system onto a field theoretical model of interacting matrices. This model yields an expansion of the critical exponents at the mobility edge around the lower critical dimensionality two. (9 refs.)

Proceedings of the Conference on Mathematical Analysis and Applications .... See Entry 98633

Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981 .... See Entry 98660

Absence of long-range order above two dimensions .... See Entry 98934

Scaling analysis for random walk properties on percolation clusters .... See Entry 98957

Diffusion in concentrated lattice gases. V. Particles with repulsive nearest-neighbor interaction on the face-centered-cubic lattice .... See Entry 98971

Sol-gel transition .... See Entry 99058

Residual entropy of two-dimensional ice on a ruby lattice .... See Entry 99059

Thermal conductivity in the diatomic Toda lattice .... See Entry 99060

Phase transitions in new solvable Hamiltonians by a Hamiltonian minimization .... See Entry 99065

Position-space renormalisation group for directed branched polymers .... See Entry 100614

On the probability distribution of the end-to-end vector of a polymer chain .... See Entry 100615

Percolation behaviour of permeable and of adhesive spheres . See Entry 101514

Magnetic properties of superconducting or normal networks and random walks on percolating clusters .... See Entry 102561

Extended high-temperature series expansions for the spin-*s* Ising model .... See Entry 102607

Computer simulations of a discontinuous phase transition and percolation clusters in the two-dimensional one-spin-flip Ising model .... See Entry 102609

A probabilistic approach to the models of spin glasses .... See Entry 102668

Exact correspondence between equilibrium polymerization and multispin Ising models .... See Entry 103521

05.60 TRANSPORT PROCESSES: THEORY

99042 Boltzmann equation on a lattice global solution for nonMaxwellian gases. A.Palczewski (Inst. of Mech., Univ. of Warsaw, Warsaw, Poland).
Arch. Mech. (Poland), vol.34, no.3, p.287-96 (1982).
The author discusses the nonlinear Boltzmann equation in which the spatial variable is replaced by an infinite lattice. He proves the existence of a global strong solution in the case of nonMaxwellian molecules (unbounded collision kernel). (7 refs.)

99043 Local similarity solutions for the initial-value problem in nonlinear diffusion. R.E.Grundy (Appl. Math. Dept., Univ. of St. Andrews, St. Andrews, Scotland).
IMA J. Appl. Math. (GB), vol.30, no.2, p.209-14 (March 1983).
Considers the initial-value problem for the equation $\partial v/\partial t=(\partial v/\partial x)^2+\beta v(\partial^2 v/\partial x^2)$ with $\beta>0$. For initial data with finite support the interfaces where v is zero may move immediately or after the lapse of a finite time. The structure of the solution, in the cases where this is governed by local conditions on the initial data, is described by local similarity solutions which in the appropriate limit can be matched to the global solution. (4 refs.)

99044 On the stability of a class of kinetic equations. W.Maass (Fachbereich Phys., Philipps-Univ. Marburg, Marburg, Germany).
Found. Phys. (USA), vol.13, no.7, p.715-29 (July 1983).
Stability properties of kinetic model equations (including discrete versions of the master equation and Boltzmann's equation) are derived by means of Lyapunov's direct method. The construction of suitable Lyapunov functions leads to results about the structural stability of the dynamical systems and makes it possible to compose more complicated systems from the given ones, preserving automatically some form of stability. (15 refs.)

99045 Closed similarity solutions for a class of stationary nonlinear Boltzmann-like equations. H.Cornille, A.Gervois, V.Protopopescu (Service de Physique Theorique, CENS, Gif-sur-Yvette, France).
J. Phys. A (GB), vol.16, no.11, p.L343-50 (1 Aug. 1983).
The authors look for closed stationary solutions of nonlinear transport equations of the stochastic Boltzmann type in $(1+1)$ dimensions (velocity v and position x). These solutions, mainly written as the product of an exponential by a polynomial in $z=x^\lambda v^2$, have the quasi similarity property. As a consequence of their polynomial character, they violate the positivity requirement; however, the authors think that they are the dominant term of infinite series solutions which might have the desired positivity property. Calculations are greatly simplified by using sum rules analogous to conservation of mass and energy. (11 refs.)

99046 A note on the super-*H*-theorem for a linear Boltzmann equation. J.O.Vigfusson (Inst. fur Theoretische Phys., Univ. Zurich, Zurich, Switzerland).
J. Phys. A (GB), vol.16, no.11, p.L351-3 (1 Aug. 1983).
The super-*H*-theorem $(-1)^n d^n H(t)/dt^n \geq 0$, $n\geq 1$, $t\in[0,\infty)$, is proven to be incorrect for the Boltzmann equation in the relaxation time approximation (i.e. the homogeneous BGK model for Maxwellian molecules). (12 refs.)

99047 Use of macromolecular compounds to control internal mass transfer in a granular material. A.M.Abramets, I.I.Lishtvan, N.V.Churaev (Peat Inst., Acad. of Sci., Minsk, Belorussian SSR).
J. Eng. Phys. (USA), vol.43, no.6, p.1389-94 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.6, p.976-82 (Dec. 1982).
Experimental data are presented on the effects of water-soluble macromolecular compounds (MMC) on the internal mass transfer in quartz sand and peat under nonisothermal conditions. (23 refs.)

99048 Relaxations and high frequency diffusional processes in condensed media. V.O.Shestopal (Div. of Environmental Mech., CSIRO, Canberra, Australia).
Mol. Phys. (GB), vol.49, no.5, p.1231-45 (10 Aug. 1983).
Diffusional mechanisms are considered, particularly of high frequency processes where the frequency of individual jumps is comparable with that of the external force oscillation. The dependence of jump probability on the time interval from the arrival of the diffusing element is taken into account. Introduction of the sink function yields a solution without lengthy calculations. The dispersion equation relating wave vector and frequency and the generalized Fokker-Planck equation are obtained for homogeneous and nonhomogeneous media. The example of interstitial diffusion in a crystal lattice illustrates the method. Diffusion between two states is considered for the case of finite diffusional jump time. The results are applicable to orientational

relaxations. Complex diagrams reveal several maxima on the internal friction frequency dependence, similar to some experimentally observed spectra. The mean velocity and dispersion of a singgle diffusin element are expressed through the probability distribution of diffusional jumps, for both translational and rotational diffusion. (14 refs.)

99049 Systematic method for solving transport equations derived from master equations. O.J.Eder, T.Lackner (Austrian Res. Center, Seibersdorf, Austria).
Phys. Rev. A (USA), vol.28, no.2, p.952-62 (Aug. 1983).
It is shown how a one-dimensional transport equation (derived from a master equation) for a time-dependent conditional average of an arbitrary function can be solved successively, if the moments of the transition probability can be expanded in a series of a special parameter. The transport equation for the time-dependent conditional average value can be transformed into a set of l linear partial differential equations of first order for the lth approximation of the conditional average value. The system of equations is closed in the sense that the lth partial differential equation is determined by the solutions of the l-1 partial differential equations. It is shown how the results obtained compare with the linear noise approximation. Two examples are chosen to illustrate the way to use the method. One is the classical example of the diffusion of a Brownian particle, the other is Alkemade's diode. (17 refs.)

99050 Charged-particle transport in one-dimensional systems [dosimetry application]. G.Muthukrishnan (Health Phys. Unit, Bhabha Atomic Res. Centre, Calcutta, India), D.V.Gopinath.
Radiat. Res. (USA), vol.95, no.1, p.1-14 (July 1983).
A semianalytical technique to study the charged-particle transport in one-dimensional finite media is developed. For this purpose, the transport equation is written in the form of coupled integral equations, separating the spatial and energy-angle transmissions. Legendre polynomial representations for the source, flux, and scattering kernel are used to solve the equations. For evaluation [illegible] the spatial transmission, discrete ordinate representation in space, energy, and direction cosine is used for the particle and source flux. The integral equations are then solved by the fast iteration technique. The computer code CHASFIT, written on the basis of the above formulation, is described. The fast convergence of the iteration process which is characteristic of charged-particle transport is demonstrated. Convergence studies are carried out with a number of mesh points and polynomial approximations. The method is applied to study the depth-dose distributions due to 140-, 200-, 300-, 400-, 600-, and 740-MeV protons incident normally on a 30-cm-thick tissue slab. The values of the quality factor at the surface and at 5 cm depth, as well as the total average quality factor, are calculated. The results thus obtained are compared with those predicted by the Monte Carlo method. This method can also be applied to multienergy, multiregion systems with arbitrary degree of anisotropy. (8 refs.)

99051 Non-holonomy and the diffusion of particles. P.C.Soares (Dept. de Fisica Nuclear, Univ. Federal do Rio de Janeiro, Rio de Janeiro, Brazil), L.C.Gomes.
Rev. Bras. Fis. (Brazil), vol.12, no.2, p.261-83 (June 1982).
The diffusion equation for non-holonomic systems is derived and discussed. This equation, valid in the limit of high viscosity, exhibits in the equilibrium state permanent solenoidal currents. These currents disappear when the system is Liouvillian, a concept introduced to generalize the behaviour of holonomic systems. The continuity of the diffusion equation from non-holonomy to holonomy is also shown. (4 refs.)

99052 Non-holonomy and the diffusion of particles. II. P.C.Soares (Dept. de Fisica Nuclear, Univ. Federal do Rio de Janeiro, Rio de Janeiro, Brazil), L.C.Gomes.
Rev. Bras. Fis. (Brazil), vol.12, no.4, p.663-91 (Dec. 1982).
The authors have obtained the equilibrium solution of the Fokker-Planck equation for both Liouvillian and non-Liouvillian systems. They present procedures to solve the diffusion equation for non-holonomic systems. They present a suggestion as to where such systems may be found in nature, at the microscopic level. (6 refs.)

99053 Decay to uniform states in competitive systems. P.N.Brown (Dept. of Math., Univ. of Houston, Houston, TX, USA).
SIAM J. Math. Anal. (USA), vol.14, no.4, p.659-73 (July 1983).
Weakly coupled parabolic systems describing populations undergoing diffusion and competition in a spatial domain Ω are discussed. Assuming the existence of a unique critical point of the interaction dynamics with all populations coexisting, sufficient conditions are given (on the dynamics) which guarantee the global asymptotic stability of the critical point. These conditions imply the existence of a continuous family of contracting rectangles which decrease down to the critical point and then the theory of contracting rectangles implies the stability. General two and n species models are discussed along with some illustrative examples. (10 refs.)

99054 Diffusions generated from dynamical systems. M.Williams (Dept. of Math., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.290-6
The probability distribution of the random variable defined to be the length of time the process remains within some fixed domain before leaving is determined in the asymptotic limit as the strength of the noise on the system tends to zero. The method used here is an interplay between probabilistic tools and the techniques of differential equations and singular perturbations. (20 refs.)

Interaction of a light particle with a system of heavy particles .... See Entry 98866

Microstructure of two-phase random media. II. The *n*-point matrix probability functions for fully penetrable spheres .... See Entry 98954

On the position-space renormalisation group approach to diffusion-limited cluster growth problems .... See Entry 98955

Non-linear mechanics of a string in a viscous noisy environment .... See Entry 99000

Velocity and diffusion constant of a periodic one-dimensional hopping model .... See Entry 99022

Localized excitation transport on substitutionally disordered lattices .... See Entry 99023

05.70 THERMODYNAMICS

(see also 44.60 Thermodynamic processes, 64. Equations of state, phase equilibria and phase transitions, 65. Thermal properties of condensed matter; for chemical thermodynamics, see 82.60)

99055 A study of equilibrium points with application to constitutive modelling. K.Frischmuth (Inst. of Fundamental Technol. Res., Polish Acad. of Sci., Warsaw, Poland).
Arch. Mech. (Poland), vol.34, no.3, p.263-73 (1982).
The paper contains an analysis of the behavior of a general constitutive model during relaxation processes. Basic definitions and a minimal set of assumptions are introduced to prove some theorems on equilibrium states as well as on the set of all equilibrium points. The results of Sect. 5 are the starting point for a discussion of unstable processes. Some of the present results are generalizations of theorems, which were earlier obtained by other authors. Several restrictions for the modelling of viscoplastic media follow from the paper. (11 refs.)

99056 A new approach to irreversibility from maximum entropy estimation. M.Dutta, J.Sen Gupta (S.N. Bose Inst. of Phys. Sci., Univ. of Calcutta, Calcutta, India).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.7, p.757-62 (1983).
Deals with the study of some irreversible processes like slow heating of a thermodynamic system or of inhomogeneity, i.e. spatially local equilibrium in it, based on the principle of maximum entropy estimation, in a stochastic model. (8 refs.)

99057 On a third-order phase transition. T.Eisele (Inst. fur Angewandte Math., Univ. Heidelberg, Heidelberg, Germany).
Commun. Math. Phys. (Germany), vol.90, no.1, p.125-59 (1983).
The asymptotic behaviour of random variables of the general form $\ln\Sigma_{i=1}^{\kappa N}\exp(N^{1/p}\beta\zeta_i)$ with independent identically distributed random variables ζ_i is studied. This generalizes the random energy model of Derrida (1980). In the limit $N\rightarrow\infty$, there occurs a particular kind of phase transition, which does not incorporate a bifurcation phenomenon or symmetry breaking. The hypergeometric character of the problems its Φ-function, and its entropy function are discussed. (8 refs.)

99058 Sol-gel transition. A.Coniglio (GNSM, Istituto di Fisica Teorica, Napoli, Italy).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.721-32 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The basic phenomenology of the sol-gel transition is reviewed. Distinction is made between reversible and irreversible gelation, which can be interpreted correspondingly as an annealed and quenched process. The geometrical nature and the driving mechanism of the sol-gel transition is described and analogies and differences with other types of phase transitions are pointed out. Classical theories, which neglect loops predict a set of critical exponents rather different from those predicted by percolation models. However, more realistic kinetic models seem to fall in a different universality class. When solvent effects are taken into account, the occurrence of critical density fluctuations gives rise to interesting multicritical phenomena, which can be described by a lattice gas Potts model. The structure of the gel network in the vicinity of such a multicritical point is predicted to be rather different from the usual one. (43 refs.)

99059 Residual entropy of two-dimensional ice on a ruby lattice. Keh Ying Lin, Wen Jong Ma (Phys. Dept., Nat. Tsing Hua Univ., Hsinchu, Taiwan).
J. Phys. A (GB), vol.16, no.11, p.2515-19 (1 Aug. 1983).
The authors have calculated the residual entropy of two-dimensional ice on a ruby lattice by the method of series expansion. Based on the first five terms of the series, they have found that the residual entropy is $S=Nk \ln W$ where N is the number of molecules and $W=1.560\pm0.001$. (11 refs.)

99060 Thermal conductivity in the diatomic Toda lattice. F.Mokross, H.Buttner (Phys. Inst., Univ. Bayreuth, Bayreuth, Germany).
J. Phys. C (GB), vol.16, no.23, p.4539-46 (20 Aug. 1983).
The diatomic Toda lattice, a linear chain with exponential interaction and alternating masses, is coupled to different heat baths at the two ends. The non-integrability of the system leads to a quasi-ergodic behaviour. It is shown numerically that a stationary linear temperature gradient is supported by the chain. The conductivity coefficient κ depends on the mass ratio and the temperature of the heat baths, but not on the chain length. The theoretical values for κ compare reasonably well with experimental results in BN and MgO. (21 refs.)

99061 On the relationship between fluctuating irreversible thermodynamics and 'extended' irreversible thermodynamics. J.Keizer (Dept. of Chem., Univ. of California, Davis, CA, USA).
J. Stat. Phys. (USA), vol.31, no.3, p.485-97 (June 1983).
The relationship between fluctuating irreversible thermodynamics and theories of irreversible processes which include the thermodynamic fluxes as independent variables is explored. It is shown that the usual fluctuating linear theory of irreversible thermodynamics is a contraction of the extended theory. This contraction contains nonMarkovian effects dependent upon the relaxation times associated with the thermodynamic fluxes. In the limit that these relaxation times are small, the extended theory is shown to be equivalent to the usual fluctuating thermodynamic theory. A critique of the extended theories is given from the point of view of the mechanistic statistical theory of irreversible processes. (36 refs.)

99062 Extrapolation and series acceleration procedures: hard spheres and discs as illustrations. M.V.Sangaranarayanan, S.K.Rangarajan (Dept. of Inorganic & Phys. Chem., Indian Inst. of Sci., Bangalore, India).
Phys. Lett. A (Netherlands), vol.96A, no.7, p.339-43 (18 July 1983).
Three new procedures—in the context of estimation of virial coefficients and summation of the partial virial series for hard discs and hard spheres—are proposed. They are based on the parameterised Euler transformation, a novel resummation, identity and the ϵ-convergence methods respectively. A comparison with other estimates (molecular dynamics, graph theory and empirical methods) reveals satisfactory agreement. (15 refs.)

99063 Exact results for a linear chain planar EQQ model. R.B.Pandey (Dept. of Phys., North Carolina State Univ., Raleigh, NC, USA).
Phys. Lett. A (Netherlands), vol.96A, no.8, p.397-8 (25 July 1983).
A linear chain planar EQQ model is studied using the transfer matrix method. The specific heat is found to vary as T^2 in the high-temperature limit and is linear in T in the low-temperature to the leading orders. (7 refs.)

99064 Comment on 'The question of an upper bound on entropy'. B.R.Iyer, J.Samuel (Raman Res. Inst., Bangalore, India).
Phys. Lett. A (Netherlands), vol.97A, no.3, p.99 (15 Aug. 1983).
Shows that the upper bound on the entropy of a finite system proposed by Qadir (see ibid., vol.95A, p.285, 1983) is not universal and consequently

neither interesting nor relevant to the Bekenstein-Unruh-Wald debate (1981-3). (3 refs.)

99065 Phase transitions in new solvable Hamiltonians by a Hamiltonian minimization. M.Kardar (Dept. of Phys., MIT, Cambridge, MA, USA).
Phys. Rev. Lett. (USA), vol.51, no.7, p.523-6 (15 Aug. 1983).
By minimization of a Hamiltonian with respect to its interaction parameters, new Hamiltonians are generated. The same minimization procedure is carried out with the free energy of the initial Hamiltonian, and it is proven that in the thermodynamic limit the minimized free energy is the free energy of the minimized Hamiltonian. This method is illustrated with two-dimensional Ising models generalized to include both nearest-neighbor bonds and infinite-range bond-bond interactions. New critical behaviour is observed. (19 refs.)

99066 Bounds on the effective thermal conductivity of two-phase systems. R.N.Pande, V.Kumar, D.R.Chaudhary (Dept. of Phys., Univ. of Rajasthan, Jaipur, India).
Pramana (India), vol.20, no.4, p.339-46 (April 1983).
The weighted geometric mean of resistors considered for determining the effective thermal conductivity K_E of two-phase systems has been optimised. Solutions of the equations lead to a useful set of bounds. When compared with other bounds the present bounds give the better results in estimating the upper and lower values of the effective thermal conductivity of a two-phase system. (20 refs.)

99067 On the virial coefficients of the equation of state of system of non-axial molecules. S.Singh (Dept. of Phys., Banaras Hindu Univ., Varanasi, India).
Pramana (India), vol.20, no.4, p.347-57 (April 1983).
A thermodynamic perturbation theory in which all angle-dependent interactions are considered as a perturbation of the central potential is applied to calculate the second and third virial coefficients of a fluid composed of non-axial molecules. The influence of a large number of anisotropic pair- and three-body non-additive interactions has been considered. Experimental values have been used for the dipole moment, quadrupole tensor and for anisotropic polarizability. The parameters for the central Lennard-Jones (12-6) potential have been determined from the viscosity data. The relative contribution of each branch of pair and triplet interactions has been evaluated as a function of temperature for molecules possessing both the axial- and non-axial symmetries. It has been shown that the non-axial approximation is an improvement over the axial one. Theoretical results have been compared with the experimental data of CH_3OH. (19 refs.)

99068 Topological entropy on rotation sequences. C.Gillot (Dept. de Math., Inst. Nat. des Sci. Appl., Toulouse, France).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.254-6
Let $f:[0,1]\rightarrow[0,1]$ be a continuous unimodal map: for $u\epsilon[0,1]$,f is strictly increasing on $[0,u]$,$f(0)>0$,$f(u)=1$, and strictly decreasing on $[u,1]$, $f(1)=0$ The author assumes that f is such that u is a periodic point, with period $N>2$. The relative positions of the iterates of u are transcribed by some distinct integer sequence $R_N=(i_k)$. $1\leq k,i_k\leq N$, which is called the rotation sequence of the cycle. The aim of this paper is to give a direct application of these properties in the study of topological entropy. He claims that entropy can be defined on the set of rotation sequences, and, among others, a 'fractal' behaviour of the entropy function is shown. (6 refs.)

99069 Dynamic groups and coexistence phenomena. A.I.Solomon (Faculty of Maths., Open Univ., Milton Keynes, England).
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.553-7
This note describes an application of dynamical Lie groups to many body systems exhibiting phase transitions. The specific model exemplified is that of a three-phase many fermion system for which the appropriate groups is SO(6). (12 refs.)

Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981 .... See Entry 98660

Nonequilibrium thermodynamics of surface phenomena in solids .... See Entry 98763

On condensation in the free-boson gas and the spectrum of the Laplacian .... See Entry 98940

Entropy and smooth dynamics .... See Entry 98981

Topological entropy and scaling behaviour .... See Entry 98988

Feasibility of calculating dimension and topological entropy .... See Entry 98999

Monte Carlo methods for quantum lattice models .... See Entry 99004

Interface properties of the two-dimensional Blume-Emery-Griffiths model .... See Entry 99016

Evidence for classical critical behavior in long-range site percolation .... See Entry 99032

Connectivity: a primer in phase transitions and critical phenomena for students of particle physics .... See Entry 99037

Finite-size scaling theory .... See Entry 99040

The renormalization group and critical phenomena .... See Entry 99309

n-Fold polarization measures and associated thermodynamic entropy of N partially coherent pencils of radiation .... See Entry 100631

A model of thermo-mechanical behaviour of metals with phase changes .... See Entry 101081

Thermodynamics and structure of simple dense fluids .... See Entry 101519

Perturbation theory for equilibrium properties of a binary mixture of hard discs .... See Entry 101520

Extended high-temperature series expansions for the spin-*s* Ising model .... See Entry 102607

Computer simulations of a discontinuous phase transition and percolation clusters in the two-dimensional one-spin-flip Ising model .... See Entry 102609

A probabilistic approach to the models of spin glasses .... See Entry 102668

The ideal law of mass action and first-order phase transition .... See Entry 103493

05.90 OTHER TOPICS IN STATISTICAL PHYSICS AND THERMODYNAMICS

99070 A simplification of the Second Law of Thermodynamics. J.F.McCauley.
Energy Eng. (USA), vol.80, no.3, p.51-65 (1983).
The article presents some facsimiles between thermal, electrical and hydraulic energy as they relate to the Second Law of Thermodynamics. It cites specific examples of Second Law applications and presents a numerical quality yardstick for consideration in preliminary energy source-energy receiver matching. (no refs.)

06.00 MEASUREMENT SCIENCE, GENERAL LABORATORY TECHNIQUES, AND INSTRUMENTATION SYSTEMS

06.20 METROLOGY

06.20D Measurement and error theory

99071 Calculation of the errors of direct measurements. R.Rakowski.
Pomiary Autom. Kontrola (Poland), vol.29, no.1, p.15-16 (Jan. 1983). In Polish.
Describes statistical methods of calculating the error of a direct measurement taking into consideration two and three component errors: random, systematic, and of a measuring tool. (4 refs.)

Dynamic properties of instruments for measuring heat flux .....See Entry 99098

Problem of compensating the influence of temperature changes on measurement results. .... See Entry 99101

Improving the accuracy of absolute measurements in a photometric sphere .... See Entry 99151

Optimization of Schlieren apparatus parameters .... See Entry 100876

06.20H Measurement standards and calibration

99072 Calibration of wavelengths by optogalvanic spectroscopy. Jin Ju-guang, Jin Chang-tai, Wang Song-yue (Changchun Inst. of Appl. Chem., Acad. Sinica, China).
Chin. Phys. (USA), vol.3, no.2, p.430-2 (April-June 1983).
Typical optogalvanic spectra of neon, lithium, sodium, calcium, and nickel were obtained using hollow cathode lamps and a tunable CW dye laser in the 574-625 nm range. 43 spectral lines of neon were identified and the first optogalvanic spectroscopical data were provided for calibrating wavelengths. Optimum conditions for generating optogalvanic spectra and the characteristics of optogalvanic spectroscopy were discussed. (no refs.)

99073 Radiation standard of high radiance. E.Geyer, K.Gunther, St.Lang.
Exp. Tech. Phys. (Germany), vol.31, no.3, p.257-64 (1983).
The operation conditions and the radiation properties of a pulsed radiation standard are described which emits a blackbody radiation of 12000K for wavelengths >310 nm during a 1 ms pulse. A recent comparison of the source with state temperature standards (IPTS-68) as well as the particularities of the use of the radiation standard in connection with time integrating radiation detectors are described. (7 refs.)

99074 Gold as a reliable internal pressure calibrant at high temperatures. L.C.Ming, M.H.Manghnani, J.Balogh (Hawaii Inst. of Geophys., Univ. of Hawaii, Honolulu, HI, USA), S.B.Qadri, E.F.Skelton, J.C.Jamieson.
J. Appl. Phys. (USA), vol.54, no.8, p.4390-7 (Aug. 1983).
Energy-dispersive X-ray diffraction measurements on a mixture of powdered NaCl and Au were carried out at high temperatures up to 600°C (at atmospheric pressure) and also at simultaneously high temperatures and high pressures (to 425°C and 10.2 GPa). A modified diamond-anvil high pressure cell with a mini resistance-wire heater was used in conjunction with the synchrotron radiation at the Stanford Synchrotron Radiation Laboratory. The temperature of the sample was measured directly by a precalibrated Pt-Pt 10% Rh thermocouple adjacent to the sample. The pressure of the sample was determined by measuring the molar volume changes in NaCl and deriving the pressure through an equation of state. The measured thermal expansion from 25°C up to 600°C for NaCl and Au at 1 atm can be expressed by second-order polynomials: $V/V_0(\mathrm{NaCl})=1+(1.08\pm0.05)\times10^{-4}(T-25)+(7.5\pm1.1)\times10^{-8}(T-25)^2$ and $V/V_0(\mathrm{Au})=1+(4.26\pm0.85)\times10^{-5}(T-25)+(5.0\pm20)\times10^{-9}(T-25)^2$, where T is in °C. These results are in excellent agreement with previously published data. The measured molar volume ratios of Au at simultaneously high temperatures and high pressures have been found to be in good agreement (within 0.2%) with the values based on the calculated isochore from shock wave data. The pressures determined from the compression of Au at high temperature are compatible with those based on the compression of NaCl (within 2.7% at pressures up to 10.2 GPa). These results enhance the reliability and the scope of the use of Au as an internal pressure calibrant at high temperatures. (16 refs.)

99075 Measuring and test equipment calibration systems. D.M.Turnbull (Consumers Power Co., Midland, MI, USA).
Qual. Prog. (USA), vol.16, no.5, p.28-33 (May 1983).
Discusses the calibration of measuring and test equipment. The calibration system should be described in a written procedure. A company that has a defence contract will usually have MIL-STD-45662 imposed on it. A calibration procedure must also address a range of environmental controls, including the conditions under which production and inspection instruments may be used, the conditions under which calibration must be done, and alternatives to use when required conditions cannot be obtained. (no refs.)

Traceable temperatures. An introductory guide to temperature measurement and calibration .... See Entry 98670

Optical transmission channel for a standard frequency signal, by means of a laser [carrier beam]. .... See Entry 99084

Measurement standards of light and radiation .... See Entry 99147

Calibration and error analysis in rotating analyzer ellipsometers .... See Entry 99158

Mobile tracking imaging radiometer .... See Entry 99181

Trial manufacture of fixed point blackbody with large aperture .... See Entry 99186

Measurements on the accuracy of pyranometers .... See Entry 99187

Stokes/anti-Stokes Raman vibrational temperatures: reference materials, standard lamps, and spectrophotometric calibrations .... See Entry 99191

Dimensional measurements of the Petten calibration pin .... See Entry 99662

Search for adequate quality standards for neutron radiography of nuclear fuel .... See Entry 99663

Inter-laboratory standardization of glass dosimeters .... See Entry 99732

Test facility for relativistic beam pickups .... See Entry 100155

A new method for identification of low energy fragments with $8<Z\leq18$ in plastic track detector Makrofol .... See Entry 100177

Precision measurements of gamma-ray intensities. IV. Low energy region: ^{75}Se and ^{133}Ba .... See Entry 100179

Precision measurements of gamma-ray intensities. V. ^{160}Tb, ^{168}Tm and ^{182}Ta .... See Entry 100180

Laser measurement services at NBS .... See Entry 100792

Calibration of film probes using a submerged jet .... See Entry 101369

Neutron radiography standards in the United States of America .... See Entry 103487

Work on the characterization of sensitive surfaces used in neutron radiography, conducted under the auspices of AFNOR .... See Entry 103488

Methodology used to characterize an industrial neutron radiography facility; use of the specific image quality indicator .... See Entry 103489

In-flight radiometric calibration of advanced remote sensing systems .... See Entry 103774

06.20J Determination of fundamental constants

Implicit meanings in physics: students and constants .... See Entry 98692

Interaction constants as numerical characteristics of discrete spaces .... See Entry 99313

06.30 MEASUREMENT OF BASIC VARIABLES

A power compensation measurement transducer for micropressure differences .... See Entry 99091

06.30C Spatial variables measurement

(inc. measurement of all variables extending in space e.g. diameter, height, thickness, displacement, surface topography, particle size, area of disperse systems)

99076 Particle size distributions from forward scattered light using the Chahine inversion scheme. R.Santer, M.Herman (Lab. d'Optique Atmospherique, Univ. des Sci. et Tech. de Lille, Villeneuve d'Ascq, France).
Appl. Opt. (USA), vol.22, no.15, p.2294-301 (1 Aug. 1983).
The classical inversion of forward scattered light to obtain the size distribution of spherical particles is considered. Using the diffraction approximation, the measurement points are selected so as to reduce the influence of the particle refractive index and to make the Chahine inversion scheme usable with a good convergence rate. The algorithm efficiency, in the presence of refractive-index errors and of experimental noise, is studied. An interesting behavior of the Chahine inversion scheme, in the presence of very large experimental errors, is outlined. (11 refs.)

99077 Simultaneous determination of refractive index and size of spherical dielectric particles from light scattering data. P.Chylek, V.Ramaswamy (Nat. Center for Atmospheric Res., Boulder, CO, USA), A.Ashkin, J.M.Dziedzic.
Appl. Opt. (USA), vol.22, no.15, p.2302-7 (1 Aug. 1983).
The diameter and refractive index of micrometer sized spherical dielectric particles are simultaneously deduced using the wavelength dependence of backscattering data from optically levitated particles. The accuracy of the results is set by experimental errors in the determination of the wavelength of backscatter resonance peaks and the ratio of slopes of specified peaks. At present the refractive index and diameter can be deduced with relative errors of 5×10^{-5}. This represents the most accurate determination of absolute size and refractive index yet made by light scattering. A reduction of these errors by an order of magnitude is possible. The authors assume a priori knowledge of diameter and refractive index with accuracy of 10^{-1} and 5×10^{-3}, respectively. (10 refs.)

99078 Particle size distributions from Fraunhofer diffraction. I. An analytic eigenfunction approach. M.Bertero (Istituto di Sci. Fisiche, Univ. di Genoa, Genoa, Italy), E.R.Pike.
Opt. Acta (GB), vol.30, no.8, p.1043-9 (Aug. 1983).
Generalized concepts of information theory indicate that the numerical solution of the Fredholm equation of the first kind relating a particle-size distribution to its Fraunhofer diffraction pattern can be achieved without ill-conditioning by use of a truncated eigenfunction expansion. The authors give explicit analytic formulae for the eigenfunctions and eigenvalues of this problem and give numerical values of the latter of use for experimental reductions. The results show how many independent fractions of a particle-size distribution may be determined in the presence of quantified levels of noise. (7 refs.)

99079 Low amplitude measurement by direct lock-in ESPI, a proposal. P.B.Nagy (Appl. Biophys. Lab., Tech. Univ. Budapest, Budapest, Hungary), O.J.Lokberg.
Opt. Commun. (Netherlands), vol.47, no.1, p.18-22 (1 Aug. 1983).
A method for mapping of low vibrational amplitude and phase distributions is proposed. The method is based on the use of an image orthicon TV-camera as a two-dimensional lock-in amplifier. The potentials of the technique are discussed, and compared to similar techniques. (13 refs.)

99080 Measurements of the size and position of aerosol droplets using holography. W.Grabowski (Inst. of Meteorology & Water Management, Warsaw, Poland).
Opt. & Laser Technol. (GB), vol.15, no.4, p.199-205 (Aug. 1983).
Positions and diameters of aerosol particles are measured using Gabor's holographic system. The infuence on image quality of the homogeneity of the holographic material, resolution, hologram processing method and optical reconstruction system are considered. The best experimental procedure is suggested. (17 refs.)

99081 A contactless method of measuring rapidly varying displacements. R.Boruta, L.Majewski.
Pomiary Autom. Kontrola (Poland), vol.29, no.1, p.10-11 (Jan. 1983). In Polish.
Discusses a method of measuring linear displacements by means of a specially constructed measuring system. This system has been used for measuring the components of displacement of the centre of a connecting-rod bushing relative to the centre of a slider crank mechanism. The measurement results are shown in the form of diagrams. (2 refs.)

99082 Teaching and research in the electronic measurement of distances in the TU Dresden. F.Deumlich (Tech. Univ. Dresden, Dresden, Germany).
Wiss. Z. Tech. Univ. Dresden (Germany), vol.31, no.5, p.199-204 (1982). In German. [received: May 1983]
The author discusses the physical basis of electronic measurement of distances (tachymetry) and the development of its application in the past 30 years, describing a number of electro-optical and microwave distance measuring devices made in the GDR. It deals with the training of students of geodesy in the use of electronic tachymetry and its relation to the general development of the discipline. It concludes with an account of some recent research and development work in connection with electronic tachymetry, with particular reference to activities in the TU Dresden. (30 refs.) *C.J.O.G.*

99083 The extremum-slope criterion for precise dimensional measurements in neutron radiography. J.C.Osuwa, A.A.Harms (McMaster Univ., Hamilton, Ontario, Canada).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.859-65
An analytical-experimental procedure for the ready determination of dimensional measurements of radiographed objects is described. The application of this procedure requires only elementary curve fitting of the experimentally obtained optical density variation about the edge of the radiograph and the determination of the point at which the optical density slope is a maximum. Theory suggests that this method is essentially exact; experimental tests provide excellent confirmation. (8 refs.)

Simple and direct determination of complex refractive index and thickness of unsupported or embedded thin films by combined reflection and transmission ellipsometry at 45° angle of incidence .... See Entry 99157

Analysis of Young's fringes in speckle photography: generalised square imaging aperture .... See Entry 99164

Experimental determination of variations in optical-waveguide film thickness by the interference of scattering fields of modes with different polarization .... See Entry 99170

On the problems relating to the accuracy of the measurement of fuel pin diameters by neutron radiography .... See Entry 99660

Measuring signal-to-noise ratio of typical neutron radiographs .... See Entry 99661

Dimensional measurements of the Petten calibration pin .... See Entry 99662

Euratom test program for image quality and accuracy of dimensions .... See Entry 99664

Automatic evaluation of angular movements and linearity with holographical methods .... See Entry 100693

Contrast enhancement in holographic moire fringes .... See Entry 100699

Angle-of-incidence derivatives of the complex parallel and perpendicular reflection coefficients and their ratio for a film-substrate system ..See Entry 102837

Some optical techniques of displacement and strain measurements on metal surfaces .... See Entry 103428

Particle size from optical anisotropy effects in scattered light .... See Entry 103602

06.30E Mass and density measurement

External weighing with analytical balances: determination of magnetic susceptibility of inorganic compounds .... See Entry 98704

The gyroscope as a precision force transducer .... See Entry 99092

06.30F Time and frequency measurement

(for astronomical aspects see 95.70)

99084 Optical transmission channel for a standard frequency signal, by means of a laser [carrier beam].. A.Podoleanu, P.E.Sterian (Inst. Politehnic Bucuresti, Bucuresti, Rumania).
Metrol. Apl. (Rumania), vol.30, no.1, p.25-9 (1983). In Rumanian.
The system described can provide a standard frequency to various users for calibration purposes. A He-Ne laser is 5% modulated (by HT variation) with a highly accurate 100 kHz signal and the beam is transmitted through the atmosphere. The signal is received via a photodiode, actively filtered and then converted to 1 or 10 MHz standard frequency by means of a phase-locked loop circuit controlling a suitable oscillator with its appropriate frequency divider circuits. Block diagrams and circuit details are given. A 30 day plot of relative atmospheric attenuation has shown losses of 0 to 40 dB; the phase-locked loop, however, remained stable under such conditions. (5 refs.) *C.J.R.*

06.30G Velocity, acceleration and rotation measurement

(for flow velocity measurement see 47.80)

Compact, pulsed laser Doppler anemometer for airborne and wind-tunnel applications .... See Entry 101361

Burst-correlation laser Doppler velocimetry .... See Entry 101366

06.30L Measurement of basic electromagnetic variables

(see also 07.50 Electrical instruments and techniques)

The NBS-LANL RTM end-magnet field mapper .... See Entry 99138

Report on the production magnet measurement system for the Fermilab Energy Saver superconducting dipoles and quadrupoles .... See Entry 99139

The LBL magnetic measurements data acquisition system .....See Entry 100220

Attenuation of low frequency fields by conducting ellipsoidal shells ....See Entry 100627

Sea floor measurement of geomagnetic field using newly developed ocean bottom magnetometers ....See Entry 104603

06.50 DATA HANDLING AND COMPUTATION

(see also 02.70 Computational techniques; 29.80 Nuclear information processing; for optical data processing, storage and retrieval see 42.30; for geophysical data acquisition and storage see 93.65)

99085 Profile deconvolution method for small computers. R.Verma (Radiometall. Div., Bhabha Atomic Res. Centre, Bombay, India).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.323-6 (1 July 1983).
A simple method of profile deconvolution is discussed. Unlike the Fourier analysis based on iterative methods this method directly uses the observed spectrum to compute the true (original) spectrum. The method is tested on a synthetic profile and also used to deconvolute an ESCA (electron spectroscopy for chemical analysis) spectrum from a Zircaloy-2 sample. (9 refs.)

99086 A rapid-response recording system for electrothermal atomic absorption spectrophotometry. N.T.Faithfull (Agricultural Sci. Analytical Lab., Univ. Coll. of Wales, Frongoch Field Station, Aberystwyth, Wales).
Lab. Pract. (GB), vol.32, no.7, p.78 (July 1983).
A method is described of coupling a transient recorder to an atomic absorption spectrophotometer in order to measure the transient signals produced by a tungsten filament atomizer on a normal chart-recorder. (6 refs.)

99087 Simplified real-time television image analyzer based on an Apple II microcomputer. M.Bordes, J.-C.Bernengo, J.-F.Renaud (Centre de Biochimie CNRS, Faculte des Sci., Nice, France).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.1053-8 (Aug. 1983).
A simple system for black-and-white image acquisition and treatment, based on a consumer TV camera and an Apple II microcomputer, is described. This system provides a real-time analysis up to 20 images per second with a resolution of 40×48 pixels. The acquired images are displayed on the Apple monitor, at the same rate, with a color scale. The operation of the specially designed hardware interface is extensively explained, together with the associated software, and some applications are proposed. (6 refs.)

Binomial smoothing filter: a way to avoid some pitfalls of least-squares polynomial smoothing ....See Entry 98736

Computer graphics for the intelligent microscope ....See Entry 99180

Analysis of photon correlation spectral decay curves by the *S*-exponential sum method ....See Entry 99197

Computer interface for a diode-array based spectrophotometer ....See Entry 99205

Boolean logic system for infrared spectral retrieval ....See Entry 99206

FASTBUS for data acquisition and control ....See Entry 100219

The LBL magnetic measurements data acquisition system .....See Entry 100220

Computer representation of molecular surfaces ....See Entry 100591

06.60 LABORATORY TECHNIQUES

99088 System of laboratory experiment automation for kinetic investigations. A.G.Abilov, K.A.Lyutfaliev, F.M.Agaev, R.G.Azimov, G.A.Ibragimov, M.I.Shanturov, M.R.Efendiev.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.5, p.118-24 (1982). In Russian.
The realization program of a system of laboratory experiment automation constructed on the base of mini- and macrocomputers is described. For effective realization of laboratory experiments some technical facilities of experiment automation and interface systems constructed on the base of the CAMAC standard were used. (3 refs.)

99089 Mechanical scan system for microscopic applications. H.J.B.Marsman, R.Stricker, R.W.Wijnaendts van Resandt (European Molecular Biology Lab., Heidelberg, Germany), G.J.Brakenhoff, P.Blom.
Rev. Sci. Instrum. (USA), vol.54, no.8, p.1047-52 (Aug. 1983).
A high-speed mechanical scanning stage for microscopic applications has been designed and constructed. It is especially suitable for high-resolution confocal UV microscopy. It is a feedback design using electromagnetic actuators and piezoelectric sensors with motor-driven screws for coarse adjustment. Scanning of areas up to 1 mm square at up to 300 lines per second is possible with positional resolution of better than 0.01 μm. An exceptionally stable optical system is also described. (5 refs.)

Sample manipulator for operation between 20 and 2000K in ultrahigh vacuum ....See Entry 99117

Ultrahigh vacuum apparatus for the optical study of thin films, in an energy range from 2 to 10.25 eV ....See Entry 99119

Subnanosecond high-voltage two-stage resistive divider ....See Entry 99134

Time-dependent spectra of ultra-short laser pulses ....See Entry 100821

06.70 GENERAL INSTRUMENTATION

99090 Measurement of bending loads with suspended electric strain guages. A.P.Loktionov.
Sov. Aeronaut. (USA), vol.25, no.2, p.85-8 (1982). Translation of: *Izv. VUZ Aviats. Tekh. (USSR)*, vol.25, no.2, p.73-5 (1982).
Suspended electric strain guage displacement transducers are widely used in devices for measuring the load on structural elements. Transducers measuring the bending and shearing deformations of the landing gear structural elements have been introduced in the last decade in the on-board equipment for measuring aircraft ramp weight and cg location. This equipment is effective as a supplement to platform scales. The OBAWS system determines the weight of the Douglas DC-10 and Boeing 747 airplanes with an error of ±1%. (6 refs.)

99091 A power compensation measurement transducer for micropressure differences. P.Krischker (Tech Univ. Berlin, Berlin, Germany).
Tech. Mess. tm (Germany), vol.50, no.7-8, p.273-6 (July-Aug. 1983). In German.
A transmitter for measuring very small pressure differences in liquids and gases is presented. It works on the principle of power inverse feedback and is constructed as a double membrane system. The tap and the positioning device are placed between the membranes. The usable resolution capacity of the transducer is 0.1 μbar (8×10^{-5} Torr) and the linear deviation and hysteresis values are below $\pm 1^{0}/_{00}$ of the final value. Apart from a short responding time this measurement principle offers the possibility of cutting out the breathing or swallowing volume of the membranes. (5 refs.)

99092 The gyroscope as a precision force transducer.
Transducer Technol. (GB), vol.5, no.1, p.24 (Oct. 1982).
The property of precession of a gyroscope can be exploited to provide a no-movement force transducer with good resolution and extremely fast response. The principle of gyroscope operation is outlined and its applications to weighing are considered. (no refs.)

99093 Semiconductor strain gauges. M.Baker.
Transducer Technol. (GB), vol.5, no.1, p.25, 27, 30 (Oct. 1982).
Discusses the development and applications of semiconductor strain gauges. In particular, the principle, fabrication and properties of Si piezoresistive gauges are dealt with. (no refs.)

99094 Trends in digital oscilloscope applications. A.Tegen (Nicolet Instrument Corp., Madison, WI, USA).
Wescon/81 Conference Record, San Francisco, CA, USA, 15-17 Sept. 1981 (El Segundo, CA, USA: Electron. Conventions 1981), p.7/1/1-4
Improvements in digital circuitry have widened the applications for which oscilloscopes are the optimum measuring instruments. The author discusses the trends of such applications and considers digital storage to be at the heart of these changes, for it brings with it the ability to hold and quantify time-varying signals for close inspection. Microprocessors within the digital oscilloscope control much of its functioning and memory usage. They can also take display refinements even further, by adding cursors which are controllable by the user. These cursors are easily moved to points of interest, with exact time and voltage displayed on the screen. 'Time per division' and 'volts per centimeter' calculations are unnecessary. (no refs.)

Measuring and test equipment calibration systems ....See Entry 99075

Cryostat for combined investigation of kinetic and photoelectrical properties of semiconductors within the range from 2 to 650K ....See Entry 99111

Humidity sensing with heat-treated composite films of silicone polymers and metal oxides ....See Entry 99115

Fully electronic servocircuitry for wavelength-modulation spectroscopy ....See Entry 99201

Forces and torques acting on plane and cylindrical electrets in slot-effect transducers ....See Entry 102803

A balloon-borne far-infrared telescope with a new azimuth stabilization system ....See Entry 104737

An autoguider system for the 40 cm Schmidt telescope ....See Entry 104738

07.00 SPECIFIC INSTRUMENTATION AND TECHNIQUES OF GENERAL USE IN PHYSICS

(see also within each subdiscipline for specialized instrumentation and techniques)

07.10 MECHANICAL INSTRUMENTS AND MEASUREMENT METHODS

(for measurement in the mechanics of solids and rheology, see 46.30R; for materials testing, see 81.70)

99095 Techniques for the measurement of forces between solids. K.B.Lodge (School of Molecular Sci., Univ. of Sussex, Brighton, England).
Adv. Colloid & Interface Sci. (Netherlands), vol.19, no.1-2, p.27-73 (July 1983).
Techniques for the direct measurement of forces between solids as a function of the distance of separation of their surfaces are reviewed. If the solids are separated by gas or a vacuum, then the forces are generally identified as macroscopic van der Waals forces. The impetus for their measurement has been the verification of the Lifshitz theory. The non-linear character of these forces means that the measuring system has very interesting mechanical properties. The exploitation of these properties in measurements by deflection, dynamic and jump methods is discussed. Particular attention is given to a completely novel technique; the dynamic-jump method. The existence of repulsive forces between solid particles dispersed in liquid phases has been known for a long time in colloid science. In ionic solutions, the measurement of forces between solids has reproduced the effects predicted by simple electrical double-layer theory. In polymer solutions forces have been detected that may be attributed to steric stabilisation forces. However, the nature of forces due to liquid structure has not been so well known. Recently, liquid structure forces of an oscillatory character have been measured between mica sheets. Forces measured between hydrophobic surfaces in aqueous systems under certain conditions exhibit significant departures from DLVO theory. (183 refs.)

99096 Influence of hysteresis upon the coefficient of dynamometer sensitivity. N.Fintinaru (Inst. Nat. de Metrologie, Timisoara, Rumania).
Metrol. Apl. (Rumania), vol.30, no.1, p.9-12 (1983). In Rumanian.
The metrological behaviour of mechanical and electrical dynamometers and their calibration has been the subject of extensive research in recent years. Compensating curves were presented previously for the characteristics of nine different instruments. The author follows this up by studying the influence of hysteresis upon the scale coefficient for the same instruments. These are oval type PGH Kraftmessgerate Halle/Saale RDG, fitted with 1/100 mm quadrant comparators (five compression- and four extension-type instruments). Results are tabulated. (8 refs.) *C.J.R.*

99097 Analysis on stability of a rotary-drive vibratory-output rate gyro. H.Yamada (Nat. Aerospace Lab., Chofu, Japan), H.Uchino, S.Nagasono.
Trans. Soc. Instrum. & Control Eng. (Japan), vol.19, no.4, p.348-50 (April 1983). In Japanese. (4 refs.)

The gyroscope as a precision force transducer ....See Entry 99092

Determination of the behaviour of composite materials under dynamic conditions ....See Entry 103417

Load fixture for uniform plastic deformation of single crystals ....See Entry 103440

Machine for testing polymer materials in the three-dimensional stressed state at various temperatures ....See Entry 103447

07.20 THERMAL INSTRUMENTS AND TECHNIQUES

(see also 44.50 Thermal properties of matter, 44.60 Thermodynamic processes; for radiometry and detection of thermal radiation see 07.60D and 07.62)

99098 Dynamic properties of instruments for measuring heat flux. S.Lopata, J.Taler (Inst. Aparatury Przemyslowej i Energetyki, Politech. Krakowskiej, Krakow, Poland).
Pomiary Autom. Kontrola (Poland), vol.29, no.1, p.1-3 (Jan. 1983). In Polish.
The authors derive and experimentally check the formulae for determining dynamic properties of instruments for measuring heat flux. A comparison is made of dynamic properties of the two commonest measuring methods. (9 refs.)

99099 Flow induced vibration in a heat exchanger with seal strips. J.H.Kissel (American Standard, Heat Transfer Div., Buffalo, NY, USA).
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.372-8 (May 1982).
Flow induced vibration tests using water as the shell side medium were conducted on a shell and tube exchanger with single segmental baffles and various tube layouts. The heat exchanger was of the externally packed floating head type with seal strips that directed the water flow into the bundle to prevent by-passing of the fluid between the bundle and the shell. High localized velocities exist in the vicinity of the seal strips and contributed directly to the vibration problem. The tube natural frequency for various baffle spacings was measured at the vibration point and a gap velocity at the critical section of the bundle was estimated. A correlation was then made with these parameters and the fluidelastic excitation theory. A discussion of the velocity profile through the heat exchange is included. (5 refs.)

Modern Utilization of Infrared Technology VIII ....See Entry 98624

07.20D Thermometry

99100 Effectiveness criteria for recuperative thermocouples. Yu.M.Lobunets'.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.6, p.64-7 (1983). In Ukrainian.
The efficiency of recuperative thermocouples is determined by the Ioffe number $I_0=(e^2\sigma/\lambda)\Delta t_0$ and by the $\Lambda=\lambda s/hW$ and $\beta=KF/W$ factors. (2 refs.)

99101 Problem of compensating the influence of temperature changes on measurement results.. Z.Moron (Inst. Metrologii Elektrycznej, Politech. Wroclawskiej, Wroclaw, Poland).
Pomiary Autom. Kontrola (Poland), vol.29, no.1, p.12-14 (Jan. 1983). In Polish.
Discusses an example of measurements of physico-chemical properties of a substance. A method is presented of temperature compensation using a polynomial approximation of temperature characteristics of objects, and also an electronic circuit to accomplish such a compensation. A case is also considered of a compensation where the approximating polynomial has variable coefficients. (6 refs.)

99102 Temperature determination of freely rotating bodies. A.Weller (Inst. fur Grenzflachenforschung & Vakuumphys., KFA Julich, Julich, Germany).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.952-7 (Aug. 1983).
A new approach for the determination of the temperature of rotating bodies is described, which makes use of the fact that the sample is rotating with virtually no friction. The basic principle is that a temperature change causes thermal expansion, and hence a change in the moment of inertia which, due to conservation of angular momentum, results in a change of rotational frequency. The method was used to determine the temperature of a magnetically suspended cylinder of pure iron within ±5K while cooling down from 800 to 300K. The contact-free suspension is ideally suited to study the radiative interaction of the sample with its environment. It is shown that on the basis of the Stefan-Boltzmann equation the time constant of radiation exchange and the emissive power of the sample can be evaluated. From the results of these investigations the measuring limit of a spinning rotor vacuum gauge due to temperature fluctuations can be estimated. (7 refs.)

99103 Radiation error correction method for temperature measurement by the digital type thermometer. M.Kawamura, H.Uesako (Faculty of Engng., Tokyo Univ., Kawagoe, Japan).
Trans. Soc. Instrum. & Control Eng. (Japan), vol.19, no.4, p.308-13 (April 1983). In Japanese.
An experimental result is reported on the radiation error correction method for temperature measurement by the thermistor type digital thermometer. A principle for the radiation error correction is based on the fact that radiation error varies on each emissivity of a temperature sensing element. That is using two points of measured temperature values obtained by separate temperature sensing elements having different emissivity and temperature value on the coordinate axis at emissivity equals to zero is extrapolated. During the experiment, two kinds of digital type thermometers have been employed, one of which is a reflection type equipped with gold or aluminum vaporised temperature sensing element of lower emissivity and another black painted absorption type with the emissivity nearly equals to unity. Accurate temperature can be calculated by an extrapolation formula using the measured emissivities by the two thermometers and an emissivity ratio between two thermometers. (5 refs.)

Traceable temperatures. An introductory guide to temperature measurement and calibration ....See Entry 98670

Simple differential thermometer for low temperatures using a thermocouple with a SQUID detector ....See Entry 99112

Behavior of diffused planar germanium thermometers at temperatures below 1K ....See Entry 99113

Application of fast infrared detectors to detonation science ...See Entry 103525

Deep ocean temperature profile measurements ....See Entry 104599

07.20F Calorimetry

A thermoelectric detector for high radiant flux densities ....See Entry 99188

07.20K High-temperature techniques and instrumentation; pyrometry

Gold as a reliable internal pressure calibrant at high temperatures ....See Entry 99074

High-temperature, high-pressure optical cells ....See Entry 99144

Trial manufacture of fixed point blackbody with large aperture ....See Entry 99186

X-ray diamond-anvil press for use at high temperatures ....See Entry 99246

Temperature measurement of copper wire in process of the electrical explosion ....See Entry 101485

07.20M Cryogenics

99104 An automatic low temperature heat switch. W.Hilberath, B.Vowinkel (Univ. Koln, Koln, Germany).
Cryogenics (GB), vol.23, no.9, p.467-8 (Sept. 1983).
A heat switch for use at cryogenic temperatures is described. It utilizes the pressure-dependence of thermal conductivity of gases and the decrease of vapour pressure with temperature. The switching temperature can be varied widely by changing the working gas. Due to the absence of mechanically moving parts, lifetime and reliability are high. A thermal conductivity on/off ratio of 500 can easily be achieved. (6 refs.)

99105 The Joule-Thomson microliquefier described with use of dimensional analysis. E.Bodio, M.Chorowski (Tech. Univ. of Wroclaw, Wroclaw, Poland).
Cryogenics (GB), vol.23, no.9, p.469-70 (Sept. 1983).
Single stage Joule-Thomson microliquefiers have been studied in an open system. A set of easily measure parameters which influence the liquefaction process has been determined. The relation between these parameters has been found using dimensional analysis theory and experimental data. (7 refs.)

99106 Ultimate temperature stability of a magnetic refrigerator. P.Kittel (NASA, Ames Res. Center, Moffet Field, CA, USA).
Cryogenics (GB), vol.23, no.9, p.477-8 (Sept. 1983).
The ultimate stability limit of an isothermal demagnetization feedback control system is discussed. (4 refs.)

99107 A simple inexpensive cryostat for measurement of Mossbauer spectra from 77K to 300K. S.Das, M.Bhattacharya, R.Bhattacharya (Saha Inst. of Nuclear Phys., Calcutta, India).
Cryogenics (GB), vol.23, no.9, p.479-81 (Sept. 1983).
A simple continuous flow cryostat designed for Mossbauer investigations with liquid nitrogen in the temperature range 77-300K is described. The cryostat is built with a perspex sample holder, glass tubes and metallic frames for mylar windows which facilitate transmission of gamma rays. A copper-constantan thermocouple is used as the temperature sensor. The cryostat can be used in investigations where either the absorber or the source is at rest and the detector-absorber-source axis is horizontal. The performance of the unit is tested on low-temperature studies of stainless steel. (3 refs.)

99108 A cryostat for investigating inelastic scattering of neutrons on liquid He^4 between 4.2 and 0.5K. I.V.Bogoyavlenskii, Yu.Ya.Milenko, L.V.Karnatsevich, V.S.Kogan, A.V.Puchkov, V.A.Parfenov, J.A.Kozlov, N.M.Blagoveschenskii (Inst. of Phys. & Technol., Acad. of Sci., Kharkov, Ukranian SSR).
Cryogenics (GB), vol.23, no.9, p.498-500 (Sept. 1983).
A cryostat is described which is designed for the research of inelastic scattering of neutrons on a large volume (3.5 l) of He^4 between 4.2 and 0.5K. Temperatures lower than 1.3K are produced by means of pumping out vapour above liquid He^3 ($\sim$330 cm^3) with an adsorption pump (1 kg of coal CKT-2) located in the device itself. A minimum temperature is held during 140 h. The essential time for the cryostat start is about 10 h. The cryostat was used for the measurement of temperature dependence of the Bose-condensate density in He^4. (5 refs.)

99109 Optimization and temperature distribution of a current lead for a cryogenic device. Nan. H.L..
Cryogenics (GB), vol.23, no.9, p.501-7 (Sept. 1983).
A method of optimizing the cross-sectional area of a cooled current lead is described in this paper. First, the dependence of the gas flow rate on the cross-sectional area is derived from the heat balance equations. Then, two curves are acquired, one relating to the optimum area, and the other to the corresponding temperature gradient at the cold end. The product of the utilization coefficient of the coldness together with the temperature difference is the independent variable of the functions represented by the two curves, from which the graphic changes of the minimum gas flow rate under various situations would be noted. Also mentioned here is the choice of the optimum material. On the basis of the result of the calculation given above, curves of one-dimensional temperature distribution of a lead under different conditions could be drawn up. Lastly, the designing principle of a lead with non-constant cross-section area is discussed. (7 refs.)

99110 Cryogenic system for production testing and measurement of Fermilab Energy Saver superconducting magnets. W.E.Cooper, A.J.Bianchi, R.K.Barger, F.B.Johnson, K.J.McGuire, K.D.Pinyan, F.R.Wilson (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3602-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The cryogenic system of the Fermilab magnet test facility has been used to provide cooling for the testing of approximately 1200 Energy Saver superconducting magnets. The system provides liquid helium, liquid nitrogen, gas purification, and vacuum support for six magnet test stands. It provides for simultaneous high current testing of two superconducting magnets and non-high current cold testing of two additional magnets. The cryogenic system has been in operation for about 32000 hours. The 1200 magnets have taken slightly more than three years to test. (4 refs.)

99111 Cryostat for combined investigation of kinetic and photoelectrical properties of semiconductors within the range from 2 to 650K. S.A.Aliev, D.G.Arasly, Z.F.Agayev, Sh.S.Ismailov, E.I.Zul'figarov.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.6, p.67-71 (1982). In Russian.
Deals with the description of cryostat for the combined investigation of kinetic and photoelectrical properties of semiconductors within the range from 2 to 650K. The mounting of the sample the cryostat allows one to measure the coefficients of the electroconductivity σ, thermoelectromotive force α, heat conductivity χ, Hall coefficient R, magnetoresistance $\Delta\rho/\rho$, magnetothermoelectromotive force $\Delta\alpha$, Nernst-Ettingshausen $Q_\perp$ and Righi-Leduc S transverse thermomagnetic effects, Magy-Righi-Leduc effect $\Delta\chi$, Nernst-Ettingshausen galvanomagnetic effect. Remounting of the sample gives the possibility of measuring additionally the linear magnetoresistance, Etting-

shausen linear galvanomagnetic effect, and photoelectrical and photomagnetic effects. Moreover, it can be used to study different characteristics of solid state refrigerating devices. They are as follows: Peltier device, magneto-Peltier device and Peltier-magneto-Peltier-Ettinghausen hybrid refrigerating device. (11 refs.)

99112 Simple differential thermometer for low temperatures using a thermocouple with a SQUID detector. Y.Maeno, H.Haucke, J.Wheatley (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.946-8 (Aug. 1983).
Details of design and construction of a simple and rugged thermocouple differential thermometer are presented. Gold +0.03 at.% iron wire is used, with niobium leads connected to a SQUID. It is demonstrated that at 1K the response time is about 15 ms and that the temperature sensitivity of 10^{-7}K with a 10-Hz filter is Johnson-noise limited. Additional qualities such as small size, little self-heating, and high reproducibility make this device ideal for differential thermometry at low temperatures. (10 refs.)

99113 Behavior of diffused planar germanium thermometers at temperatures below 1K. G.X.Mack, A.C.Anderson (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA), P.R.Swinehart.
Rev. Sci. Instrum. (USA), vol.54, no.8, p.949-51 (Aug. 1983).
The performance of diffused planar germanium thermometers is found to be reliable at temperatures $T>90$ mK. At lower temperatures performance can be limited by overheating caused by measuring and spurious currents. The heating is associated with a thermal impedance $Z \propto T^{-4}$ which is larger than that found in typical bulk germanium thermometers. Surprisingly, Z is found to be essentially independent of the size of the planar resistor. (13 refs.)

Sample manipulator for operation between 20 and 2000K in ultrahigh vacuum .... See Entry 99117

Helium refrigeration system for BNL Colliding Beam Accelerator .... See Entry 99869

Operation of the Tevatron six-kilometer-long transfer line .... See Entry 100036

Cryogenic system for a superconducting spectrometer .... See Entry 100173

Flashover voltage of spacer insulators in a vacuum at 290-6K .... See Entry 101488

Radiation induced thermomechanical shock experiments of structural materials for cryogenic applications .... See Entry 103181

07.25 HYGROMETRY

99114 Hygrometers—meeting the needs of an expanding market. D.T.Parker (Shaw Moisture Meters, Bradford, England).
Hong Kong Eng., vol.11, no.4, p.55-7 (April 1983).
Manufacturing and chemical processes as well as operating procedures for new equipment, which require an accurate measurement of moisture levels in air, gases and liquids, continue to multiply. The article describes how an established manufacturer of moisture meters is keeping pace with the needs of an increasingly-demanding market. (no refs.)

99115 Humidity sensing with heat-treated composite films of silicone polymers and metal oxides. F.Uchikawa, K.Miyao, K.Shimamoto (Material Engng. Lab., Mitsubishi Electric Co. Ltd., Kamakura, Japan).
Oyo Buturi (Japan), vol.52, no.5, p.451-8 (May 1983). In Japanese.
Basic materials of the humidity sensitive films of the present humidity sensor are heat-treated mixtures of silicone polymers and metal oxides. Upon heating, the organic groups in silicone polymers are decomposed. New composite materials are thus formed, which are based on metal oxides bound by the decomposition residue. One of the main constituents is amorphous SiO_2. The present sensor has good humidity sensitivity characteristics which vary with heat-treated temperatures. Hardly any surface hydroxyl group is formed on the humidity sensitive element of the present sensor (heat-treated at 500°C). Therefore, the present sensor is more reliable than the conventional ceramic humidity sensors with regard to the time dependence of humidity-resistance characteristics. Also, the present sensor can be produced by heat treatment at lower temperatures in comparison with the conventional ceramic sensors. (29 refs.)

07.30 VACUUM PRODUCTION AND TECHNIQUES

(inc. pressures below 1 atmosphere; see also 47.45 Rarefied gas dynamics; 81.15G Vacuum deposition)

99116 Performance of the SPS ring vacuum system for colliding beam operation. B.Angerth, R.B.Flockhart, G.Kouba, H.Wahl (European Organization for Nuclear Res., CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2790-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The SPS ring vacuum system was recently upgraded to the vacuum requirements for proton-antiproton collider operation. The new specification stipulated an average operating pressure in the ring of 3.10^{-9} mbar, to be reached within 10 days of pumping after a venting to air. The pressure is expressed in nitrogen equivalent gauge reading. Bakeout to rapidly reduce the gas desorption from the system cannot be used in the SPS, except at a few special positions which cover less than 5% of the ring circumference. The specified pumping time is much shorter than the time it usually takes for an unbaked vacuum system to reach its limit pressure. The pressure thus continues to fall for roughly 3 months from the beginning of a pumpdown and finally settles at about 7.10^{-10} mbar. (1 ref.)

99117 Sample manipulator for operation between 20 and 2000K in ultrahigh vacuum. E.E.Chaban, Y.J.Chabal (Bell Labs., Murray Hill, NJ, USA).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.1031-3 (Aug. 1983).
The authors present a simple design for an ultrahigh vacuum (UHV) sample manipulator which allows rapid temperature changes from 2000 to 20K while maintaining *xyz* translations, rotation, and tilt capabilities. A mechanical heat switch is used between the cryogenic reservoir and the sample holder. The sample is kept electrically isolated at all times. A large thermal mass of the sample holder gives good temperature stability (1 K/h); yet temperature extremes can be obtained within a few minutes. (2 refs.)

99118 Simple ultrahigh vacuum transfer system for surface barrier detectors. S.P.Withrow, J.E.Weidley, P.S.Herrell (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.1059-60 (Aug. 1983).
The design of an assembly to transfer a surface barrier detector into and out of a UHV chamber is described. (2 refs.)

99119 Ultrahigh vacuum apparatus for the optical study of thin films, in an energy range from 2 to 10.25 eV. R.Rivoira, J.P.Petrakian, B.Vidal (Faculte des Sci. et Tech., CECM, Marseille, France).
Vide les Couches Minces (France), vol.38, no.215, p.13-19 (Jan.-Feb. 1983). In French. [received: July 1983]
An experimental arrangement is described to allow the preparation and the optical study of metallic thin films under ultrahigh vacuum for an energy range from 2 to 10.25 eV. In this range, particular attention must be paid to surface roughness which induces diffuse scattering and surface plasmon resonance. In order to test the apparatus the spectral variations of a rough deposit of aluminium chosen for its sensitivity to the mentioned phenomena was presented. A comparison with previous data is given to check the performances of this experimental set up. (10 refs.)

Vacuum Symposium Proceedings (Kobe 1982) .... See Entry 98634

Vacuum technology, thin films, and sputtering. An introduction .... See Entry 98673

Performance of the new cryogenic vacuum system at the Bevatron .... See Entry 99867

Performance of the NBS-LANL RTM injection line vacuum system .... See Entry 99870

Construction of vacuum system for TRISTAN accumulation ring .... See Entry 99871

The GANIL vacuum system—results .... See Entry 99872

07.30C Vacuum pumps

99120 Applications of vacuum technology to novel accelerator problems. E.L.Garwin (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2758-62 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Vacuum requirements for electron storage rings are most demanding to fulfill, due to the presence of gas desorption caused by large quantities of synchrotron radiation, the very limited area accessible for pumping ports, the need for 10^{-9} torr pressures in the ring, and for pressures a decade lower in the interaction regions. Design features of a wide variety of distributed ion sublimation pumps (DIP) developed at SLAC to meet these requirements are discussed, as well as NEG (non-evaporable getter) pumps tested for use in the Large Electron Positron Collider at CERN. Application of DIP to much higher pressures in electron damping rings for the Standard Linear Collider are discussed. (10 refs.)

99121 Investigations on pumping speed and compression work of liquid ring vacuum pumps. U.S.Powle, S.Kar (Dept. of Mech. Engng., Indian Inst. of Technol., Bombay, India).
Vacuum (GB), vol.33, no.5, p.255-63 (May 1983).
Liquid ring vacuum pumps are used to create coarse vacuum. Very limited theoretical work has been reported on these vacuum pumps. In the present work, an attempt is made to develop an equation for pumping speed as a function of free air displacement conditions, vapour pressure of the sealant liquid, pressure and index of expansion process in the system to be evacuated and index z representing the set of operating conditions. Analysis is carried out for compression work for isothermal systems. Expressions are developed for the pressure at which the compression work is maximum and its dependence on various parameters is studied. Theoretical derivations are compared with the experimental work carried out and the dependence of index z on various operating conditions is studied. The theoretical equations are also compared with theoretical and experimental studies of other investigators. The analysis presented will help in understanding the performance characteristics of these vacuum pumps. (10 refs.)

99122 Sorption of active gases by non-evaporable getter. S.Parkash, P.Vijendran (Tech. Phys. Div., Bhabha Atomic Res. Centre, Bombay, India).
Vacuum (GB), vol.33, no.5, p.295-9 (May 1983).
The behaviour of St 101 getter towards the sorption of active gases like oxygen, carbon dioxide, carbon monoxide, background water vapour and nitrogen at 10 torr pressure have been studied gravimetrically at 400°C and at other temperatures. A Cahn RG electrobalance has been used in the above studies. The sorption by ST 101 getter has been compared with that of Zr powder. The sorption law and the reaction mechanism are also discussed. (12 refs.)

99123 A heavy-duty turbomolecular pump. D.G.Gotz, H.-H.Henning (Leybold-Heraeus GmbH, Koln, Germany).
Vak.-Tech. (Germany), vol.32, no.5, p.130-5 (July 1983). In German.
A recently developed grease-lubricated turbomolecular pump, designated TURBOVAC 1000, is introduced. Its construction is described whereby special demands as asked for in a variety of industrial applications have been taken into consideration. The technical data of the pump are presented and discussed in detail. It becomes clear that the use of this particular pump is not only confined to industrial applications—though mainly designed for them—but also fulfils conventional duties turbomolecular pumps are well known for. (4 refs.)

99124 Use of turbomolecular pumps in the rough- and medium vacuum range during the pump-down phase. E.Kellner, W.Czech (Fachbereich fur Phys., Tech. Univ., Munchen, Garching, Germany), H.-H.Henning, D.Urban.
Vak.-Tech. (Germany), vol.32, no.5, p.136-9 (July 1983). In German.
Pump-down experiments were carried out at the Technical University in Munich where turbomolecular pumps had been operative already in the rough- and medium vacuum range. The respective pump-down curves for various vacuum pump systems show that turbomolecular pumps do contribute considerably to the pumping speed in the continuum-flow range. The recently developed pump TURBOVAC 1000 manufactured by Leybold-Heraeus appears to be very suitable for this type of duty. (no refs.)

99125 Advanced operation of Roots pumps. H.-D.Burger (CIT-ALCATEL GmbH, Wertheim, Germany).
Vak.-Tech. (Germany), vol.32, no.5, p.140-7 (July 1983). In German.
The problem of an 'absolutely oilfree pumping chamber' of Roots-type vacuum pumps is examined and discussed. Improvements for the smallest possible hydrocarbon-concentration in the Roots pumps are suggested. For the simultaneous solution of the problems of pressure regulation and starting of the Roots pump at atmospheric pressure the application of a DC-motor drive is described. To avoid rotational feedthrough of the driving shaft and to conserve at the same time the advantages of the DC-motor drive a small size magnetic coupling is shown. (no refs.)

Performance of the SPS ring vacuum system for colliding beam operation .... See Entry 99116

07.30D Vacuum meters

99126 Modulating ion current pressure gauge. F.Watanabe (Sakura-no-Seibo Gakuin High School, Fukushima-shi, Japan), S.Hiramatsu, H.Ishimaru.
Vacuum (GB), vol.33, no.5, p.271-8 (May 1983).
A remote pressure measurement system suitable for ultra-high vacuum in a very severe noise environment, such as found in high energy accelerators, is reported. The pressure in a beam pipe of the 12 GeV proton synchrotron at the National Laboratory for High Energy Physics has been measured with high accuracy by a newly developed hot-cathode extractor type ionization gauge, here called the modulating ion current gauge. The output signal from the gauge head was sent to the synchrotron subcontrol room by a 120 m long cable and the measurement was carried out with full beam in the synchrotron. The miniaturized gauge head has a hemispherical mesh anode and a cylindrical electrode between the ionization region and the ion-collector to modulate the ion current. The modulated signal is sent to an amplifier via a double shielded coaxial cable and after amplification is detected with a phase sensitive detector. This new gauge can reject externally induced noise. The effects both of ions desorbed by electron-impact from the anode and of X-ray photocurrents from the ion-collector can also be avoided. (10 refs.)

99127 Manometer for measuring pressures between 1.10^{-3} and 1000 mbar. J.Morel (CIT-ALCATEL, Annecy, France).
Vide les Couches Minces (France), vol.38, no.217, p.301-7 (May-July 1983). In French.
Thermal-conductivity gauges are those most currently used for measuring high vacuum. In order to use them on a large pressure scale ($1.10^{-3}-1000$ mbar) the authors have developed a machine combining natural convection with a Pirani gauge. When used with gases other than air, this machine must be utilised with care because of the variations of sensitivity according to the composition of the gas mixture. (22 refs.)

07.35 HIGH PRESSURE PRODUCTION AND TECHNIQUES

(inc. pressures above 1 atmosphere)

An inexpensive high pressure optical absorption cell for IR-VIS-UV studies ..... See Entry 98705

Gold as a reliable internal pressure calibrant at high temperatures ..... See Entry 99074

High-temperature, high-pressure optical cells ..... See Entry 99144

High-pressure collisional activation mass spectrometry ..... See Entry 99228

X-ray diamond-anvil press for use at high temperatures ..... See Entry 99246

Measurement of low interfacial tensions under high hydrostatic pressures ..... See Entry 102120

Machine for testing polymer materials in the three-dimensional stressed state at various temperatures ..... See Entry 103447

07.50 ELECTRICAL INSTRUMENTS AND TECHNIQUES

99128 Dielectric anisotropy of nematic liquid crystals at centimeter wavelengths. P.Sura (Katedra Experimentalnej Fyziky MFF UK, Bratislava, Czechoslovakia).
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.4, p.265-72 (1983).
The method of measuring dielectric anisotropy on five thermotropic liquid crystals in the K microwave band and the attained results are presented. (5 refs.)

99129 Investigation of an electrodeless technique for the estimation of the electrical conductivity at high temperatures. G.Wollenberg, M.Wobst (Tech. Hochschule Karl-Marx-Stadt, Karl-Marx-Stadt, Germany).
Exp. Tech. Phys. (Germany), vol.31, no.3, p.227-38 (1983). In German.
With this method the sample falls through the solenoid of a high frequency oscillator. The origin of the electrical measurement values was mathematically investigated, if the conductivity σ varies above several orders of magnitude. The results yield instructions for dimensioning and dimensional stability of this measurement technique. An electro-analogic calibration method was derived and experimentally proved for this range of conductivities with purely real impedance of the solenoid. (19 refs.)

99130 Reliability of conductometers MK-3 and PK 80 MS. J.Muciek (Inst. Metrologii Elektrycznej, Politech. Wroclawskiej, Wroclaw, Poland).
Pomiary Autom. Kontrola (Poland), vol.29, no.1, p.6-7 (Jan. 1983). In Polish.
Procedure and results of reliability tests of conductometers MK-3 and PK 80 MS are presented. Reliability indices of the instruments under test, a mean failure rate, and a mean failureness operation time have been determined. Values of the indices have been established analytically on the basis of the design features, mechanics, and number of elements, and also experimentally through accelerated reliability tests involving checks on correct operation of the conductometers. (5 refs.)

99131 Contactless determination of the conductivity in semi-insulators. P.Muller (Zentralinst. fur Elektronenphys., Akad. der Wissenschaften, Berlin, Germany).
Phys. Status Solidi a (Germany), vol.78, no.1, p.41-51 (16 July 1983).
It is shown how isothermal relaxation current measurements on MISM or MISM multilayer structures can be used to determine the specific conductivity of materials in the range of about 10^{-12} to 10^{-5} Ω^{-1} cm^{-1}. Using a boxcar integrator for measuring the current-time signals, the proposed method is applied to investigate the properties of semi-insulating GaAs and of AgBr at room temperature. In accordance with the expectations in the case of semi-insulating GaAs with increasing voltages a perceptible carrier depletion in the bulk takes place. From the polarity dependence of the extraction effect conclusions can be drawn about the predominant conduction mechanism. (20 refs.)

99132 Surface acoustic-wave device for measuring high voltages. S.G.Joshi (Dept. of Electrical Engng. & Computer Sci., Marquette Univ., Milwaukee, WI, USA).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.1012-16 (Aug. 1983).
A surface acoustic-wave (SAW) device for measuring high voltages is described. The device consists of two SAW oscillators fabricated on a 128° rotated *Y*-cut $LiNbO_3$ substrate. The voltage to be measured is applied to one of the oscillators while the other oscillator acts as the reference oscillator for temperature compensation purposes. The frequency of the perturbed oscillator varies linearly with the applied voltage. An oscillator fabricated on a 0.5-mm-thick substrate can withstand greater than 9 kV of voltage giving a fractional frequency deviation greater than 1630 parts per million. Attractive features of this technique include: (1) direct measurement of high voltages without the need for resistive or capacitive voltage dividers, (2) very high input resistance, (3) direct conversion of voltage to frequency, and (4) resolution better than 0.01% of full scale. This paper will discuss the basic operation and present experimental data on the performance of the device. A technique for obtaining improved temperature compensation in SAW sensors will also be presented. (12 refs.)

99133 Optimization of a clip-on SQUID current probe. M.C.Leifer (Dept. of Phys., Stanford Univ., Stanford, CA, USA), J.P.Wikswo,Jr..
Rev. Sci. Instrum. (USA), vol.54, no.8, p.1017-22 (Aug. 1983).
This paper presents details of an unusual clip-on nanoammeter. The device utilizes a toroidal magnetic flux sensor which is split to allow its placement around a continuous current carrying filament, and is coupled to a sensitive superconducting current amplifier. Optimization formulas allow the design of an instrument having the greatest possible signal-to-noise ratio consistent with the physical volume available for the sensing element. A prototype exhibited 125-nA current sensitivity at 25 Hz with a noise level of 40 $nA/Hz^{1/2}$. The performance of this instrument verified the predictions of the theory. The optimization analysis for this probe demonstrated that the signal-to-noise ratio could have been doubled by a slight change in toroid dimensions. It was shown that SQUID noise is negligible for this instrument, justifying the assumption of a noiseless amplifier in the original calculation. Finally, the conditions under which an impedance matching transformer can reduce the importance of the SQUID noise relative to the Johnson noise are derived, and the required inductances are given. (7 refs.)

99134 Subnanosecond high-voltage two-stage resistive divider. Z.Y.Lee (Dept. of Electrical Engng. & Electronics, Univ. of Liverpool, Liverpool, England).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.1060-2 (Aug. 1983).
A simple, easily constructed, two-stage $CuSO_4$ solution 'tube' resistive divider for measuring high-voltage ns pulses has been developed. The test results for the divider showed that it was capable of maintaining pulse rise times less than 1.5 ns, and the hold-off voltage for pulses with rise times less than 5 ns was above 120 kV. (7 refs.)

99135 Linearization of volt-watt characteristics of Hall-effect power meters. A.M.Konin (Inst. of Semiconductor Phys., Acad. of Sci., Lithuanian SSR).
Sov. Phys.-Collect. (USA), vol.22, no.2, p.50-2 (1982). Translation of: *Litov. Fiz. Sb. (USSR)*, vol.22, no.2, p.64-7 (1982).
A method is proposed such that, given that the microwave Hall EMF is compensated for by external electric and magnetic fields, it is possible to obtain a linear relationship between the voltage applied to the sensor and the microwave power. This is achieved by choosing a certain length of the sensor. High temperature stability of the method is predicted. (5 refs.)

99136 Use of an immersion method to measure the dielectric constant of glassy semiconductors. M.S.Gutenev, I.N.Blinov (M.I. Kalinin Leningrad Polytech. Inst., Leningrad, USSR).
Sov. J. Glass Phys. & Chem. (USA), vol.8, no.4, p.299-303 (July-Aug. 1982). Translation of: *Fiz. & Khim. Stekla (USSR)*, vol.8, no.4, p.439-44 (July-Aug. 1982). [received: May 1983]
The promising nature of the immersion method for measuring the dielectric constant of glassy semiconductors is demonstrated. The limits of applicability of this method are defined; the relationship between the measurement frequency and the critical value of the electrical conductivity at which the measured value of the dielectric constant is still correct has been considered; the effect of various factors on the results of the experimental measurement of the dielectric characteristics has been analyzed. An evaluation of the value of the frequency corresponding to the beginning of the dispersion of capacitance is in good agreement with the experimentally measured values. (8 refs.)

Modelling of multiple electrode Van de Graaff generators with up-charge and down-charge processes ..... See Entry 99766

Attenuation of low frequency fields by conducting ellipsoidal shells ..... See Entry 100627

Improved wideband coaxial methods for dielectric measurements on nitrogen ceramics ..... See Entry 102799

Pulse amplitude method for determining the pyroelectric coefficient of pyroelectric materials ..... See Entry 102824

07.55 MAGNETIC INSTRUMENTS AND TECHNIQUES

99137 Superconducting laboratory magnets. J.Bankuti, L.Laszloffy (Dept. for Low Temperature Phys., Roland Eotvos Univ., Budapest, Hungary).
Acta Phys. Acad. Sci. Hung. (Hungary), vol.53, no.3-4, p.445-53 (1982). [received: Aug. 1983] (CRYOSEM '81. Second International Seminar on Low Temperature Physics, Visegrad, Hungary, 8-10 Oct. 1981).
Superconducting magnets were constructed for different investigations of magnetic phenomena. The magnetic field of this series ranges from 1.5 kOe to 72.6 kOe. By the volume minimalization of each magnet the authors have developed these with little helium consumption. In some cases their aim was to reach high homogeneity using a graphical interpolation technique with computer. (9 refs.)

99138 The NBS-LANL RTM end-magnet field mapper. E.R.Lindstrom, P.H.Debenham, D.L.Mohr, N.R.Yoder (NBS, Washington, DC, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3605-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A computer-controlled magnetic field mapper is under construction at the National Bureau of Standards to map the end magnets of the NBS-LANL racetrack microtron (RTM). The mapper consists of a large, two-dimensional translation stage which simultaneously positions a nuclear magnetic resonance (NMR) magnetometer probe in the 55 cm×135 cm uniform field region and a temperature-compensated Hall effect probe in the fringe field region. A computer-based control system automatically positions the probes at points on a selected grid and records the measured field values and positions in computer memory. The authors describe the field mapping requirements, the mapper, its operation, and the field measurements and analysis that are to be performed. (5 refs.)

99139 Report on the production magnet measurement system for the Fermilab Energy Saver superconducting dipoles and quadrupoles. B.C.Brown, W.E.Cooper, J.D.Garvey, D.A.Gross, R.Hanft, K.P.Kaczar, J.E.Pachnik, C.W.Schmidt, E.E.Schmidt, F.Turkot (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3608-10 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The measurement system and procedures used to test more than 900 superconducting dipole magnets and more than 275 superconducting quadrupole magnets for the Fermilab Energy Saver are described. The system is designed to measure nearly all parameters relevant to the use of the magnets in the accelerator including maximum field capability and precision field measurements. The performance of the instrumentation with regard to precision, reliability, and operational needs for high volume testing described. (8 refs.)

Magnetic field measurements near a steel plate .... See Entry 98702

Design, fabrication and performance of the dipole and quadrupole magnets for the RIKEN heavy-ion linear accelerator .... See Entry 99809

Lambertson magnetic design for the Tevatron extraction channel .... See Entry 100052

The LBL magnetic measurements data acquisition system ..... See Entry 100220

High-resolution NMR spectrometry of solids. II .... See Entry 102757

Sea floor measurement of geomagnetic field using newly developed ocean bottom magnetometers .... See Entry 104603

07.58 MAGNETIC RESONANCE SPECTROMETERS, AUXILIARY INSTRUMENTS AND TECHNIQUES

(see also 61.16N EPR and NMR determinations)

99140 T_1, nuclear Overhauser effects measurements in ^{13}C NMR spectroscopy: analytic relations for short equilibration delays. V.Leon (Centro de Fisica, Inst. Venezolano de Investigaciones Cientificas (IVIC),,Venezuela). Caracas.
Appl. Spectrosc. (USA), vol.37, no.4, p.357-60 (July-Aug. 1983).
Anaylytic relations that describe magnetization as a function of time are given for several dynamic nuclear Overhauser effects (NOE) experiments. They allow the extraction of spin-lattice relaxation times (T_1) and NOE (η) from a three-parameter fitting of experimental data. These results are valid even for short equilibration delays if the saturated protons have a much shorter relaxation time than the observed ^{13}C. A simple pulse sequence that combines a progressive saturation experiment with gate decoupling is proposed for measuring T_1 and η values. The calculated η values are a good approximation even for short equilibration delays without any restrictive assumptions about relaxation times of the nuclei involved. (9 refs.)

99141 Separate measurements of heteronuclear *J* coupling constants by manipulated polarization transfer in two-dimensional NMR. V.Rutar (Dept. of Chem., Univ. of Missouri, Columbia, MO, USA).
J. Am. Chem. Soc. (USA), vol.105, no.12, p.4095-6 (15 June 1983).
Scalar spin-spin (J) coupling constants between ^{13}C and ^{1}H nuclei are very important for molecular identification and conformational analysis. Two-dimensional (2-D) J-resolved spectoscopy separates chemical shifts and coupling constants, thus avoiding the overlapping of multiplets that occurs in one-dimensional coupled NMR spectra. Although the 2-D approach simplifies interpretation and also improves resolution, only few practical applications have been reported, because typically 1000 data sets have to be acquired and processed to obtain competitive results. Measuring times can be shortened by approximately 10 times by adopting the new strategy described by the author together with the first successful application. (9 refs.)

99142 Nuclear magnetic double resonance: the use of difference spectroscopy. J.K.M.Sanders, J.D.Mersh (Univ. Chem. Lab., Cambridge Univ., Cambridge, England).
Prog. Nucl. Magn. Resonance Spectrosc. (GB), vol.15, pt.4, p.353-400 (1982).
The authors outline the double resonance difference techniques which are available, and show how careful experimental design can maximise the useful information content of difference spectra, and describe a selection of chemical and biochemical applications. Only Fourier transform (FT) techniques are described. The emphasis is largely but not exclusively on proton NMR. (203 refs.)

The ab initio gradient revolution in structural chemistry: the importance of local molecular geometries and the efficacy of joint quantum mechanical and experimental procedures .... See Entry 100247

The determination of absolute configuration using nuclear magnetic resonance techniques .... See Entry 100425

07.60 OPTICAL INSTRUMENTS AND TECHNIQUES

(for radiation detection, see 07.62; for spectroscopy and spectrometers, see 07.65; for holography, see 42.40; for optical sources and standards, see 42.72; for optical lens and mirror systems, see 42.78; for optical devices, techniques and applications, see 42.80; for optical testing and workshop techniques, see 42.85; for radiation spectrometers and spectroscopic techniques, see 29.30; for radiation measurement, detection and counting, see 29.70)

99143 Determining the optical constants of high index thin films (II-VI compound thin film) with optical waveguides. K.Sasaki (Faculty of Sci. & Technol., Keio Univ., Tokyo, Japan).
Oyo Buturi (Japan), vol.52, no.3, p.237-8 (March 1983). In Japanese.
Ellipsometry, Abeles', Male's and other methods for determining optical constants of thin films have been extensively discussed in the literature and a number of review articles have been written concerning them. The author briefly describes his method for determining optical constants of II-VI semiconductor thin-films. Unlike other methods, the author's method does not need to perform complicated calculations using an electronic computer; the method can provide the refractive index of test films by finding the propagation constant, which depends on the geometry of the substrate and unimode guided wave path, and by measuring the resonance film thickness. The main difficulty in using the method is to prepare an accurately-tapered test film. (5 refs.) *K.B.*

99144 High-temperature, high-pressure optical cells. L.R.Holland, R.P.Harris, R.Smith (Space Sci. Lab., NASA-Marshall Space Flight Center, Huntsville, AL, USA).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.993-5 (Aug. 1983).
A strong, optically flat cell of fused silica has been developed which has routinely withstood internal pressures in excess of 60 atm at 900°C. Construction details are presented. (5 refs.)

Field Measurement and Calibration Using Electro-Optical Equipment: Issues and Requirements .... See Entry 98622

Ultrahigh vacuum apparatus for the optical study of thin films, in an energy range from 2 to 10.25 eV .... See Entry 99119

Method of characterizing the optical quality of glass .... See Entry 100932

07.60D Photometry and radiometry

(inc. colorimetry; see also 07.62 Detection of radiation)

99145 Evaluation of effective emissivities of nonisothermal cavities. Y.Ohwada (Nat. Res. Lab. of Metrology, Ibaraki, Japan).
Appl. Opt. (USA), vol.22, no.15, p.2322-5 (1 Aug. 1983).
Local effective spectral and total emissivities of nonisothermal cavities having diffuse surfaces are evaluated. The effective emissivity of the cavity wall around the half-depth of a cylinder is little affected by a linear decrease or increase of temperature along the axis because of a compensation effect. The nonisothermal effect on the integrated cavity emissivity changes considerably with cavity geometry for a given temperature distribution. (10 refs.)

99146 Wavelength precision of a Cary model 14R spectrophotometer. M.E.Hills (Res. Dept., US Naval Weapons Center, China Lake, CA, USA).
Appl. Opt. (USA), vol.22, no.15, p.2326-8 (1 Aug. 1983).
The precision of wavelength measurements made with a Cary model 14R spectrophotometer was determined using the D_β line of the deuterium lamp of the instrument as a standard. The wavelength of the line as measured by the instrument was found to depend upon the manner in which the instrument was operated. (3 refs.)

99147 Measurement standards of light and radiation. N.Oba.
J. Soc. Instrum. & Control Eng. (Japan), vol.22, no.3, p.315-20 (March 1983). In Japanese.
In employing methods that obtain the best measured value, it is obvious that the standard plays an important role in the measurement process and in the factor of confidence in the resultant value. This paper describes standard sources of light and radiation, and contains a description of blackbody radiators, synchrotron orbital radiation, absolute radiometers, standard luminous intensity, standard luminous flux, and problems in measuring light. (14 refs.) *K.B.*

99148 Characteristics of the use of silicon photodiodes in pulse photometry. S.G.Garasevich, Yu.A.Myagchenko, S.I.Osipov, A.V.Slobodyanyuk.
J. Appl. Spectrosc. (USA), vol.37, no.4, p.1178-80 (Oct. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.4, p.628-30 (Oct. 1982).
Silicon photodiodes are small and have low feed voltages, high mechanical strength, and stability of sensitivity for many thousands of pulses. Such properties give them a number of advantages over other photodetectors used in laser technology and laser spectroscopy, e.g. for measurement of the parameters of near-IR radiation pulses, in various synchronization circuits, etc. The comparatively low speed of such highly popular serially produced photodiodes as FD-7K, FD-18K, and FD-24K imposes certain restrictions on their use as photodetectors for nanosecond-range pulse photometers. Since the photodiodes mentioned and photodiodes similar to them have significant detecting surface dimensions, one can expect the existence of a relation of the parameters of the output electric signal to the position of the light spot on the detecting surface. This pertains primarily to photodiodes with asymmetric arrangement of electrodes. The existence of such a relation makes it possible in principle to improve the parameters of the output pulse signal by optimal choice of the cross section and the position of the light spot on the detecting surface of the photodiode. The authors have studied the coordinate relations of the response of the photodiodes to short radiation pulses ($\sim 10^{-8}$ sec). (3 refs.)

99149 Key features in densitometry.
Lab. Pract. (GB), vol.32, no.7, p.43-4 (July 1983).
The characteristics of scanning densitometers are discussed and systems which are available on the market are surveyed. Criteria which should be considered by purchasers include the optical system, the instruments' electronic capabilities, and the sample gel holder and sample application methods. (no refs.)

99150 A model of a standard operational radiometer for the visible and infrared [ranges]. G.Ispasoiu, I.Toma, V.Dragan (Inst. Nat. de Metrologie, Bucuresti, Rumania), M.Ciocirlan.
Metrol. Apl. (Rumania), vol.30, no.1, p.21-5 (1983). In Rumanian.
General aspects of radiometric magnitudes and methods for their measurement are discussed, particular attention being paid to the energy aspects of illumination, e.g. spectral density, flux energy, spectral efficiency, etc. A description of a particular radiometer, the RAVIR A-77, which is designed for measurement of illumination intensity and luminance in the 0.5 to 12 μm spectral range is presented. Principal components of the circuit are discussed, e.g. the thermocouple, operational amplifier, and the microammeter for the readout. A future digital instrument is also considered. (10 refs.) *C.J.R.*

99151 Improving the accuracy of absolute measurements in a photometric sphere. M.A.Bukhshtab.
Opt. & Spectrosc. (USA), vol.54, no.1, p.90-3 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.158-63 (Jan. 1983).
A method is proposed for canceling the systematic error in absolute measurements of various light modification coefficients in a photometric sphere by arranging a partial illumination of the photodetector by light directly reflected or transmitted by the test object. Expressions are derived for the transmission coefficient of the shading screen or the illuminated area of the detector for various cases. The additional errors in such devices are shown to be small quantities of second order in comparison with the measurement errors by the Taylor method. Experiments confirm that highly accurate measurements can be taken in a sphere with incomplete screening. (7 refs.)

99152 Colorimetric effectiveness value of light sources. W.Stanioch.
Pr. Inst. Elektrotech. (Poland), vol.31, no.123, p.47-74 (1983). In Polish.
The paper presents a method of determining a novel parameter characterising the quality of light sources, i.e. their colorimetric effectiveness value. The latter determines to what degree does the relative spectral distribution of the light of lamps influence the chromatic contrast level of viewed objects which is an essential factor of the visibility level. The results of a verification of the method, made by means of psychophysical observation of coloured samples, are quoted. The presented method is intended for application in light engineering with the use of computers and completes the present methods, mainly, that concerning the colour rendition index. (2 refs.)

99153 Sensitivity and time constant of thin film thermopile radiometer with radial geometry. A.Septier, C.Machet (Conservatoire Nat. des Arts et Metiers, Paris, France).
Rev. Phys. Appl. (France), vol.18, no.8, p.507-14 (Aug. 1983). In French.
Using a simple model, sensitivity and time constant of a thermopile made of semiconducting thin thermoelements with a radial symmetry and operating in a vacuum, have been calculated. The radiation flux, collected by a metal disc covered with a thick layer of gold black, flows to the heat reservoir at constant temperature T_0 surrounding the receiver by conduction and thermal radiation. A flux sensitivity $S_\phi=68.5$ V W^{-1} and a time constant $\tau=0.76$ s have been obtained, in good agreement with experiments. (13 refs.)

99154 Photometer for quasielastic and classical light scattering. H.R.Haller, C.Destor, D.S.Cannell (Dept. of Phys., Univ. of California, Santa Barbara, CA, USA).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.973-83 (Aug. 1983).
An accurate light scattering photometer capable of measuring both the angular distribution of intensity and the intensity fluctuation spectrum of laser light scattered from a wide variety of samples including solutions of polymers and other macromolecules is described. The photometer employs 18 fixed scattering angles ranging from 2.6° to 163° and is sufficiently accurate to measure a molecular radius of gyration as small as 60 Å reliably. Stray elastically scattered light normally comprises less than 1% of the light scattered from pure toluene at the smallest scattering angle and is unmeasurable at other angles. The apparatus employs optical fibers to transmit the scattered light to a single photomultiplier tube and functions automatically under microprocessor control, with sample temperature controlled to ±0.1 mK. (16 refs.)

99155 Colorimetry for fluorescent materials. H.Minato.
Res. Electrotech. Lab. (Japan), no.829, p.1-98 (Oct. 1982). In Japanese.
A practical measuring method is established for accurate prediction of colours of fluorescent materials under arbitrary illuminants. The two-monochromator method, considered to be the most accurate method in principle, is first investigated. Then the one-monochromator method is investigated based on the evaluation mode by the two-monochromator method. Spectral characteristics of fluorescent and non-fluorescent materials are described. A method for accurate determination of the reflected spectra radiance factor in the overlapping region in spectral colorimetry for fluorescent materials is given, and the effect of polarisation of the measuring system studied. Two methods are proposed for accurate estimation of the relative spectral integrating sphere efficiency, which plays an important role in the colorimetry for fluorescent materials by means of conventional colour-measuring spectrophotometers. (47 refs.)

99156 A system for controlling the luminance stability of colour temperature reference lamps. Klochkova O.A., D.I.Chetvergov.
Svetotekhnika (USSR), no.6, p.7-8 (1983). In Russian.
A system intended for controlling the stability of the radiant parameters of colour temperature reference lamps has been developed. To obtain convergent measurement results, use was made of the optical system including lenses, a turning mirror and an interchangeable reflecting prism. Total measurement errors were calculated. (6 refs.)

Two readily-constructed instruments for the teaching laboratory (colorimeter and polarimeter) ....See Entry 98706

Mobile tracking imaging radiometer ....See Entry 99181

Trial manufacture of fixed point blackbody with large aperture ....See Entry 99186

Computer interface for a diode-array based spectrophotometer ....See Entry 99205

Determination of the probability of quantum absorption for particles of photographic blackening ....See Entry 99217

High dynamic range laser energy distribution mapping using dual charge injected device (CID) cameras as an imaging radiometer ....See Entry 100788

Pulsed laser beam control by hot spot tracking ....See Entry 100812

Temperature measurement of copper wire in process of the electrical explosion ....See Entry 101485

Application of fast infrared detectors to detonation science ...See Entry 103525

In-flight radiometric calibration of advanced remote sensing systems ....See Entry 103774

New developments in instrumentation for long path atmospheric transmittance and radiance measurements ....See Entry 104588

07.60F Polarimetry and ellipsometry

99157 Simple and direct determination of complex refractive index and thickness of unsupported or embedded thin films by combined reflection and transmission ellipsometry at 45° angle of incidence. R.M.A.Azzam (Dept. of Electrical Engng., Univ. of New Orleans, New Orleans, LA, USA).
J. Opt. Soc. Am. (USA), vol.73, no.8, p.1080-2 (Aug. 1983).
Measurements of the polarisation states (represented by complex numbers χ_r and χ_t, respectively) of light reflected and transmitted by an unsupported or embedded thin film, for totally polarised light (with nonzero p and s components) incident at 45°, permit simple, direct, and explicit determination of the film's complex refractive index N_1 independently of film thickness or input polarisation. If $\alpha=\chi_r/\chi_t$, the author finds that $\alpha=r_s+r_s^{-1}$, where r_s is Fresnel's complex reflection coefficient of the ambient-film interface for the s polarisation at 45° incidence. From α, r_s is determined, and from r_s one gets $N_1=N_0(1+r_s^2)^{1/2}/(1+r_s)$, where N_0 is the refractive index of the transparent medium surrounding the film. Knowledge of the incident polarisation χ_i allows the film thickness to be determined, also explicitly, by using either of the ratios χ_i/χ_r or χ_i/χ_t. (10 refs.)

99158 Calibration and error analysis in rotating analyzer ellipsometers. T.Hoshino, A.Moritani, J.Nakai (Dept. of Electronic Engng., Osaka Univ., Suita, Japan).
Oyo Buturi (Japan), vol.52, no.5, p.443-50 (May 1983). In Japanese.
An accurate calibration method taking account of imperfections in optical components is described for rotating analyzer ellipsometers. Precision and accuracy are discussed in detail for both stationary and time-varying ellipsometric parameters, Ψ and Δ, in rotating analyzer ellipsometry. An application of the present method to the study of anodic film growth on Bi_2Te_3 is shown. (15 refs.)

99159 Ellipsometric method of determining the quality of surface processing. A.V.Rzhanov, S.N.Svitasheva, K.K.Svitashev, V.K.Sokolov, Yu.V.Ashkerov, L.A.Osadchev, L.S.Tsesnek (Inst. of Semiconductor Phys., Acad. of Sci., Novosibirsk, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.967-9 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.373-7 (Nov. 1982).
By studying the polarization of a reflected light beam one can obtain detailed information on the properties of reflecting surfaces. As the quality of the polishing improves, the abrupt changes in the apparent values of n and k as functions of the angle of incidence should vanish, and this is seen in the experiment. The proposed method provides an objective quantitative basis for comparison of the quality of surface processing for samples of a material with standard characteristics for the material and, without requiring expensive instrumentation or a highly trained staff, permits contactless and nondestructive monitoring. (10 refs.)

Two readily-constructed instruments for the teaching laboratory (colorimeter and polarimeter) ....See Entry 98706

Some proposals for the application of liquid crystals to photoelastic instrumentation ....See Entry 101159

Angle-of-incidence derivatives of the complex parallel and perpendicular reflection coefficients and their ratio for a film-substrate system ..See Entry 102837

07.60H Refractometry and reflectometry

99160 Vacuum-ultraviolet refractive index of LiF and MgF_2 in the temperature range 80-300K. P.Laporte, J.L.Subtil, M.Courbon, M.Bon (Equipe de Spectroscopie, CNRS, Saint-Etienne, France), L.Vincent.
J. Opt. Soc. Am. (USA), vol.73, no.8, p.1062-9 (Aug. 1983).
The refractive indices of LiF and MgF_2 have been measured with an accuracy better than ±0.003 from 200 nm down to their respective cutoff wavelengths for various temperatures ranging from 80 to 300K. For LiF, the temperature coefficient changes sign at 160 nm. The data were fitted to a two-term dispersion equation. The corresponding oscillator strength values for the exciton peak (0.45 and 0.69 for LiF and MgF_2, respectively) are in agreement with existing data. (24 refs.)

99161 New graphical method for the determination of the optical constants of thin films. A.A.El-Shazly, H.T.El-Shair, M.M.El-Nahass (Faculty of Education, Ain Shams Univ., Cairo, Egypt).
J. Opt. (India), vol.12, no.1, p.6-7 (Jan.-March 1983).
A new graphical method for the determination of the components n and k of the complex refractive index of a thin absorbing films is proposed. The method utilises reflectance and transmittance measured at normal incidence. (7 refs.)

Simultaneous determination of refractive index and size of spherical dielectric particles from light scattering data ....See Entry 99077

Simple and direct determination of complex refractive index and thickness of unsupported or embedded thin films by combined reflection and transmission ellipsometry at 45° angle of incidence ....See Entry 99157

A sharp bend in an optical fiber waveguide as a basis for sensors of physical quantities ....See Entry 100917

Angle-of-incidence derivatives of the complex parallel and perpendicular reflection coefficients and their ratio for a film-substrate system ..See Entry 102837

Possibilities and limits of the interference microscopic phase analysis ....See Entry 103424

07.60L Interferometry

99162 Selective counting path to Young's fringes in speckle photography for eliminating diffraction halo effects. C.S.Vikram, K.Vedam (Materials Res. Lab., Pennsylvania State Univ., University Park, PA, USA).
Appl. Opt. (USA), vol.22, no.15, p.2242-3 (1 Aug. 1983).
Along with the whole field filtering approach, the pointwise method utilizing Young's fringes is very common in speckle photography for the analysis of lateral object motion or displacement. In this the diffraction halo is modulated by a fringe pattern (Young's fringes) that is used for analysis. Until recently, it has been the practice to ignore the effect of the diffraction halo intensity variation on the fringe positions. However, the halo intensity variation does alter the fringe position significantly resulting in error if the effect is not accounted for. The present methods involve eliminating the effect of the halo by complicated electronic techniques or analytical methods. Both these approaches significantly complicate a remarkably simple instrumentation or analysis on both. The authors propose to eliminate this dilemma by an altogether new and simple approach. The entire problem is due to the normal practice (which is very common in optics) of observing the fringes along a direction perpendicular to their orientation. In what follows, the authors show that a slight deviation from this practice can simply eliminate the halo effects as far as positions of fringe maxima and minima are concerned. Thus one can work without complicated instrumentation or analytical tools. (7 refs.)

99163 Fourier transform Michelson interferometer for the far infrared. Y.Shibata, T.Tsutaya, S.Takahashi (Res. Inst. for Sci. Measurements, Tohoku Univ., Sendai, Japan).
Bull. Res. Inst. Sci. Meas. Tohoku Univ. (Japan), vol.31, no.2-3, p.91-108 (1982). In Japanese.
A Fourier transform Michelson interferometer for the far infrared was constructed. The construction and performance of this handy interferometer are described. The focal length of the spherical collimating mirror is 30 cm and the aperture 10 cm in diameter. The maximum optical path difference is 10 cm. With a Golay detector, the resolution achieved is about 0.1 cm^{-1}, the operational reproducibility ±5%, and the accuracy of the wavenumber ±0.2 cm^{-1}. Illustrative spectra of water vapor are given. (10 refs.)

99164 Analysis of Young's fringes in speckle photography: generalised square imaging aperture. C.S.Vikram (Materials Res. Lab., Pennsylvania State Univ., University Park, PA, USA).
Appl. Phys. B (Germany), vol.B31, no.4, p.221-4 (Aug. 1983).
Processing speckle photography data using Young's fringes method is described when a square imaging aperture is used. The direction of the lateral motion and hence the fringe orientation is assumed to be general. The cases considered are step motion (double-exposure) and sinusoidal vibration in time-average manner. (16 refs.)

99165 Method of fabrication and photographic characteristics of the Fabry-Perot type photosystems. D.Saint-Germain, G.Boivin (Dept. de Phys., Univ. Laval, Quebec City, Quebec, Canada).
Can. J. Phys. (Canada), vol.61, no.8, p.1212-17 (Aug. 1983).
The use of a Fabry-Perot filter as a positive transmission photosystem is discussed first. Its construction is similar to an interference filter with multistacked mirrors. A lead-iodide and copper photosensitive element is made in

such a way as to be combined with the multistacked mirrors. They then propose a method to fabricate the filter which is independent of the refractive indices of the materials. Finally, the authors present the sensitivity and contrast results of the photosystems. (13 refs.)

99166 Speckle and its application to strain sensing. K.A.Stetson (United Technologies Res. Center, East Hartford, CT, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353, p.12-18 (1983). (Industrial and Commercial Applications of Holography, San Diego, CA, USA, 24-25 Aug. 1982).
Discusses ways in which laser speckles may be used to determine strain on the surface of an object. This may be done either by measuring variations in speckle displacement across a specklegram, or by measuring the slewing of the speckle field relative to the object surface. The latter method required the use of tandemly recorded specklegrams, and, although data processing is time consuming, it yields a complete solution for the surface strain rotation matrix. The first method is effective when the surface is observed in focus, along the surface normal, but it suffers serious problems when a significantly contoured surface is considered. Equations are derived that relate the derivatives of observed speckle displacements to surface strains and rotations as a function of illumination and observation direction and variations in defocusing. (13 refs.)

99167 Automated data reduction for speckle metrology. G.E.Maddux (Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353, p.19-23 (1983). (Industrial and Commercial Applications of Holography, San Diego, CA, USA, 24-25 Aug. 1982).
Speckle Metrology has transitioned from a laboratory curiosity to a useful engineering tool. It is now in a stage where some means is required to process the enormous amount of data it is capable of generating. The author explores the requirements and characteristics for an automated data reduction system. Examples are given of current operational systems and what direction future system developments may take. (10 refs.)

99168 White light optical processing of speckle interferograms. F.T.S.Yu, P.H.Ruterbusch (Dept. of Electrical Engng., Pennsylvania State Univ., University Park, PA, USA), G.R.Gerhart.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353, p.90-5 (1983). (Industrial and Commercial Applications of Holography, San Diego, CA, USA, 24-25 Aug. 1982).
A technique of white-light color encoding of misfocused speckle interferometric fringe patterns is presented. The encoding is performed in the spatial frequency plane with color filters. This technique allows the viewing of a multiset of encoded speckle interferograms simultaneously. Thus it may provide new information on the interferometric aspects of the object under stress or vibration. The effect on the speckle fringe pattern due to the spatial filtering is briefly discussed and experimental demonstrations of color encoded fringe patterns are presented. Due to the simplicity and versatility of the processing technique, the authors feel that the technique may develop into a practical tool for strain, stress and vibrational measurement. (10 refs.)

99169 Speckle-shear interferometry with double Dove prisms. R.K.Mohanty, C.Joenathan, R.S.Sirohi (Engng. Design Center, Indian Inst. of Technol., Madras, India).
Opt. Commun. (Netherlands), vol.47, no.1, p.27-30 (1 Aug. 1983).
A method for carrying out speckle-shear interferometry with θ-shear is discussed and applied to the study of eccentrically loaded diaphragms and cantilever beams. It is also shown that it can be used for the measurement of rigid body tilt. (14 refs.)

99170 Experimental determination of variations in optical-waveguide film thickness by the interference of scattering fields of modes with different polarization. A.Yu.Agapov, L.N.Deryugin, S.V.Zaitsev, A.V.Chekan.
Opt. & Spectrosc. (USA), vol.54, no.1, p.87-90 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.153-7 (Jan. 1983).
Feasibilities are considered for the determination of variations in the thickness of thin-film optical waveguides based on measurement of the width of the interference fringes of scattering fields of two waveguide modes with different polarization, TE and TM. The error of the method is calculated for waveguides with different refractive indices of the waveguide layers. Results of experimental studies on the variations of the thickness of polystyrene waveguide films on glass are given. (8 refs.)

99171 Autocollimation multibeam interferometer with spatial beam separation and its use in frequency selection of laser radiation. Yu.T.Mazurenko, Yu.A.Rubinov.
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.213-16 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.383-9 (Feb. 1983).
A new type of multibeam interferometer with side entrance of radiation is proposed. A theoretical analysis is made of a three-mirror autocollimation interferometer with side entrance and it is shown both theoretically and experimentally that such an interferometer can be used as an efficient selector of longitudinal modes in laser resonators. Such a longitudinal-mode selector has advantages over a Fabry-Perot etalon in the resonators of high-power tunable lasers. In lasers of this type the use of an autocollimation multibeam interferometer with spatial beam separation ensures a considerable reduction in the optical loading on the components of the laser system and on coatings of mirrors in the selector, and it makes it possible to use the Fresnel reflection effectively. (12 refs.)

How to detect the gravitationally induced phase shift of electromagnetic waves by optical-fiber interferometry .... See Entry 98929

Low amplitude measurement by direct lock-in ESPI, a proposal .... See Entry 99079

Evaluation of spectral line profile from relative widths of Fabry-Perot interferograms .... See Entry 99199

Real time holographic interferometry with photorefractive $Bi_{12}SiO_{20}$ crystals .... See Entry 100682

Holographic nondestructive evaluation with on-line acquisition and processing .... See Entry 100689

Automatic computer analysis of double exposure hologram in industrial nondestructive control .... See Entry 100690

Nd:YAG holographic interferometer for aerodynamic research .... See Entry 100691

Automatic evaluation of angular movements and linearity with holographical methods .... See Entry 100693

Holography in Europe .... See Entry 100694

Present state of holography in Japan .... See Entry 100695

Contrast enhancement in holographic moire fringes .... See Entry 100699

Increasing the sensitivity of interference measurements .... See Entry 100702

The use of a fibre-optic reference beam in a focused image holographic interferometer .... See Entry 100703

Digital and optical moire detection of flaws applied to holographic nondestructive testing .... See Entry 100705

Temporal and interference fringe analysis of TEM_{01}* laser modes .... See Entry 100819

New vistas for diffraction gratings .... See Entry 100882

Synchronous phase detection for optical fiber interferometric sensors .... See Entry 100895

An investigation of multimodal interference of surface light waves in a microwaveguide interferometer .... See Entry 100928

Determination of dynamic stress-intensity factors by holographic interferometry .... See Entry 101157

Interferometric measurements of surface properties during laser annealing .... See Entry 101786

Possibilities and limits of the interference microscopic phase analysis .... See Entry 103424

Some optical techniques of displacement and strain measurements on metal surfaces .... See Entry 103428

Location and estimation of the defective area in a diaphragm: an a posteriori moire method .... See Entry 103438

07.60P Optical microscopy

99172 Jenalumar—the fluorescence research microscope of the Jena-microscope series 250-CF. G.Borner, H.Bruch.
Jena Rev. (Germany), vol.28, no.2, p.59-60, 71 (1983).
The application of fluorescence microscopy covers many fields in science and technology and of increasing importance is fluorescence microscopy for biology and medicine. The Jenalumar provides for: fluorescence microscopy of wide fields with 170% increased information content compared with former microscopes; combination of fluorescence excitation with all other optical contrasting methods for simultaneous or alternative use; great flexibility of the fluorescence excitation by exchange of excitation sources and filters. The microscope user may choose between three Jenalumar standard outfits: Jenalumar-a/d is the fluorescence microscope for all common fluorescence techniques; Jenalumar-contrast is an extended version of the Jenalumar-a/d with a special contrast tube; Jenalumar-a has been designed for demanding routine fluorescence microscopy in incident light. All Jenalumar microscopes have, in addition, a built-in variable 6 V/25 W halogen lamp for use with other than fluorescence methods. (4 refs.)

99173 Jenapol polarizing microscope of the Jena-microscope series 250-CF. J.Bergner.
Jena Rev. (Germany), vol.28, no.2, p.61-3 (1983).
As polarized light microscopy is as important as ever in many scientific and technical fields of application for materials and structural analysis—the Jena-microscope series 250 CF also includes the Jenapol polarized light microscopes. Particular attention has been paid to the improvement of its optical performance regarding imaging quality and field of view in the orthoscope and conoscopic path of rays, the extension of usable polarized light methods and ease of operation, and the extension and optimization of the range of accessories for polarized light microscopy taking thereby advantage of the possibilities modern microelectronics offers. (6 refs.)

99174 The polarization optical digital compensator Retarmet. R.Werlich, J.Bergner.
Jena Rev. (Germany), vol.28, no.2, p.64-5 (1983).
The Retarmet instrument disposes of six polarization-optical compensation programmes and one length measuring programme. For statistical measurements with tilt compensators, one of the two compensation strips, which are formed in the microscope symmetrically to the zero position, are brought into alignment with the centre of the cross lines and the coordinated position of the angle-measuring device is set as zero point. By pressing the key, the path difference is calculated from the number of pulses determined by the counter up to the measuring of the second compensator strip. The measurement of the rotary compensators proceeds analogously, where the extinction position of the compensator plate serves as a reference point. Easy operation, high measuring frequency in kinetic processes and an amount of labour which is reduced up to 10% of that required formerly are characteristic features of the digital compensator Retarmet and make it a highly effective means of rationalization for polarization-microscopic measurements. (2 refs.)

99175 Wide-field planapochromats and special-type objectives for the Jena-microscope series 250-CF. H.Riesenberg.
Jena Rev. (Germany), vol.28, no.2, p.66-8 (1983).
The new-developed microscope objectives represent a systematic extension of the new generation of microscope optics developed since 1982 and complete the programme planned for transmitted-light microscopy as well as for fluorescence and polarization microscopy. With these wide-field planapochromats, objectives of the highest performance characteristics for the Jenaval microscope are made available. Additional objectives are adapted to special requirements and served as basic or supplementary equipment for the Jenalumar fluorescence microscope and the Jenapol polarizing microscope. Specific oil immersion objectives complete the programme of supplementary objectives which may be used with the different instruments of the Jena-microscope series 250-CF. Finally, suggestions are given how the well-known objectives with long working distance may be adapted to the microscopes of the new generation. (5 refs.)

99176 Contemplations on fluorescence photomicrography. H.Storz (Inst. for Clinical Immunology, Freidrich-Schiller-Univ., Jena, Germany).
Jena Rev. (Germany), vol.28, no.2, p.79-81 (1983).
Primarily, three essential problems have to be taken into account in fluorescence photomicrography: 1. Compared with other microscopic examination methods, the light intensities in fluorescence microscopy are very low. The so-called Scwarzschild effect occurs. 2. In dependence on their fluorescent intensity and thus also on the excitation intensity, fluorescent objects display a certain fading effect. 3. Fluorescent images are similar to dark field images, i.e. they are luminous objects on dark ground. This fact has to be taken into account when measuring or regulating the exposure time or also in the subjective rating of the object brightness. To test the Schwarzschild effect on film materials used in fluorescence microscopy, the author made several series of trial exposures, employing the bright field method at differing intensity steps. The optimum setting values for the Automatic Exposure Control BA 2 indicate that, in photomicrography and especially in fluorescence processes, the effective sensitivity of the films cannot directly be deduced from the film sensitivity stated on the film case. The intensities in the ranges 1/400 and 1/4000 were comparable with those of the most brilliant immunofluorescent

objects. The variation of the setting values results from the Schwarzschild effect. (6 refs.)

99177 Commercial image analysers and the characterization of microscopical images. S.Bradbury (Dept. of Human Anatomy, Univ. of Oxford, Oxford, England).
J. Microsc. (GB), vol.131, pt.2, p.203-10 (Aug. 1983).
This review surveys some of the current approaches to the characterization of microscopical images using commercially available image analysers. The role of image pre-processing and segmentation is considered, together with the characterization of images by optical density, as well as size and shape. The newer analysers are capable of investigating relationships between grey-levels in small areas of the image ('texture-analysis'); some of the descriptive approaches in this latter field are briefly outlined. (50 refs.)

99178 Two-point resolution with partially coherent illumination, and the relation between self-luminous and illuminated objects. J.Rienitz (Inst. of Sci. Microscopy, Univ. of Tubingen, Tubingen, Germany).
Microsc. Acta (Germany), vol.87, no.3, p.311-28 (May 1983).
For more than thirty years past the theory of microscopic image formation has been deepened and improved by means of the concept of partial coherence. In practical microscopy, however, this progress has hardly been noticed up to now. The present paper tries to explain, in a comprehensible manner, the concept of partial coherence as well as its application to the formation of the image of two object points. A graphical representation developed by the author provides not only a synopsis of the resolution under different conditions but demonstrates, moreover, that the relations between self-luminous and illuminated objects are not inconsiderably different from the conclusions drawn from the 'equivalence principle' of von Laue (1914). An application of annular bright-field illumination and the character of this method are discussed. (11 refs.)

99179 Image contrast in a laser projection microscope. K.I.Zemskov, M.A.Kazaryan, V.M.Matveev, G.G.Petrash (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.183-6 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.336-41 (Feb. 1983).
An experimental investigation was made of the contrast of an amplified image produced by a laser projection microscope. It was found that under typical operation conditions the amplified image contrast differed little from the initial contrast. (8 refs.)

99180 Computer graphics for the intelligent microscope. J.M.S.Prewitt (Div. of Computer Res. & Technol., Nat. Inst. of Health, Bethesda, MD, USA), B.Lander, L.Roelofs.
Proceedings of the Fifteenth Hawaii International Conference on System Sciences 1982, Honolulu, HI, USA, 6-8 Jan. 1982 (HI, USA: Hawaii Int. Conference Syst. Sci. 1982), p.58 vol.2
Summary form only given. The authors are developing color computer graphics software for 'Intelligent Microscopes' on an image processing facility based on a VAX 11/780 host computer and De Anza IP 5000 image processing system. A variety of graphics tools for quantitative image analysis, be it automatic or interactive, have been developed. These include color isopleth and surface representations, and image display manipulation capabilities which can be combined in a variety of useful ways to facilitate both algorithm design and testing and viewing by the human observer. (no refs.)

Abbe's error .... See Entry 98709

Mechanical scan system for microscopic applications .... See Entry 99089

Abbreviations for microscopical and analytical methods .... See Entry 99241

The examination of grain collectives with the aid of microscopes .... See Entry 103423

Possibilities and limits of the interference microscopic phase analysis .... See Entry 103424

07.62 DETECTION OF RADIATION (BOLOMETERS, PHOTOELECTRIC CELLS, I.R. AND SUBMILLIMETRE WAVES DETECTION)

99181 Mobile tracking imaging radiometer. J.A.Roth (Instrumentation Directorate, US Army, White Sands Missile Range, NM, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.356, p.90-7 (1983). (Field Measurement and Calibration Using Electro-Optical Equipment: Issues and Requirements, San Diego, CA, USA, 24-25 Aug. 1982).
The Mobile Tracking Imaging Radiometer (MTIR) has been developed at White Sands Missile Range to support future tests of experimental laser systems. The MTIR features a high angular resolution Forward Looking Infrared imaging system (FLIR) capable of simultaneous operation at 3.7-5.5 and 8-12 micrometers. The FLIR, which is mounted behind a long focal-length tracking telescope, utilizes internal calibration sources as well as external targets to obtain radiometric data. Radiometric calibration considerations are discussed and measurement results presented. (3 refs.)

99182 Jitter suppression: a data processing approach. P.E.Barry, M.Klop (Res. & Dev. Center, Grumman Aerospace Corp., Bethpage, NY, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.366, p.2-9 (1983). (Modern Utilization of Infrared Technology VIII, San Diego, CA, USA, 26-27 Aug. 1982).
The problem of suppressing the effects of line-of-sight (LOS) jitter in starting mosaic sensors is approached from the viewpoint of both real time and post-processing of the corrupted focal plane data. Fundamental limits on the joint observability of LOS motion and spatial scene gradients are established as a function of the level of sensor and background characterization information assumed to be available. It is shown that although separability cannot be assured in most cases of interest, the effects of jitter can be estimated and synchronously subtracted from focal plane data. Simulation results are presented which demonstrate signal to noise improvements in excess of a factor of ten. (2 refs.)

99183 Optical technique for increasing fill factor of mosaic arrays. E.F.Cross, W.A.Garber, G.D.Wiemokly, O.L.Gibb, I.J.Spiro (Aerospace Corp., Los Angeles, CA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.366, p.10-18 (1983). (Modern Utilization of Infrared Technology VIII, San Diego, CA, USA, 26-27 Aug. 1982).
A novel optical technique for improving the performance of focal plane staring arrays by increasing the fill factor ratio is described. The specific mosaics considered are 64×32 and 128×64 Schottky barrier infrared detectors with charge coupled devices (IRCCD) made fron monolithic silicon. The video enhancement is accomplished by means of a refracting silicon faceplate that redirects focused image irradiance from nonsensitive CCD areas to the infrared detector elements. Operational theory and design parameters for this unique faceplace construction are detailed. With the optimum faceplate configuration installed at the IRCCD front surface, a sensitivity increase of at least 200 percent is predicted from the analysis presented. (2 refs.)

99184 Focal plane spatial response and modulation transfer function (MTF) measurements using a computer-aided flying spot scanner. S.R.Hawkins, R.P.Farley, G.Gal, A.K.Gressle, S.B.Grossman, W.G.Opyd (Lockheed Palo Alto Res. Lab., Palo Alto, CA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.366, p.41-9 (1983). (Modern Utilization of Infrared Technology VIII, San Diego, CA, USA, 26-27 Aug. 1982).
In the measurement and characterization of the performance of infrared and visible focal plane arrays, the determination of the detailed spatial response of individual detectors as well as the entire array can be extremely important in many electro-optic sensor applications such as the detection of targets in the presence of clutter and passive acquisition and tracking. The authors describe a computer-controlled flying spot scanning technique for the measurement of detailed focal plane detector responses as well as detector-to-detector cross talk and spurious responses. The technique uses a computer-controlled flying spot scanner and online data processing. A simple deconvolution is used to remove the known temporal responses of the detector and electronics followed by a two-dimensional decorrelation of the blur spot from the output signal to obtain the focal plane spatial response. As a natural result of this process the individual detector MTFs can be obtained. This technique has been implemented in a low-background focal plane test facility, which is also described. Several examples of actual test data are shown to demonstrate the use of this spot-scanning facility and its utility as a diagnostic tool. (9 refs.)

99185 Wideband heterodyne detection in the far infrared with extrinsic Ge photoconductors. G.Dodel, J.Heppner, E.Holzhauer (Inst. fur Plasmaforschung, Stuttgart, Stuttgart, Germany), E.Gornik.
J. Appl. Phys. (USA), vol.54, no.8, p.4254-9 (Aug. 1983).
The heterodyne performance of Ge photoconductors doped with shallow impurities was investigated using optically pumped far infrared lasers. Two lasers operating on the 67-μm NH_3 Raman line generated difference frequencies from 0-100 MHz. An additional frequency point at 1.155 GHz was produced with two methanol-isotope lasers at 118 μm. For three detectors with different doping levels IF bandwidths of 141, 63, and 8 MHz were measured using local oscillator powers of a few milliwatts. The detector gain and quantum efficiency were calculated from shot noise measurements. For impedance matched operation the calculated noise equivalent power (NEP) values are 2×10^{-18} W Hz^{-1} for the fastest detector and 6.5×10^{-19} W Hz^{-1} for the slowest detector. (18 refs.)

99186 Trial manufacture of fixed point blackbody with large aperture. S.Hattori.
J. Soc. Instrum. & Control Eng. (Japan), vol.22, no.3, p.309-14 (March 1983). In Japanese.
Describes the construction and performance of a recently-developed large-aperture fixed-temperature blackbody using a graphite crucible inside which copper is melted as fixed-temperature metal. A temperature-controlled electric furnace with the core tube using 310S stainless steel is employed to heat the crucible. A silicon monochromatic radiation pyrometer is used to measure the temperature of the thermal radiation emitted from the blackbody. The luminance distribution inside the crucible is within 0.5K in uniformity. This experiment has proved that the large-aperture fixed-temperature blackbody is useful as a means of calibrating radiation pyrometers. (6 refs.) *K.B.*

99187 Measurements on the accuracy of pyranometers. P.-M.Nast (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt eV, Inst. fur Tech. Phys., Stuttgart, Germany).
Sol. Energy (USA), vol.31, no.3, p.279-82 (1983).
The performance of four different types of pyranometers is investigated. Changes in the sensitivities of the instruments caused by nonlinearity, by angular dependence on the direction of insolation and by tilting of the pyranometers are determined. The calibration factors specified by the manufacturer are checked. The results show that errors due to nonlinearity or angular dependence can be roughly predicted for each type of instrument. For accurate measurements with pyranometers, calibration factors should be redetermined by the user and corrections for the angular dependence of the sensitivity should be taken into account. Some types of instruments are unsuited for inclined positions. (6 refs.)

99188 A thermoelectric detector for high radiant flux densities. J.W.Cochrane, H.J.Goldsmid, R.J.Moore (School of Phys., Univ. of New South Wales, Kensington, Australia).
Sol. Energy (USA), vol.31, no.3, p.327-39 (1983).
The measurement of the high radiant flux density from a tracking solar concentrator can present some difficulties, since it is unlikely that the response of a device, that has been calibrated in unconcentrated radiation, can be extrapolated satisfactorily to high intensities. In particular silicon photodiodes become ineffective at high solar concentrations because of heating of the junction and, moreover, they are not broadband devices. The authors have carried out some experiments on a thermoelectric detector, that has a small enough thermal resistance not to become overheated in concentrated solar radiation but which, at the same time, is sensitive enough to give an accurately measurable response in ordinary sunlight. The device consists essentially of a block of silicon with a blackened copper plate attached to one face and a copper heat sink attached to the opposite face. Because of the very high thermal conductivity of silicon, virtually all the radiant energy that is absorbed by the blackened plate is conducted to the heat sink through the block of semiconductor. The resultant temperature difference across the silicon gives rise to a thermoelectric e.m.f., which is relatively large since the Seebeck coefficient is typically in excess of 1 mV K^{-1}. (1 ref.)

99189 Integrated-optics photodetector utilizing the external photoelectric effect in a Schottky barrier. V.A.Karavanskii, V.N.Morozov, L.F.Plavich, Yu.M.Popov, V.L.Smirnov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.259-61 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.449-52 (Feb. 1983).
An investigation was made of the possibility of using the photoelectric effect in a Schottky barrier at a metal-semiconductor interface for detection of waveguide radiation. The dependences of the photocurrent and photo-emf on the power at the entry to such a photodetector were determined for $GaAs_xP_{1-x}$-GaP waveguide structures with barriers formed at gold and silver contacts, and the quantum efficiency was calculated. (11 refs.)

Optics and Images in Law Enforcement II .... See Entry 98621

Modern Utilization of Infrared Technology VIII .... See Entry 98624

Radiation standard of high radiance .... See Entry 99073

Measurement standards of light and radiation .... See Entry 99147

A model of a standard operational radiometer for the visible and infrared [ranges] .... See Entry 99150

Sensitivity and time constant of thin film thermopile radiometer with radial geometry .... See Entry 99153

Theoretical and experimental investigations of light scattered from a rotating ground glass .... See Entry 100666

High dynamic range laser energy distribution mapping using dual charge injected device (CID) cameras as an imaging radiometer .... See Entry 100788

Pulsed laser beam control by hot spot tracking .... See Entry 100812

Fiber-optic detectors .... See Entry 100921

Application of fast infrared detectors to detonation science ... See Entry 103525

Photodiode array detectors for LC .... See Entry 103608

07.65 OPTICAL SPECTROSCOPY AND SPECTROMETERS

(inc. photoacoustic spectroscopy)

99190 Digital filter for computationally efficient smoothing of noisy spectra. M.U.A.Bromba, H.Ziegler (Angewandte Phys., Univ. Paderborn, Paderborn, Germany).
Anal. Chem. (USA), vol.55, no.8, p.1299-302 (July 1983).
Savitzky-Golay smoothing filters can be implemented both nonrecursively and recursively. An advantage of the recursive representation is that it saves much computation time in the case of large filter widths. Unfortunately, exact arithmetic is needed to avoid instabilities of the algorithm. Together with the large computer word length required for large filter widths, this is a severe restriction when the algorithm should be programmed in a high level language like FORTRAN. A modification of the second degree Savitzky-Golay smoothing filter is suggested. The new filter also conserves area, first, second, and third moment of a line. Its recursive realization uses less computation time and smaller word lengths and is less sensitive to roundoff errors. Nevertheless, the new filter shows a slightly better signal/noise behavior than the famous Savitzky-Golay filter. (16 refs.)

99191 Stokes/anti-Stokes Raman vibrational temperatures: reference materials, standard lamps, and spectrophotometric calibrations. M.Malyj, J.E.Griffiths (Bell Labs., Murray Hill, NJ, USA).
Appl. Spectrosc. (USA), vol.37, no.4, p.315-33 (July-Aug. 1983).
The problem of measuring equilibrium vibrational temperatures in materials by using Raman spectroscopy has been analyzed theoretically and experimentally. One major problem is the determination of the corrections, due to the Raman instrument response, that must be applied to raw data to obtain the temperature. Normally a 'standard' lamp is used for this purpose but the problems that can arise are legion. Methods for determining spectral response and temperature response function corrections that must be applied to raw Raman data, for ultimately deriving the equilibrium temperatures of various materials, have been developed such that standard lamps are not required. Instead pure vitreous silica and liquid cyclohexane are selected as reference materials of choice for determining the appropriate spectral corrections applicable to the spectrophotometric data. The results were tested against data obtained from other transparent materials, namely CCl_4, $CHCl_3$, CH_3PCl_2 $GeGl_4$, $GeBr_4$, and CS_2. $GeBr_4$ and CS_2 were poor choices because of the proximity of the melting point of the former to room temperature and laser-induced photolysis of the latter. Detailed statistical analyses of the results indicate a marked lowering of systematic errors over those yielded by standard lamp calibrations. Shortcomings of both methods are also discussed, including several lesser known spectral abnormalities arising from the use of a standard lamp. (22 refs.)

99192 Precise determination of frequency shifts by Raman difference spectroscopy using Voigt profile for the Raman band. B.P.Asthana, W.Kiefer (Phys. Inst., Univ. Bayreuth, Bayreuth, Germany).
Appl. Spectrosc. (USA), vol.37, no.4, p.334-40 (July-Aug. 1983).
A convenient method for the precise determination of the frequency shifts from experimentally obtained Raman difference spectra is described. The method is based on the explicit calculation of the difference curve taking Voigt profile for the Raman band. A relationship between Δ/Γ (Δ, frequency separation between two Raman bands, Γ, Raman bandwidth) and d/I_0 (d, peak-to-peak height in the difference spectrum; I_0, Raman band height) is presented in a graphical form as a function of the band shape parameter $\Gamma/\Gamma G_G$ [$\Gamma_G = (\Delta\nu_{1/2})_{slit}$: used slit width determined experimentally by measuring the half-bandwidth of a narrow plasma line]. The experimental determination of $(\Delta\nu_{1/2})_{slit}$, Γ, d, and I_0 then allows direct derivation of Δ/Γ from the graphically presented functions and consequently the actual frequency shift Δ. The value of Δ/Γ can usually be determined with a typical uncertainty of ±0.002 in the small frequency shift limit and ±0.005 for medium and large frequency shifts and these would determine the frequency shift, Δ, with a maximum uncertainty of ± 0.02 cm^{-1}. An example of experimental spectra has been analyzed in order to assess the utility of the present technique. (17 refs.)

99193 Technique for measuring the amount of pressure-induced polarization scrambling by optical windows in high pressure light scattering cells. S.Perry, P.T.Sharko, J.Jonas (Dept. of Chem., Univ. of Illinois, Urbana, IL, USA).
Appl. Spectrosc. (USA), vol.37, no.4, p.340-2 (July-Aug. 1983).
A simple method for estimating the amount of pressure-induced polarization scambling by optical windows in the high pressure Raman scattering cells is proposed. This method is based on the measurement of the depolarization ratio ρ for a polarized band ($\rho=0$) for which a nonzero value of ρ is produced by the leakage of the I_{VV} component due to stress-induced birefringence of the window material. As an illustrative example the measurement of ρ for the polarized $\nu_3(A_1)$ band in liquid tetramethyltin is presented. (7 refs.)

99194 New experiments in femtosecond condensed matter spectroscopy. C.V.Shank, C.Hirlimann (Bell Telephone Labs., Holmdel, NJ, USA).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.373-81 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Recent advances have taken place in optical pulse generation techniques pushing optical pulsewidths down into the femtosecond domain. Optical pulses with a duration as short as 30 femtoseconds have recently been reported. The authors describe these new advances and show how these techniques are giving new insights in the very fast processes in condensed matter physics. (16 refs.)

99195 Total internal reflectance optoacoustic spectroscopy. P.R.Muessig, G.J.Diebold (Dept. of Chem., Brown Univ., Providence, RI, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4251-3 (Aug. 1983).
When radiation undergoes total internal reflection at a solid-gas interface, an exponentially decaying wave, known as the evanescent wave, propagates into the gas. If the incident radiation is amplitude modulated and the gas has an absorption at the wavelength of the radiation, the optoacoustic effect can be produced by absorption of energy from the evanescent wave. Experiments with 10.6 μ radiation internally reflected in an NaCl prism show the amplitude of the optoacoustic signal (in SF_6) to be linearly proportional to the product of the square of the electric field amplitude and the penetration depth of the evanescent wave as given by Fresnel's equations. The amplitude of the optoacoustic signal in a 100-μl detection cell is found to increase linearly with the mole fraction of SF_6 in He over the range from 10^{-5} to 10^{-2}. (9 refs.)

99196 Effect of spatial incoherence of the laser in photon-correlation spectroscopy. P.N.Pusey, J.M.Vaughan, D.V.Willetts (Royal Signals & Radar Establ., Malvern, England).
J. Opt. Soc. Am. (USA), vol.73, no.8, p.1012-17 (Aug. 1983).
The effects of spatial incoherence of the laser output in photon-correlation spectroscopy are examined both theoretically and experimentally. It is shown that, when several transverse cavity modes oscillate simultaneously at different frequencies, the amplitude of fluctuations in the intensity of scattered light can be reduced significantly. For simultaneous operation of TEM_{00} and $TEM_{01}*$ (doughnut) modes the reduction of the zero-time-delay intercept $g^{(2)}(0)-1$ [where $g^{(2)}(\tau)$ is the normalized intensity-correlation function] can amount to a factor of 3. The effects are shown to be particularly marked when high-gain ion lasers are used, and hitherto unexplained apparently random changes of intercept have been found. Possible implications of these observations for speckle applications, holography, and other forms of coherent optical processing are pointed out. (14 refs.)

99197 Analysis of photon correlation spectral decay curves by the *S*-exponential sum method. P.J.Nash, T.A.King (Dept. of Phys., Univ. of Manchester, Manchester, England).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.7, p.989-1009 (July 1983).
The analysis of decay curves by the fitting of sums of positive exponentials by the *S*-exponential sum method of Cantor and Evans (1970) is considered. The method has significant advantages over previous methods in guaranteeing the uniqueness of the derived set of positive amplitude exponentials, which provide the best weighted least-squares fit to the data, and in not requiring prior estimates of the number or the values of the decay constants. This paper treats the case of analysis of a single exponential with background and varying noise levels. A comparison of the accuracy obtainable using the C-E method and the Marquardt least-squares procedure is made. The application of this analysis to photon correlation spectroscopy is discussed. (19 refs.)

99198 Formation of an absorbing layer of atoms in semiclosed atomizers for atomic absorption spectrometry. Small atomizers. A.Kh.Gil'mutdinov, I.S.Fishman.
J. Appl. Spectrosc. (USA), vol.37, no.4, p.1103-9 (Oct. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.4, p.541-8 (Oct. 1982).
The authors present a sequential treatment of the formation of absorbing atomic layers as a phenomenon of physics. In the results of the analysis, which comprises almost all processes resulting in an absorbing layer with various degrees of precision, the stationary furnaces appear as a particular case. Since in nonstationary furnaces the probe enters into a medium with a rapidly increasing temperature, a preliminary solution to the problem of the motion of the medium per se must be made before the characteristic features of the transfer are considered. (21 refs.)

99199 Evaluation of spectral line profile from relative widths of Fabry-Perot interferograms. M.Platisa (Faculty of Natural & Math. Sci., Dept. of Phys. & Meteorology, Belgrade, Yugoslavia), R.Konjevic, S.Bukvic.
Opt. & Laser Technol. (GB), vol.15, no.4, p.209-13 (Aug. 1983).
A graphical method for deconvolution of spectral line profile scanned by a Fabry-Perot inteferometer from relative widths is described. The relation between the normalized intensity and relative width is derived. All calculations have been carried out assuming that the overall surface defects function can be approximated by Gaussian function and the contribution of broadening due to the scanning aperture is negligible. (9 refs.)

99200 High repetition rate subnanosecond gated photon counting. A.J.Alfano, F.K.Fong, F.E.Lytle (Dept. of Chem., Purdue Univ., West Lafayette, IN, USA).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.967-72 (Aug. 1983).
A gated photon counting instrument which is capable of operation at the full 100-MHz repetition rate of mode-locked ion lasers is described. This instrument provides a high throughput alternative to more complex and costly instrumentation commonly used in time-correlated single photon counting. Applications to the measurement of subnanosecond fluorescence lifetimes at a 96.8 MHz laser repetition rate and to the reduction of matrix quenching effects in fluorometry at a 5-MHz laser rate are presented. (20 refs.)

99201 Fully electronic servocircuitry for wavelength-modulation spectroscopy. R.Stearns, J.Steele, R.Braunstein (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.984-8 (Aug. 1983).
Electronic circuits have been developed to replace the mechanical servos and lock-in amplifiers customarily used in a wavelength-modulated derivative spectrometer. The result is a faster response and wider range of gain while maintaining a constant photomultiplier-tube voltage. (19 refs.)

99202 Frustrated total internal reflection spectroscopy of films with absorption gradients. S.D.Stuchebryukov, A.A.Vavkushevskii, V.M.Rudoi (Inst. of Phys. Chem., Acad. of Sci., Moscow, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.931-2 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.82-4 (Nov. 1982).
One of the main advantages of frustrated total internal reflection spectroscopy (FTR) is the possibility of studying surface layers whose thickness is of the order of the wavelength of the incident radiation. However, the use of the standard methods of FTR permits one to determine only the integrated average properties of such a layer. Attempts to determine the gradient of the absorption in the surface layer of a sample, i.e. the absorption coefficient α as a function of the coordinate z in the direction normal to the interface between the FTR element and the medium being studied, have been undertaken by Hirschfield (1977). In this investigation the FTR-element+sample was considered as a two-layer system. This approximation is valid only when $d_p \ll d$, where d_p is the penetration depth and d is the thickness of the sample. However, in the general case the optical system must be considered as consisting of at least three media. Then to determine $\alpha(z)$ in the sample being studied it is necessary to find the form of the integrals of absorption and solve the resulting integral equations. (4 refs.)

An inexpensive high pressure optical absorption cell for IR-VIS-UV studies ..... See Entry 98705

Theoretical and experimental investigations of light scattered from a rotating ground glass ..... See Entry 100666

Photon correlation spectroscopy of polydisperse samples. I. Histogram method with exponential sampling ..... See Entry 100667

Time-dependent spectra of ultra-short laser pulses ..... See Entry 100821

Broad band electro-optic tuning of a CW dye laser ..... See Entry 100822

Effect of matrix on the magnetic enhancement of spectral lines in the DC arc ..... See Entry 101490

Applications of picosecond and sub picosecond spectroscopy ..... See Entry 101511

Time-resolved laser-induced breakdown spectrometry of aerosols ..... See Entry 103769

07.65E UV and visible spectroscopy and spectrometers

99203 Optical constants of some commercial microwave materials between 90 and 1200 GHz. J.R.Birch (Div. of Electrical Sci., NPL, Teddington, England).
IEE Proc. H (GB), vol.130, no.5, p.327-30 (Aug. 1983).
The optical constants of three commercial microwave materials have been determined between 90 and 1200 GHz at 290K by the techniques of dispersive Fourier-transform spectroscopy. The materials studied were a cast microwave absorber known as Ferroflow, a machinable glass ceramic known as Macor and a substrate material for planar microwave circuitry known as Epsilam-10. The former two of these have been shown to be potentially suitable for use as thermal sources for the absolute calibration of radiometric instrumentation. The glass ceramic has also been shown to have a broad absorption band centred on 9 cm^{-1} that is obscured in the absorption spectrum by its rapid increase to high wave number, but that is clearly seen in the refraction spectrum. (17 refs.)

99204 Scanning pulsed-polarization spectrometer applied to Na_2. A.J.Taylor, K.M.Jones, A.L.Schawlow (Dept. of Phys., Stanford Univ., Stanford, CA, USA).
J. Opt. Soc. Am. (USA), vol.73, no.8, p.994-8 (Aug. 1983).
The authors report on a computer-controlled system for pulsed-polarization-labeling spectroscopy using a Fizeau-wedge wavemeter and a scanned narrow-band probe. Constants for n=3-7 ${}^1\Sigma_g{}^+$ states in Na_2 are presented. (21 refs.)

99205 Computer interface for a diode-array based spectrophotometer. H.L.Pardue, S.D.Hamilton, W.E.Weiser, H.Kirk, I.Laois (Dept. of Chem., Purdue Univ., West Lafayette, IN, USA).
J. Autom. Chem. (GB), vol.5, no.2, p.108-10 (April-June 1983).
This paper describes hardware and software developed to interface the Hewlett-Packard 8450A spectrophotometer to a general-purpose computer. Selected data for the reaction of acetoacetate with glycine are presented to illustrate the utilization of rapid scanning, multiwavelength kinetic data obtained with the system. (5 refs.)

Wavelength precision of a Cary model 14R spectrophotometer ..... See Entry 99146

Vacuum-ultraviolet refractive index of LiF and MgF_2 in the temperature range 80-300K ..... See Entry 99160

Spectrophotometric investigation of the process of colour centre rearrangement during the fixation of a photochemically coloured emulsion ...See Entry 103563

07.65G IR spectroscopy and spectrometers

99206 Boolean logic system for infrared spectral retrieval. S.R.Lowry, D.A.Huppler (Nucolet Instrument Corp., Madison, WI, USA).
Anal. Chem. (USA), vol.55, no.8, p.1288-91 (July 1983).
An interactive retrieval system has been developed for infrared spectral data. This system employs Boolean logic operations on sets defined by the presence or absence of this procedure can reduce the original library of 3300 spectra down to a few spectra, which can be displayed and compared to the unknown spectrum. Options have been included for both peak location and intensity variations. The system has been evaluated by using spectra obtained from a capillary GC/IR experiment. (11 refs.)

99207 FTIR photoacoustic mapper. D.J.Gerson (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.25, no.12, p.6708 (May 1983).
A commercially available Fourier transform infrared (FTIR) spectrometer is modified to permit the recording of FTIR spectra of optically opaque materials using a photoacoustic effect. (no refs.)

99208 Trends in Fourier transform infrared spectroscopy. J.Chalmers (Polymer Div., ICI, Welwyn Garden City, England).
Lab. Pract. (GB), vol.32, no.7, p.29-30 (July 1983).
Discusses the developments and use of the Fourier transform infrared spectroscopy (FTIR). The role of signal averaging in obtaining spectra of very high signal-to-noise ratio within a useful time-scale is discussed. The developments of GC-FTIR systems, diffuse reflectance technique (DRIFT) and photoacoustic spectroscopy (PAS-FTIR) are also dealt with. (19 refs.)

FTIR in the service of art conservation ..... See Entry 98715

Fourier transform Michelson interferometer for the far infrared ..... See Entry 99163

Photoacoustic observation of third-order absorption in thallium halides at 1.06 μm ..... See Entry 100865

07.68 PHOTOGRAPHY, PHOTOGRAPHIC INSTRUMENTS AND TECHNIQUES

(for light sensitive materials see also 42.70)

99209 Grain growth during rehalogenating bleaching. L.Joly (R&D Labs., Agfa-Gevaert NV, Mortsel, Belgium).
J. Photogr. Sci. (GB), vol.31, no.4, p.143-7 (July-Aug. 1983).
Parameters influencing grain growth during rehalogenation bleaching are identified. An account is given on the influence of the grain size of the AgX formed during rehalogenation bleaching on the scattering properties as a function of the developer used before bleaching. (17 refs.)

99210 Sensitizer centres: formation, properties, function and efficiency. H.E.Spencer, R.E.Atwell, M.Levy (Res. Labs., Eastman Kodak Co., Rochester, NY, USA).
J. Photogr. Sci. (GB), vol.31, no.4, p.158-69 (July-Aug. 1983).
Presents selective review of sensitizer centres formed by sulphur, selenium, reduction, and sulphur-plus-gold sensitization. It covers salient features without attempting to be comprehensive. (70 refs.)

99211 Frequency characteristics and power conditions of the optical part of a sound exciter (cinematography). V.Langer.
Jemna Mech. & Opt. (Czechoslovakia), vol.28, no.7, p.183-6 (July 1983). In Czech.
The author analyses the constructional parameters of the optical part of a sound head and their influence on the frequency characteristics and level of the output signal. In particular, the influence of the quality of the slot image on the frequency characteristics and the effects of the constructional parameters of the optical system of the sound exciter and the uniformity of the illumination of the slot image on the output signal are analysed. (1 ref.) *E.D.*

99212 The MEOSIX colour analyser. J.Indruch.
Jemna Mech. & Opt. (Czechoslovakia), vol.28, no.7, p.191-4 (July 1983). In Czech.
Describes the principle, practical realisation and applications of the MEOSIX colour analyser developed in Czechoslovakia by ZVS-Meopta, Prerov. The MEOSIX analyser solves problems associated with determination of the corrective filtering level and the required exposure and is particularly suitable for amateur photographers. It is in particular recommended for use with the ZVS-Meopta enlarger. It is concluded that the use of the MEOSIX analyser leads to savings of photographic materials, chemicals and electrical energy of at least 40%. (3 refs.) *E.D.*

99213 An optical system of a 16 mm film projector. V.Langer, V.Venzarova.
Jemna Mech. & Opt. (Czechoslovakia), vol.28, no.7, p.195-8 (July 1983). In Czech.
Two types of optical system are compared—one with an incandescent reflector lamp and a lens with the f-number of 1.2, the other employing an aspherical mirror and a halogen lamp and featuring the f-number of 1. The properties and power parameters of both systems are compared. *E.D.*

99214 ICs for automatic camera-focusing systems. E.Matsuyama, H.Nishira (Mitsubishi Electric Corp., Tokyo, Japan).
Mitsubishi Electr. Adv. (Japan), vol.23, p.29-30 (March 1983).
Camera users have recently witnessed something of a revolution in the field of camera automation. Of the many developments involved, the autofocus camera has drawn the strongest interest, with research and development work in this area being carried out by every manufacturer. In cooperation with two leading camera manufacturers, Mitsubishi Electric has developed two ICs designed to perform autofocus functions for use in small cameras. The features of the M518805 S, developed for Minolta Camera Company, which employs an active range-finding system based on GaAs LED technology are described. (no refs.)

99215 Spectral sensitisation in conjunction with supplementary chemical sensitisation. K.V.Chibisov.
Zh. Nauchnoi & Prikl. Fotogr. & Kinematogr. (USSR), vol.28, no.3, p.161-5 (May-June 1983). In Russian.
The author carried a sensitometric investigation of a silver bromide photographic emulsion spectrally sensitised by a dye and additionally by processed solutions of chemical sensitisers of triethanolamine and hydrazine. It is shown that the reducing agents display a more effective influence on the spectrally sensitised emulsion in comparison with a control emulsion. (6 refs.)

99216 Investigation of the interaction of diglycidol ether of methylphosphonic acid with gelatin. L.B.Brainin, V.K.Evseva, S.P.Perevenentseva, V.F.Klyuchevich, N.I.Rizpolozhenskii, V.K.Kruponov, N.V.Kashina.
Zh. Nauchnoi & Prikl. Fotogr. & Kinematogr. (USSR), vol.28, no.3, p.165-9 (May-June 1983). In Russian.
The authors show that diglycidol ether of methylphosphonic acid has a hardening effect on gelatin. It is shown that the modification of gelatin by this preparation is associated with a change in the hypomolecular structure of its macromolecule. A possible mechanism for the interaction with gelatin is discussed. (19 refs.)

99217 Determination of the probability of quantum absorption for particles of photographic blackening. A.V.Balanetskii, O.N.Kozakov, V.I.Grossman.
Zh. Nauchnoi & Prikl. Fotogr. & Kinematogr. (USSR), vol.28, no.3, p.170-3 (May-June 1983). In Russian.
The authors describe a method for evaluating the optical parameter known as K, the probability of quantum absorption by particles of blackening. The method is based on the theory of single-stage scattering and on integral photometry. In the visible region of the spectrum K ranges from 0.4 to 0.7 for emulsion microcrystals in the size range 0.4 to 3.00 μ. (11 refs.)

99218 General method of calculating the electric field pattern of latent charge images. N.A.Fedorova.
Zh. Nauchnoi & Prikl. Fotogr. & Kinematogr. (USSR), vol.28, no.3, p.191-7 (May-June 1983). In Russian.
The author presents an algorithm and program for calculating the electrostatic force lines of an arbitrary latent charge image formed at the surface of an electrophotographic layer in the process of exposure. The force lines of the electric field above an electrophotographic layer of two charged lines situated at various distances from each other are calculated as an example. The character of their electrophoretic development on the basis of the force line pattern is analysed. (9 refs.)

99219 Optical systems of high-speed cameras with opto-mechanical commutation. A.V.Belinskii.
Zh. Nauchnoi & Prikl. Fotogr. & Kinematogr. (USSR), vol.28, no.3, p.198-204 (May-June 1983). In Russian.
Describes the basic forms of optical system of high-speed cameras with opto-mechanical commutation and classifies them. Optical systems which permit a significant improvement in image quality are proposed. Methods of calculating such optical systems are given. (3 refs.)

99220 The influence of a strong electric field on a photographic layer during blocked ionic conduction. A.L.Kartuzhankii, V.M.Ulanov.
Zh. Nauchnoi & Prikl. Fotogr. & Kinematogr. (USSR), vol.28, no.3, p.212-14 (May-June 1983). In Russian.
The authors discuss observation of the sensitivity of an AgBr X-ray film when subjected to 50 ns light pulses and 300 ns electric field pulses. The ratio of sensitivity with the field applied to that without is plotted as a function of the delay between the onset of the optical pulse and the field pulse (10^{-6} to 10^{-2}s), with and without immersion of the film in an acqueous solution (0.005 g.l) of 1-phenyl-5-mercaptotetrazole. (2 refs.)

99221 Relaxation processes in emulsion microcrystals of silver halides with adsorbed dyes. L.N.Duglav, Yu.F.Mitroganov, P.V.Meiklyar.
Zh. Nauchnoi & Prikl. Fotogr. & Kinematogr. (USSR), vol.28, no.3, p.217-18 (May-June 1983). In Russian.
The authors give experimental results on the photo-e.m.f. relaxation time in various spectral regions as a function of the concentration of an adsorbed dye in Ag-halide films. Photo-e.m.f. oscillograms are given for a AgCl layer exposed to 400 and to 540 mm wavelength light pulses. The rise and decay of the oscillogram signal was slower for 540 mm light than for the 400 nm light. (3 refs.)

99222 Change of state of colour centres in alloyed sodium chloride crystals. A.N.Pavlov, V.V.Sedov, I.S.Smirnov.
Zh. Nauchnoi & Prikl. Fotogr. & Kinematogr. (USSR), vol.28, no.3, p.219-21 (May-June 1983). In Russian.
The authors present results on the transformation of a photosensitivity centre to a visible image centre in NaCl crystals sensitised to UV radiation. Two types of NaCl crystal were used—one being alloyed (0.02 weight %) with anhydrous MnCl, the other being alloyed (0.02 weight %) with hydrous MnCl. The transformation process is investigated with the aid of absorption spectra and lattice parameter measurements. (7 refs.)

99223 Influence of the rate of deformation of a photographic emulsion jet during extrusion on the magnitude of maximum elongation emulsification. Yu.A.Bureev.
Zh. Nauchnoi & Prikl. Fotogr. & Kinematogr. (USSR), vol.28, no.3, p.221-3 (May-June 1983). In Russian.
Investigates the dependence of the maximum elongation of an emulsion jet on the speed of the moving substrate and on the mean velocity gradient of displacement in an emulsion jet. It is shown that both dependencies are linear. In practice this means that the higher the deformation rate the thinner is the jet which can be applied to the substrate. (3 refs.)

99224 Retention of photographic images in aluminium hydride layers. S.A.Bernval'd, V.V.Boldyrev, A.L.Kartuzhanskii, Yu.P.Larionov, R.P.Mitrofanova.
Zh. Nauchnoi & Prikl. Fotogr. & Kinematogr. (USSR), vol.28, no.3, p.223-5 (May-June 1983). In Russian.
Discusses the thermal ageing of photographic paper materials based on AlH_3. The influence of temperature and moisture content on image lifetime is investigated. The effect of actinic currents and other factors able to induce decomposition of the remaining undeveloped AlH_3 is also examined. (4 refs.)

99225 Theory of double-jet emulsification (review). A.I.Kharimonova.
Zh. Nauchnoi & Prikl. Fotogr. & Kinematogr. (USSR), vol.28, no.3, p.226-38 (May-June 1983). In Russian.
The basic kinetic equation of emulsification is presented. The rate of nucleation and growth of microcrystals are calculated and the kinetics of double-jet emulsification are discussed. The critical rate of emulsification is determined. Practical applications of the above theory are considered. (32 refs.)

Optics and Images in Law Enforcement II ....See Entry 98621

Selective counting path to Young's fringes in speckle photography for eliminating diffraction halo effects ....See Entry 99162

Analysis of Young's fringes in speckle photography: generalised square imaging aperture ....See Entry 99164

Contemplations on fluorescence photomicrography ....See Entry 99176

Some applications of holography at the Idaho National Engineering Laboratory ....See Entry 99704

Large aperture thermoplastic film computer driven holographic recording system ....See Entry 100684

Display holography: a frontier of high resolution photography ....See Entry 100696

High dynamic range laser energy distribution mapping using dual charge injected device (CID) cameras as an imaging radiometer ....See Entry 100788

Luminescence of silver halides. I. Influence of precipitation parameters on the delayed luminescence of silver bromide microcrystals ....See Entry 102930

The concentration process in the formation of development centres in silver halide microcrystals ....See Entry 103555

Regressive of the latent image in carboxyl-containing cellulose materials under the influence of an electric field ....See Entry 103558

Visible light sensitisation by means of cyanine dyes of polymer compositions based on diphenyl benzylamine and carbon tetrabromide ....See Entry 103559

Concerning the role of Ag^+ ions in a photographic process with physical development on thin TiO_2 layers ....See Entry 103560

Mechanism of the initial stage of the surface photochemical process of the microcrystals of low-sensitivity photographic layers ....See Entry 103562

Spectrophotometric investigation of the process of colour centre rearrangement during the fixation of a photochemically coloured emulsion ...See Entry 103563

Digital radiography—some system design considerations ....See Entry 104042

07.75 MASS SPECTROMETERS AND MASS SPECTROMETRY TECHNIQUES

(for mass spectroscopic chemical analysis, see 82.80)

99226 An improved tandem mass spectrometer—ion-cyclotron-resonance spectrometer. P.R.Kemper, M.T.Bowers (Dept. of Chem., Univ. of California, Santa Barbara, CA, USA).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.1, p.1-24 (1 Aug. 1983).
An improved design for a tandem mass spectrometer-ion-cyclotron-resonance spectrometer (TICR) is presented. The TICR consists of an ion source, a 180° mass filter, and a separate reaction/detection region, consisting of an ICR cell. Since the ion formation and reaction regions are separate, determinations of kinetics and product distributions are greatly simplified. The design presented includes a velocity filter at the entrance of the ICR cell, to remove translationally hot ions, and the use of a second ICR cell as an ion source. This allows ICR double-resonance techniques to be used in the ion formation region. Data on performance are presented, as well as examples of several novel experiments which are possible. The question of reactant-ion kinetic energy is discussed, and data are presented which indicate that the ions entering the ICR cell have kinetic energies of ~0.5 eV. Examples are presented illustrating the use of ICR double resonance to determine the effects of kinetic energy on reaction rate constants and product distributions. (29 refs.)

99227 Field desorption of hydrocarbon polymers. R.P.Lattimer (BF Goodrich Res. & Dev. Center, Brecksville, OH, USA), H.-R.Schulten.
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.1, p.105-16 (1 Aug. 1983).
Field desorption mass spectra have been obtained for several low-molecular weight hydrocarbon polymers—polybutadiene, polyisoprene, polyethylene and polystyrene. The principal oligomer ios corresponded to $[M]^+$ in every case, i.e. there was little tendency to for ions via proton attachment. Molecular weight averages ($\bar{M}_n$ and $\bar{M}_w$) derived from FDMS data agree well with values obtained by conventional techniques. (17 refs.)

99228 High-pressure collisional activation mass spectrometry. K.Blom, B.Munson (Dept. of Chem., Univ. of Delaware, Newark, DE, USA).
J. Am. Chem. Soc. (USA), vol.105, no.12, p.3793-9 (15 June 1983).
Ions produced under chemical ionization (CI) conditions can be collisionally activated and dissociated within the high-pressure ion source by the application of relatively large electric fields within the source. A new multiregion ion source that separates regions of CI reaction and high-pressure collisional activation (HPCA) is employed to study these processes. These HPCA spectra may differ significantly from single-collision CID spectra of protonated species. Reactions between fragment ions and the reagent/collision gas are observed that can be used to differentiate the structures of fragment ions. Both parent and fragment ions can be analyzed by high-resolution mass spectrometry under HPCA conditions. Dissociation mechanisms are investigated and analytical applications discussed. (18 refs.)

99229 Magnetic sectoral atom probe for studying the field ionization process. M.S.Glowacki, W.E.Lenkow (Solid State Phys. Dept., Coll. of Education, Czestochowa, Poland).
J. Tech. Phys. (Poland), vol.23, no.2, p.203-12 (1982).
The magnetic sectoral atom probe has been designed and constructed in such a way as to be able to operate with high-purity imaging gas. The vacuum system permits pressure in the residual gases to be attained equal to about 7×10^{-10} hPa under normal working conditions of the device. The mass-spectrum measurement of these gases showed the occurrence of only two active gases: water and carbon monoxide, having partial pressures equal respectively to 1.3×10^{-10} hPa and 2.7×10^{-10} hPa. The other active gases have partial pressures by at least one order lower. Such favourable vacuum conditions, the resolution attained of the field ion microscope, estimated on the basis of the image observations on 3-3.5 Å at the emitter temperature of 78K, as well as sufficiently high sensitivity of the detection system, all these factors permit investigating the field ionization process of the pure imaging gases and their mixtures above the single, selected atoms on the clean tungsten surface. The foregoing measurement results concerning the course of the helium field ionization process above the individual atoms in the (011)-plane of the tungsten surface, in the form of mass spectrum, and dependence of the He^{+1} ion current upon the applied voltage and the electric-field intensity, testify to distinct difference in the course of the field-ionization process, when compared with similar dependences for the total ion current. (36 refs.)

99230 Development of a totally computer-controlledl triple quadrupole mass spectrometer system. C.M.Wong, R.W.Crawford, V.C.Barton, H.R.Brand, K.W.Neufeld, J.E.Bowman (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.996-1004 (Aug. 1983).
A totally computer-controlled triple quadrupole mass spectrometer (TQMS) is described. It has a number of unique features not available on current commercial instruments, including: complete computer control of source and all ion axial potentials; use of dual computers for data acquisition and data processing; and capability for self-adaptive control of experiments. Furthermore, it has been possible to produce this instrument at a cost significantly below that of commercial instruments. This triple quadrupole mass spectrometer has been constructed using components commercially available from several different manufacturers. The source is a standard Hewlett-Packard 5985 B GC/MS source. The two quadrupole analyzers and the quadrupole CAD region contain Balzers QMA 150 rods with Balzers QMG 511 r.f. controllers for the analyzers and a Balzers QHS-511 controller for the CAD region. The pulsed-positive-ion-negative-ion-chemical ionization (PPINICI) detector is made by Finnigan Corporation. The mechanical and electronics design were developed at LLNL for linking these diverse elements into a functional TQMS as described. The computer design for total control of the system is unique in that two separate LSI-11/23 minicomputers and assorted I/O peripherals and interfaces from several manufacturers are used. The evolution of this design concept from totally computer-controlled instrumentation into future self-adaptive or 'expert' systems for instrumental analysis is described. Operational characteristics of the instrument and initial results from experiments involving the analysis of the high explosive HMX (1,3,5,7-Tetranitro-1,3,5,7-Tetrazacyclooctane) are presented. (15 refs.)

99231 Design and operating characteristics of a retarding field energy analyzer-quadrupole mass filter for measurement of energy distribution of thermal ion. T.Harada, M.Asano, K.Kubo.
Tech. Rep. Inst. At. Energy Kyoto Univ. (Japan), no.193, p.1-15 (Jan. 1983).
A specially designed retarding field energy analyzer was set in front of a quadrupole mass filter to study the energy distribution of thermal ions emitted from a hot metal surface. The ion energy distribution and its derivative are obtained by the technique of electronic differentiation of the retarding voltage curve in which a small sinusoidal modulating voltage is applied to the analyzer in a method similar to the widely used LEED-Auger systems. The effects of the frequency and the amplitude of the modulating voltage on the energy distribution and its derivative have been investigated. The analyzer has been used for the measurements of the energy distributions of Na^+, K^+ and Rb^+ thermal ions emitted from impurities in a tungsten ribbon. It is shown that the values of the retarding voltages at maximum in the energy distribution curve and at zero output in the derivative of the distribution curve correspond to the contact potential difference between the ribbon emitter and the grids in the analyzer. (19 refs.)

On the mass spectrometric determination of ionisation cross sections ....See Entry 100589

Mobilities and interaction potentials for Br^--Ar, Br^--Kr, and Br^--Xe ....See Entry 101380

07.77 PARTICLE BEAM PRODUCTION AND HANDLING; TARGETS

(see also 29.25 in elementary-particle and nuclear physics, 41.80 Particle beams and particle optics)

99232 **Radial isolated Blumlein electron beam generator.** R.J.Adler (Mission Res. Corp., Albuquerque, NM, USA), R.B.Miller, K.R.Prestwich, D.L.Smith.
Rev. Sci. Instrum. (USA), vol.54, no.8, p.940-5 (Aug. 1983).
A new high-voltage pulse-forming line, the radial isolated Blumlein (RIB), is described. The new configuration produces an output voltage pulse into a matched load equal to the charge voltage on the line (as in a conventional Blumlein circuit); however, the prepulse level is negligible and both sides of the load remain at electrostatic ground potential. The RIB is rapidly charged to allow 24 oil dielectric spark channels to close within ~2 ns. With this number of channels, 94% of the theoretical peak voltage is achieved even though the pulse duration is only 15 ns. Using a foilless diode load, the device has been used to generate 4-MeV, 100-kA electron beam pulses. (8 refs.)

99233 **Construction and calibration of a four-beam source for the preparation of rare-gas diluted metal-hydrogen films.** R.Ludwig, H.Micklitz (Inst. fur Experimentalphys. IV, Ruhr-Univ. Bochum, Bochum, Germany).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.1009-11 (Aug. 1983).
The authors present a unit which enables one to evaporate two different metals, rare gas, and atomic or molecular hydrogen at the same time onto a substrate held at a temperature of about 5K. The deposition rates of the metals and the rare gas are measured by a quartz oscillator. The hydrogen deposition rate is calibrated by using the H-concentration dependence of the superconducting transition temperature in Pd-H and Al-H, known from ion-implantation experiments. (9 refs.)

A transverse-field-focusing (TFF) accelerator for intense ribbon beams .... See Entry 99778

Design, fabrication and performance of the dipole and quadrupole magnets for the RIKEN heavy-ion linear accelerator .... See Entry 99809

Prototype sector magnets for the GeV electron microtron (GEM) .... See Entry 99864

A theoretical model and computer simulations to describe diffusion enhancement by the beam-beam interaction .... See Entry 99946

Study of periodic tune modulation with the beam-beam effect .... See Entry 99947

Analytic estimates for the dynamic aperture of nonlinear lattices .... See Entry 99948

MARYLIE: the Maryland Lie algebraic transport and tracking code .... See Entry 99949

Beam-beam synchrobetatron resonances .... See Entry 99951

The lattice design and tolerance analysis of the CBA transport line .... See Entry 99952

The design of periodic beam transport systems .... See Entry 100046

Design of the NSCL coupling line .... See Entry 100047

An RF separator for cloud muons at TRIUMF .... See Entry 100051

Lambertson magnetic design for the Tevatron extraction channel .... See Entry 100052

A nonlinear lens system to smooth the intensity distribution of a Guassian beam .... See Entry 100053

Electrode shaping for ion and electron extractors .... See Entry 100055

Long ceramic beam tubes for accelerator magnets .... See Entry 100056

Radiation-hardened field coils for FMIT quadrupoles .... See Entry 100146

Symmetrical systems in charged-particle beam transport .... See Entry 100168

Beam transport systems consisting of two quadrupole triplets .... See Entry 100169

A quadrupole system for independent horizontal and vertical beam control .... See Entry 100170

On the mass spectrometric determination of ionisation cross sections .... See Entry 100589

Use of axially symmetric electrostatic fields for ion beam focusing .... See Entry 100651

Charge state of ions in liquid metal field ion sources .... See Entry 103034

Work on the characterization of sensitive surfaces used in neutron radiography, conducted under the auspices of AFNOR .... See Entry 103488

07.80 ELECTRON AND ION MICROSCOPES AND TECHNIQUES

(see also in condensed matter 61.16D Electron microscopy, 61.16F Field ion microscopy)

99234 **Uncertainties in thick-target PIXE analysis.** J.L.Campbell, J.A.Cookson (AERE, Harwell, England), H.Paul.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.427-39 (1 July 1983).
Thick-target PIXE analysis involves uncertainties arising from the calculation of thick-target X-ray production in addition to the usual PIXE uncertainties. The calculation demands knowledge of ionization cross-sections, stopping powers and photon attenuation coefficients. Information on these is reviewed critically and a computational method is used to estimate the uncertainties transmitted from this data base into results of thick-target PIXE analyses with reference to particular specimen types using beams of 2-3 MeV protons. A detailed assessment of the accuracy of thick-target PIXE is presented. (31 refs.)

99235 **The use of mini-lenses in the transmission electron microscope.** J.Podbrdsky (Ustav Pristrojove Techniky CSAV, Brno, Czechoslovakia).
Cesk. Cas. Fyz. Sekce A (Czechoslovakia), vol.33, no.3, p.237-50 (1983). In Czech.
Describes possibilities of the optical system of a 100 kV transmission microscope using mini-lenses with high current density in their excitation coils. The construction and optical advantages of mini-lenses are compared with economical disadvantages; the compromise value of the maximum current density is found. As an example of possible mini-lenses applications an experimental optical system is described, which reaches not only high mechanical stability due to a very short optical column but makes it possible to use some unconventional methods of the transmission electron microscopy. (17 refs.)

99236 **Erection of a device for energy-loss analysis of fast electrons.** B.Kubier, G.Kaiser, H.Boudriot (Bergakad. Freiberg, Freiberg, Germany).
Exp. Tech. Phys. (Germany), vol.31, no.3, p.245-50 (1983). In German.
A commercial electron microscope EF 4 was enlarged so that it is possible to carry out energy loss analysis of fast electrons. The construction and the function of the most important units are described. (no refs.)

99237 **Scanning tunneling microscopy.** G.Binnig, H.Rohrer (IBM Zurich Res. Lab., Ruschlikon, Switzerland).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.481-2 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Scanning tunneling microscopy is a very young method for studying surfaces of conductors in real space, including adsorbates. The authors present a short account of the main steps in the development of the technique, and briefly mention the most recent results. (7 refs.)

99238 **TEM/STEM requirements: multipurpose or specialized instruments?.** W.M.Stobbs (Dept. of Metall. & Materials Sci., Univ. of Cambridge, Cambridge, England).
J. Microsc. (GB), vol.131, pt.1, p.47-53 (July 1983).
The relative advantages and disadvantages of high resolution and other more general imaging techniques are considered and the potential of a multipurpose, moderate resolution, TEM with EELS is assessed. (50 refs.)

99239 **Instrumental requirements for high resolution imaging.** K.-H.Herrmann (Inst. fur Angewandte Phys., Univ. Tubingen, Tubingen, Germany).
J. Microsc. (GB), vol.131, pt.1, p.67-78 (July 1983).
The resolution of modern transmission electron microscopes reaches the physical limits imposed by lens aberrations and energy width. One of the many conditions to be fulfilled, the alignment of illuminating the imaging beam onto the coma-free objective axis, is particularly discussed where since axial coma cannot be detected by the usual resolution-checking methods. Space consumption of specimen stages prevents the full utilization of the magnetic saturation limit only in the 100 keV range. With higher energies, this handicap is obviated, and some additional advantages can be gained which promote material investigations at atomic resolution, and which are presently utilized in instrumental research projects. High resolution with biological specimens has up to now been unsuccessful because of radiation damage. Optimum utilization of all electrons scattered at the specimen must thus be given priority over optical resolution. Important instrumental requirements are minimum exposure beam control, imaging modes with high collection efficiency, and recording devices with high detection quantum efficiency connected on-line to image processors. A remarkable decrease in beam sensitivity of organic crystals, by more than one order, has been found by cooling the specimen down to 4K which, by the use of superconducting lenses, can be combined with both ultra high vacuum and the stability requirements for high resolution. Yet up to now, such protection has not been achieved with He cryostates in conventional lenses, perhaps because a temperature increase even of only a few K is harmful. (40 refs.)

99240 **X-ray photoelectron diffraction (XPED) measurements by using high performance angle-resolved X-ray photoelectron spectrometer (ARXPS).** M.Owari, Pei-Xun Jien, M.Kudo, Y.Nihei (Inst. of Industrial Sci., Univ. of Tokyo, Tokyo, Japan), H.Kamada.
J. Spectrosc. Soc. Jpn. (Japan), vol.32, no.2, p.103-9 (1983). In Japanese.
The angle-restricting aperture and the precise two-axis-rotation sample manipulator are added-on to the high-performance multichannel X-ray photoelectron spectrometer to set up the high performance angle-resolved X-ray photoelectron spectrometer. Obtained precisions of angular control are within 0.1° along off-plane (θ), and within 1° along on-plane (ϕ) sample rotations. Angular resolutions of the aperture, in terms of the step response, are designed as 4.2° along θ and 6.4° along ϕ. Polar, azimuthal and two-dimensional XPED patterns for As3d and Ga3d photoelectrons from GaAs(001) surface are measured with the instrument. Observed XPED patterns show clear correspondence with crystal structure of GaAs, and the slopes of intensity distributions in XPED patterns indicate that expected angular resolution along ϕ and better resolution along θ are realized on the instrument. (10 refs.)

99241 **Abbreviations for microscopical and analytical methods.** H.Hantsche (Bundesanstalt fur Materialprufung, Berlin, Germany).
Microsc. Acta (Germany), vol.87, no.3, p.271-6 (May 1983). In German, English.
The number of analytical methods relying mainly on physical principles is still increasing and passed the fifty mark. To make confusion complete, identical methods have different abbreviations, because: (i) by translating into other languages first letters often change; (ii) some characterize the method by the excitation process while others take the emitted particle to name the analytical technique; (iii) of historic reasons. The list of abbreviations given was compiled over several years from the literature but is certainly not complete. The author, however, believes it to be useful. (no refs.)

99242 **Novel spectrometer for time-angle resolved ultraviolet photoemission.** Y.Canivez, L.D.Laude, R.Andrew (Univ. de l'Etat, Mons, Belgium).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.989-92 (Aug. 1983).
The authors described a new electron spectrometer for time-angle resolved photoemission. The apparatus consists of 44 electron detectors (microchannel plate) 4 mm in diameter, equally spaced on half a sphere (35-mm internal radius), and acting in the so-called 'spherical retarding potential' method configuration. Resolution in energy is measured to be of the order of 0.3 eV and typical time resolution is 0.1 s. This spectrometer is conceived essentially for time-resolved surface reaction studies. Preliminary results are presented for the Si(111) surface. (11 refs.)

99243 **Numerical calculations of electron trajectories in the 127° analyzer using a position-sensitive detector under conditions of fringing fields.** C.Oshima, R.Franchy, H.Ibach (Inst. fur Grenzflachenforschung & Vakuumphys., KFA Julich, Julich, Germany).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.1042-6 (Aug. 1983).
The theoretical performance of the 127° electron analyzer equipped with a position-sensitive detector has been discussed on the basis of a numerical calculation of electron trajectories. Including the Herzog correction in the calculation allows one to obtain good foci of electron onto almost all regions of position-sensitive detector; it suggests that electron energy loss spectroscopy with high-energy resolution ($\Delta E/E_0=1.6\times10^{-3}$) can be realized by the new analyzer. A nonlinear relation between the arriving point on the detector and electron energy has also been examined for some different fringing fields. (6 refs.)

Use of axially symmetric electrostatic fields for ion beam focusing .... See Entry 100651

High resolution electron microscopy .... See Entry 101509

On the preparation of specimens from multifilamentary Nb_3Sn superconducting wires for transmission electron microscopy .... See Entry 103432

Characterization of grain boundaries in polycrystalline solar cells using a computerized electron beam induced current system ....See Entry 103689

07.85 X-RAY, GAMMA-RAY INSTRUMENTS AND TECHNIQUES

99244 Size effect of powdered sample on EXAFS amplitude. K.-q.Lu, E.A.Stern (Dept. of Phys., Univ. of Washington, Seattle, WA, USA).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.475-8 (1 July 1983).
Powdered samples are commonly used to measure the extended X-ray absorption fine structure (EXAFS) and near-edge structure. It is shown that sizes of particles typically employed produce significant reduction in the EXAFS amplitude for concentrated samples. The distortion is calculated and found to be in good agreement with measurements on $FeSi_2$ samples. To obtain accurate EXAFS amplitudes on powdered samples it is necessary to use particles significantly smaller than 400 mesh when the atom of interest is concentrated. (6 refs.)

99245 On a certain inverse problem in γ-acoustic spectroscopy. A.R.Arakelyan, R.G.Gabrielyan, A.R.Mkrtchyan, H.A.Aslanyan, Kh.V.Kotandyan (Dept. of Appl. Problems of Phys., Acad. of Sci., Erevan, Armenian SSR).
Phys. Status Solidi b (Germany), vol.118, no.1, p.K69-74 (1 July 1983)
It is shown that the inverse problem of γ-acoustic spectroscopy, i.e. determination of US oscillation parameters depending on the acoustic properties of the medium, can be solved on their basis and the experimental results given. To achieve this aim, experimental points should be approximated by a certain function $\bar{y}=\bar{y}(d,\alpha_1,\alpha_2,\ldots,\alpha_n)$ where α_1, $\alpha_2\ldots,\alpha_n$ are the parameters to be determined. Determination of US parameters is then reduced to the choice of $\alpha_1,\alpha_2,\ldots,\alpha_n$ so that the experimental points $y_k=I(US)/I(o)d|d_k$ should best coincide with $\bar{y}$. (5 refs.)

99246 X-ray diamond-anvil press for use at high temperatures. T.Kikegawa, H.Iwasaki (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.1023-5 (Aug. 1983).
This paper describes the design and operation of a new diamond-anvil press than can conduct X-ray diffraction investigations of polycrystalline materials at sustained pressure and temperature up to 30 GPa and 500°C. Several improvements have been made in heating efficiency, uniformity of temperature, alignment operation of anvil faces, and elimination of preferred orientation effect. Examples of the application to the study of a high-pressure phase of phosphorus are shown. (16 refs.)

99247 A detailed evaluation of counting losses of detectors in wavelength-dispersion X-ray spectroscopy. P.Banerjee (Siemens AG, Karlsruhe, W Germany).
X-ray Spectrom. (GB), vol.12, no.3, p.97-105 (July 1983).
The exponential equation $R_0=R.e^{R0\tau}$ describes the counting losses in wavelength-dispersive X-ray spectroscopic (WDF) detectors up to very high counting rates. The correction error can be considerably lower than 1% for a true counting rate of 7×10^5 s^{-1}. The dead time constant τ has, however, to be determined very accurately for this. Methods of determining τ with the desired accuracy are also described. A formula for correcting for dead time losses for two detectors in series, where each detector has a different dead time, is deduced and verified by experiment. Here again, one can calculate the true counting rate with an accuracy of 1% at a true counting rate of about 7×10^5 s^{-1}. (3 refs.)

X-ray photoelectron diffraction (XPED) measurements by using high performance angle-resolved X-ray photoelectron spectrometer (ARXPS) ....See Entry 99240

A compact Compton suppression spectrometer using bismuth germanate scintillator ....See Entry 100172

Precision measurements of gamma-ray intensities. IV. Low energy region: ^{75}Se and ^{133}Ba ....See Entry 100179

Precision measurements of gamma-ray intensities. V. ^{160}Tb, ^{168}Tm and ^{182}Ta .. ..See Entry 100180

The pairing extrapolation ionization chamber for (n,γ) mixed field dosimetry ... .See Entry 100194

Measurement of double and triple velocity-correlations by means of streamwise orientated rotated X-hot-wire probes ....See Entry 101368

Polarisation properties of bremsstrahlung produced by electron opaque targets of low-*Z* elements with application to X-ray fluorescence analysis ....See Entry 103615

Characterization of laser-produced plasma X-ray sources for use in X-ray radiography ....See Entry 104035

07.90 OTHER TOPICS IN SPECIALISED INSTRUMENTATION

99248 Thermoluminescence dating of Chinese pottery. W.Wang (Shanghai Museum, Shanghai, China), Z.Zhou.
Archaeometry (GB), vol.25, pt.2, p.99-106 (Aug. 1983).
A new technique is employed in which thermoluminescence dosimetry is used for the alpha component of the annual dose as well as for the beta and gamma components; also, the need for external calibration of radioisotope sources is eliminated. Dates are reported for samples from seven sites, associated radiocarbon results being given for five of them. (16 refs.)

99249 Forensic utiization of neutron radiography. F.M.Kerr (Royal Canadian Mounted Police, Ottawa, Ontario, Canada).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.591-8
X and gamma radiography are well established aids to forensic science. Neutron radiography is less common for many reasons. The paper outlines some of the attempts made by the Royal Canadian Mounted Police to explore the potentialities of this powerful tool. It will deal with both isotopic ^{252}Cf and beam-tube swimming-pool reactor neutron sources. It outlines some of the problems encountered in the forensic area and suggests some solutions. (no refs.)

99250 Neutron image intensifier tubes. M.Verat, H.Rougeot, B.Driard.
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.601-7
The most frequently used techniques in neutron radiography employ a neutron converter consisting of either a scintillator or a thin metal sheet. The radiation created by the neutrons exposes a photographic film that is in contact with the converter: in the direct method, the film is exposed during the time that the object is irradiated with neutrons; in the transfer method, the film is exposed after the irradiation of the object with neutrons. In industrial non-destructive testing, when many identical objects have to be checked, these techniques have several disadvantages. Non-destructive testing systems without these disadvantages can be constructed with neutron-image intensifier tubes (NII). The authors present a description and operating characteristics of a neutron-image intensifier tube. They compare a system incorporating an NII with a system without an NII. The neutron image intensifier tube makes possible the use of compact, flexible, low-power neutron generators such as small accelerators or californium-252 bombs. Real-time industrial testing using TV pickup should be possible without the need for a nuclear reactor. (no refs.)

99251 Fluorescent converter and neutron absorber being made of boron nitride. G.Matsumoto, M.Teramura, J.Sato, M.Maeda (Nagoya Univ., Nagoya, Japan).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.609-15
The improvement of the sensitivity of the fluorescent convertor is essential to the neutron radiography (NRG) which utilizes portable, not so strong neutron sources. The fluorescent convertor made of boron nitride (BN) is fabricated and tested. The sensitivity is about 1/20 of the NE426. If ^{10}BN is utilized, the sensitivity will be five times as much as that of natural BN. Using the neutron beam of the Kyoto University Research Reactor, the flux of which is about 10^6 n/cm^2 sec, a good neutron television image is obtained. As a bi-product of this convertor, a flexible absorber is fabricated. (no refs.)

99252 MTF analysis of the near-real time neutron radiography facility at MURR. J.T.Lindsay, D.M.Alger, S.R.Bull, W.H.Miller.
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.617-23
With the advent of different real-time neutron radiography systems comes the necessity to develop a means to quantitatively evaluate and compare these systems. A method suitable for measuring the resolution capabilities of the image-forming system is the determination of the modulation transfer function (MTF). The MTF is a measure of an imaging system's ability to reproduce the spatial frequencies present in an image. The authors present results for several neutron scintillation screens used in neutron radiography. A plot of the MTF versus spatial frequency is presented for the two commercial screens and a few of the absorber/phosphor mixtures developed at MURR. Of the various absorbers studied, gadolinium is seen to provide the least resolution at higher frequencies with a corresponding loss in speed. The lower resolution α-emitters (B and Li) however do result in a much greater light output and for certain low resolution studies provide a means of getting an image at a considerably lower neutron flux. (14 refs.)

99253 Neutron radiographic image definition under a wide range of resolution conditions. W.L.Whittemore, G.Schlueter, J.Shoptaugh (General Atomic Co., San Diego, CA, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.885-90
When neutron radiography is intended to create suitable images of very small objects, large values of length/diameter (L/D) and, where possible, a reduction in the thickness of the object are usually sought. Typically, details having dimensions of only a few thousands of an inch can be resolved in objects that are 1 and 2 in. thick. The maximum image contrast occurs when an umbra and a penumbra form the shadow cast by the small detail. When the object thickness is much thicker or the fine detail is even smaller, the image of the detail consists only of penumbra shadows and has greatly reduced contrast. Successful neutron radiography has been conducted with very thick objects (~10 in.) in which small defects (~0.020 in.) must be imaged far from the film plane. Conventional imaging requirements suggest uneconomically large values for L/D. Analytical predictions and experimental results verify that images can be useful even if formed only by penumbra shadows. The authors present analytical results that relate image contrast to useful parameters such as thickness to the object, L/D, opaqueness and size of the fine details or defects, and multiple scattering of neutrons in the host material. (2 refs.)

99254 Inverse contrast in neutron radiography. J.Olsen, P.Gade-Nielsen (Riso Nat. Lab., Roskilde, Denmark).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.891-5
Due to the geometrical unsharpness it is possible to have inverse contrast on neutron radiographs. By changing the unsharpness, e.g. by altering the distance of the object to the film, it is possible to have a white area becoming a black area, and conversely. First, this will be shown theoretically when one has an object whose transmittance varies harmonically. Secondly it will be shown how the inverse contrast effect can be demonstrated by having a film at varying distances behind a multislit collimating system. (5 refs.)

99255 The neutron computer tomography. G.Matsumoto, S.Krata (Nagoya Univ., Nagoya, Japan).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.899-906
The method of computer tomography (CT) was applied for neutron insteady of X-ray. The neutron radiography (NRG) image of samples was scanned by microphotometer to get the transmission data. This process was so time-consuming that one could not increase the number of incident angles to samples. The transmission data was processed by FACOM computer and CT image was gained. (no refs.)

99256 The role of diffused beta radiation in imaging with beta emitting neutron radiographic converter screens. J.Rant, G.Pregl, P.Leskovar, F.Zitnik ('J. Stefan' Inst., Univ. Ljubljana, Ljubljana, Yugoslavia).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.907-17
The beta-rays back diffused from cassette backing material contribute significantly to the neutron radiographic image of beta emitting screens used in transfer neutron radiography. The photographic density intensifying factors were assessed as a function of backing material, energy of beta radiation, screen type and thickness, radiographic film parameters and irradiation film exposure geometry. The influence of backing material on the edge spread function in imaging with In converters was studied. (22 refs.)

99257 Scattering point spread functions in neutron radiograph. Y.Segal, A.Gutman, A.Notea (Dept. of Nuclear Engng., Technion-Israel Inst. of Technol., Haifa, Israel).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.929-36
The contribution of the neutron scattering in the radiographed object to the point spread function was calculated using the MORSE-CG Monte Carlo Code. The calculations were performed for a wide range of materials, thicknesses and object to film distances, covering neutron radiography geometries of practical interest. The Monte Carlo results were compared to analytical cal-

culations based on a single scattering model. Least square fitting methods were used to calculate correction functions to the analytical results by adopting them to the more precise Monte Carlo values. In this way continuous analytical functions were obtained which enable easy interpolation within the range of Σ_a, Σ_s, thickness and object to film distance covered by the Monte Carlo calculations. (8 refs.)

99258 Neutron image simulation by Monte Carlo methods. M.P.Butler, A.A.Harms (McMaster Univ., Hamilton, Ontario, Canada).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.937-43
A computationally tractable Monte Carlo simulation method for the study of image unsharpness in neutron radiography is formulated. Its underlying principles are described and tests of its reliability are illustrated. This method appears to be useful in describing selected physical processes uniquely associated with neutron radiography. (6 refs.)

99259 Digital neutron radiography using plane converters with multiwire proportional chambers. S.N.Kaplan, B.A.Director, V.Perez-Mendez, K.H.Valentine (Univ. of California, Berkeley, CA, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.961-9
The authors have developed and studied a moderately low cost, moderate resolution, high sensitivity, on-line method for digital neutron radiography, intended for use where neutron fluence is limited by source strength, or received dose. The basic imaging system consists of a position-sensitive gas proportional chamber together with its associated imaging electronics, and a plane neutron converter. Enriched-boron, gadolinium, and polyethylene (for fast neutrons) converters were analyzed and tested. Some work was done on digital data enhancement, and efforts to improve spatial resolution included pressurizing the proportional-chamber gas to reduce the track lengths of the neutron-interaction products. The results are presented. (4 refs.)

10.00 THE PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

(for cosmic rays, see 94.40; for high energy-experimental techniques and instrumentation, see 29.)

11.00 GENERAL THEORY OF FIELDS AND PARTICLES

(see also 03.65 Quantum mechanics, 03.70 Theory of quantized fields, 03.80 General theory of scattering)

11.10 FIELD THEORY

99260 Remarks on the Krolikowski-Rzewuski equation for a distinguished component of a state vector and asymptotic properties of its solutions. K.Urbanowski (Dept. of Theoretical Phys., Higher Pedagogical School, Zielona Gora, Poland).
Acta Phys. Pol. B (Poland), vol.B14, no.7, p.485-97 (July 1983).
Generalizes the Krolikowski-Rzewuski equation (1956, 1975) for a distinguished component of the state vector and give the new formulae for a quasipotential and inhomogeneity occurring there. The author also studies the strong limit (when time goes to infinity) of the quantum evolution operator occurring in this equation. A connection of this limit with the ergodic theorem on the time average is proved. (17 refs.)

99261 Thermodynamics and two-dimensional lattice gauge models. J.Jurkiewicz (Inst. of Phys., Jagellonian Univ., Cracow, Poland), K.Zalewski.
Acta Phys. Pol. B (Poland), vol.B14, no.7, p.517-32 (July 1983).
The gauge theory with the gauge group $U(N\rightarrow\infty)$ is solved on a two-dimensional lattice. The single plaquette action used depends on L parameters, where L is an arbitrary integer, and thus results for a wide class of variant actions may be compared. A rich structure of second order and third order phase transitions appears. Besides the exact analytic solution a thermodynamical discussion clarifying the qualitative features of the results is given. (13 refs.)

99262 A conventional interpretation of Kahler equation. W.Krolikowski (Inst. of Theoretical Phys., Warsaw Univ., Warsaw, Poland).
Acta Phys. Pol. B (Poland), vol.B14, no.7, p.533-7 (July 1983).
The Kahler equation (1960) for differential forms is interpreted in flat space-time as describing a system of two Dirac particles, one of which being infinitely heavy. (6 refs.)

99263 The finite-temperature phase transition at infinite N. H.Neuberger (Inst. for Advanced Study, Princeton, NJ, USA).
Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B220(FS8), no.3, p.237-45 (25 July 1983).
The finite-temperature breakdown of the global $Z(N)$ symmetry of 3+1 dimensional lattice gauge theories is studied within the framework of a reduced, quenched, large-N model using both analytical and numerical methods. (25 refs.)

99264 On the nature of the phase transition in a class of lattice gauge theories. L.Caneschi (Dept. of Phys., Univ. of Pisa, Pisa, Italy), I.Fox, S.Solomon.
Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B220(FS8), no.3, p.246-52 (25 July 1983).
The authors investigate the connection between the phase transition recently found by Anthony (1982) in a variant of SU(2) lattice gauge theory and various mechanisms known to produce phase transitions in lattice gauge theories. (9 refs.)

99265 Gauge theories on a simplicial lattice. J.M.Drouffe, K.J.M.Moriarty (CERN, Geneva, Switzerland).
Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B220(FS8), no.3, p.253-68 (25 July 1983).
The authors present various results obtained for pure gauge theories built on a simplicial lattice, an alternative to the almost always used hypercubical lattice. The main interest is to lead to shorter calculations, with more rapid thermalization of the Monte Carlo simulations. Their results are quite similar to those obtained with hypercubical lattices. (13 refs.)

99266 A quenching scenario for lattice gauge theories. Zhang Yi-cheng (Istituto di Fisica 'G. Marconi', Univ. di Roma, Roma, Italy).
Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B220(FS8), no.3, p.302-16 (25 July 1983).
The author studies lattice gauge theories with complex, random and quenched couplings. Such theories are argued to have the same continuum limits as the annealed case. The first-order phase transitions are shown to be absent and the smoother cross-over behavior of the quenched theory leads to the universal scaling law. (28 refs.)

99267 Vacuum decay by inverse scattering. R.J.Cant (Dept. of Theoretical Phys., Univ. of Manchester, Manchester, England).
Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B220(FS8), no.3, p.317-26 (25 July 1983).
Discusses the decay of false vacua which originate from quantum mechanical effects. In particular the author examines the $1/N$ expansion of the $O(N)$ $\lambda\phi^4$ model. This model has an effective potential which is complex for large values of the field. In a previous paper (1979) it is shown that this effective potential could not be used to calculate the decay rate directly. In the present work he shows that the vacuum can decay via poles in the effective action which are evident when it is written in terms of scattering variables. (18 refs.)

99268 Four dimensional theories with composite gauge fields and their supersymmetric generalizations. B.Milewski (Inst. of Theoretical Phys., Univ. of Wroclaw, Wroclaw, Poland).
Fortschr. Phys. (Germany), vol.31, no.6, p.313-38 (1983).
A fourlinear $CP(N\text{-}1)$ model which is classically equivalent to (massive) electrodynamics with a composite four-potential is shown to be renormalizable in 4 dimensions in the framework of the $1/N$ expansion. Also a supersymmetric fourlinear $CG(N, n)$ model is constructed and shown to be equivalent to the super-Yang-Mills model with composite gauge fields. A short introduction to sigma models and supersymmetric gauge theories is given. (47 refs.)

99269 Functional methods. M.H.Zaidi (Dept. de Fisica, Centro de Investigacion y de Estudios, Mexico City, Mexico).
Fortschr. Phys. (Germany), vol.31, no.7, p.403-18 (1983).
The author describes briefly the basic properties of functional differentiation and integration, including an elementary derivation of the rules of integration over anticommuting variables first introduced by Berezin. The methods are applied to examples drawn from quantum field theory. (14 refs.)

99270 The soliton solutions of the $(1+1)$-dimensional real ϕ^4 field at finite temperature. Ru-keng Su (Phys. Dept., Fudan Univ., Shanghai, China), Pin-zhen Bi, Guang-jiong Ni.
J. Phys. A (GB), vol.16, no.11, p.2445-55 (1 Aug. 1983).
Proposes a method based on the concepts of coherent state and the approach of the real time Green function to investigate the spontaneous breaking of symmetry in a $(1+1)$-dimensional ϕ^4 field as well as its restoration at finite temperatures. A critical temperature T_c is found at which the kink-like soliton disappears. In the weak coupling limit, the soliton mass $E_s|_{T=T_c}=(1/3\sqrt{3})E_s|_{T=0}$ and the critical temperature $T_c=(2/3\sqrt{3})E_s|_{T=0}$. (14 refs.)

99271 Towards non-trivial scalar theories in $d\geq4$ space-time dimensions. R.J.Rivers (Blackett Lab., Imperial Coll. of Sci. & Technol., London, England).
J. Phys. A (GB), vol.16, no.11, p.2521-40 (1 Aug. 1983).
Shows, in the large-N limit, how non-canonical quantisation of an $O(N)$-invariant (pseudo) free scalar theory in $d\geq4$ dimensions can give non-trivial behaviour. Implications for recent results on the triviality of canonical scalar theories in $d\geq4$ dimensions are discussed. (18 refs.)

99272 Topology and renormalisability. II. R.Banach (Dept. of Theoretical Phys., Manchester Univ., Manchester, England).
J. Phys. A (GB), vol.16, no.11, p.2541-70 (1 Aug. 1983).
For pt.I see ibid., vol.13, p.L365 (1980). The connection between space-times related by a covering projection and the renormalisability of quantum field theories defined on them is re-examined in the framework of constructive field theory. It is shown that a previous derivation is the heuristic version of a conditioning argument and the possibility of applying such an argument to infinite fundamental group situations (in the specific guise of finite-temperature field theory) and to boundary-value problems is explored. It is found that the implications of conditioning are broadly (though not in every detail) in agreement with known facts from renormalised perturbation theory. (29 refs.)

99273 Intrinsic geometry of the $N=1$ supersymmetric Yang-Mills theory. E.A.Ivanov (Lab. of Theoretical Phys., Joint Inst. for Nuclear Res., Dubna, USSR).
J. Phys. A (GB), vol.16, no.11, p.2571-86 (1 Aug. 1983).
The $N=1$ supersymmetric Yang-Mills theory is formulated analogously to the minimal $N=1$ supergravity in the Ogievetsky-Sokatchev approach (1980). The intrinsic superspace geometry of the $N=1$ Yang-Mills is shown to be the complex geometry of embedding of the real superspace $\mathbf{R}^{4|4}=\{x^m, \theta^{\mu}, \theta^{\mu}=(\theta^{\mu})^{+}\}$ into the extended complex one $\mathbf{C}^{4+M|2}=\{x_L{}^m, \theta_L{}^{\mu}=\theta^{\mu}, \phi_L{}^i\}$, $(i=1, \ldots, M)$, $\phi_L{}^i$ being local coordinates on the group G^c, the complexification of gauge group G, and $M=\dim G$. The $N=1$ Yang-Mills prepotential is identified with $\mathrm{Im}\phi_L{}^i$ restricted to the hypersurface $\mathbf{R}^4/^4$. It takes values in the coset G^c/G, so the $N=1$ Yang-Mills theory can be interpreted as a generalised nonlinear σ model. The corresponding Cartan forms are defined and they are applied to the construction of relevant geometric objects. Some new possibilities following from the suggested formulation of the theory are also discussed. (34 refs.)

99274 Acausality of all standard relativistic wave equations with Harish-Chandra degree four. G.Labonte (Dept. of Phys., Princeton Univ., Princeton, NJ, USA).
J. Phys. A (GB), vol.16, no.12, p.L427-9 (21 Aug. 1983).
The long-standing conjecture of non-existence of acceptable standard relativistic wave equations for particles of spins $s\geq{}^3/_2$ is proven, for all cases with Harish-Chandra degree four. This is an important step toward the general proof since the only remaining candidate equations have higher HC degrees and therefore are expected to exhibit still worse pathologies. (12 refs.)

99275 Correlation equalities and coupling constant bounds implying area decay of Wilson loop for Z_2 lattice gauge theories. F.C.Sa Barreto, M.L.O'Carroll (Dept. de Fisica, Univ. Federal de Minas Gerais, Belo Horizonte, Brazil).
J. Phys. A (GB), vol.16, no.12, p.L431-4 (21 Aug. 1983).
The authors obtain correlation equalities for Z_2 lattice gauge theories and apply them to obtain area decay of the Wilson loop observable in a range of the coupling parameter larger than that obtained from mean field theory considerations. (6 refs.)

99276 Solitary wave solutions in double sinh-Gordon system. K.Babu Joseph, B.V.Baby (Dept. of Phys., Univ. of Cochin, Cochin, India).
J. Phys. A (GB), vol.16, no.12, p.2685-91 (21 Aug. 1983).
Two new classes of solitary wave solutions for the recently suggested double sinh-Gordon system have been obtained. These solutions possess nice stability and asymptotic properties and are characterised by zero topological charge. The existence and behaviour of these solutions in more than two space-time dimensions and the properties of multisolitary waves have been studied in detail. (15 refs.)

99277 Some local covariant representations of the canonical anticommutation relations. Z.J.Hermaszewski, R.F.Streater (Dept. of Math., Bedford Coll., London, England).
J. Phys. A (GB), vol.16, no.12, p.2801-10 (21 Aug. 1983).
The authors find some non-Fock representations of the canonical anticommutation relations in $1+1$ dimensions. These representations, obtained by a Bogoliubov transformation of the Fock annihilation and creation operators, are Poincare covariant, have positive energy, and are labelled by two conserved charges which take on continuous values in the interval $[0,2\pi)$. (12 refs.)

99278 Calculation of ladder diagrams in arbitrary order. V.V.Belokurov, N.I.Ussyukina (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
J. Phys. A (GB), vol.16, no.12, p.2811-16 (21 Aug. 1983).
A scalar ladder propagator-type diagram is rigorously calculated in an arbitrary order of perturbation theory. (10 refs.)

99279 A two-parameter matrix Riccati equation pair for a class of nonlinear sigma models based on a symmetric space. M.A.Snyder (Dept. of Phys. Wellesley Coll., Wellesley, MA, USA).
J. Math. Phys. (USA), vol.24, no.8, p.2204-7 (Aug. 1983).
It is shown that the infinite action of a group on one of its associated symmetric spaces is, in the case of a classical off-diagonal symmetric space, in the form of a matrix Riccati equation. A two-parameter Riccati equation is then found for the nonlinear sigma model based on a symmetric space G/H. (19 refs.)

99280 On the solutions of the Dirac equation. P.Achuthan, S.Benjamin (Dept. of Math., Indian Inst. of Technol., Madras, India).
J. Math. & Phys. Sci. (India), vol.17, no.2, p.193-200 (April 1983). (Proceedings of the Conference on Mathematical Analysis and Applications, Madras, India, 12-13 Nov. 1982).
Dirac's relativistic wave equation, ever since its inception over half a century ago, has been the focus of attention from several points of view. In spite of its unifying feature and extraordinary elegance only very few quantum systems are known for which the Dirac equation is exactly soluble. The Dirac equation for the case of an electron in the presence of the inhomogeneous electric field $E_z(z)=E/(1-az)^2$ is solved exactly. The scattering solution only is possible for this situation. The relevant scattering parameters, viz. the reflection and transmission coefficients, are obtained in the four-component formalism. (11 refs.)

99281 Abelian dominance in a space-time lattice. V.M.Emel'yanov (Moscow Engng. Phys. Inst., Moscow, USSR).
JETP Lett. (USA), vol.37, no.3, p.201-3 (5 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.3, p.166-8 (5 Feb. 1983).
Orbits constructed from a Cartan subgroup of a gauge group are extreme in a space-time lattice. The relationship with the singular gauge in quantum chromodynamics is discussed. (4 refs.)

99282 Numerical studies of Wilson loops in SU(6) gauge theory in four dimensions. D.Barkai (Center for Appl. Vector Technol., Colorado State Univ., Fort Collins, CO, USA), M.Creutz, K.J.M.Moriarty.
J. Phys. G (GB), vol.9, no.8, p.L149-52 (Aug. 1983).
A previous Monte-Carlo study of pure SU(6) gauge theory in four space-time dimensions is extended to measure all Wilson loops up to size 3×3 on a 6^4 lattice. The string tension is extracted from the Wilson loops and a lower bound is placed on the asymptotic-freedom scale parameter Λ_0. (7 refs.)

99283 Particle production by accelerated charges moving in condensed matter. M.Pardy (Dept. of Theoretical Phys., Brno, Czechoslovakia).
J. Phys. G (GB), vol.9, no.8, p.853-9 (Aug. 1983).
The rates of electron-positron pair creation and rho-meson creation by charges moving in a uniform circular motion in condensed matter are calculated in the framework of the Schwinger source theory. (10 refs.)

99284 An alternative study of the propagation of the Rarita-Schwinger wave equation in the presence of an external electromagnetic field. C.G.Koutroulos (Dept. of Theoretical Phys., Univ. of St. Andrews, St. Andrews, Scotland).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.13, p.459-61 (30 July 1983).
The authors study the problem of propagation of the solutions of the Rarita-Schwinger wave equation (1941) for spin $^3/_2$ in the presence of an external electromagnetic field, using the method of characteristics used by Velo and Zwanziger (1969), but making use of the criterion of hyperbolicity for first-order quasi-linear systems of partial differential equations given by Jeffrey (1976). (3 refs.)

99285 On the Shamaly-Capri wave equation for spin-1 particles. C.G.Koutroulos (Dept. of Theoretical Phys., Univ. of St. Andrews, St. Andrews, Scotland).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.13, p.462-4 (30 July 1983).
The equivalence of the Shamaly-Capri wave equation (1973) to the Gel'fand-Yaglom wave equation (1963) for spin 1 is verified and is shown that there are difficulties with the charge which reflect on its causal propagation. (3 refs.)

99286 Renormalization of the self-consistent summation of exchange diagrams in a relativistic quantum field theory. A.F.Bielajew (Dept. of Phys., Stanford Univ., Stanford, CA, USA).
Nucl. Phys. A (Netherlands), vol.A404, no.3, p.428-42 (15 Aug. 1983).
The self-consistent summation of exchange diagrams is renormalized in a relativistic fermion-scalar field theory using spectral function methods. This is a non-perturbative approach in which all uncrossed exchange diagrams are summoned to all orders in the coupling constant. A detailed exposition of the renormalization technique is presented along with numerical results. Anomalous analytic structure (ghost poles and ghost branch cuts) that arises naturally from the approximation is briefly discussed. The author discusses the generalization to a finite density of fermions that may have application in nucleon-meson field theories which are currently in vogue. (24 refs.)

99287 Remarks on the gauge-invariant formulation for interaction of radiation with matter. D.Lee, A.C.Albrecht (Dept. of Chem., Cornell Univ., Ithaca, NY, USA), Kuo-Ho Yang, D.H.Kobe.
Phys. Lett. A (Netherlands), vol.96A, no.8, p.393-6 (25 July 1983).
It is pointed out the Yang's gauge-invariant formulation does not prefer any particular gauge, contrary to some recent criticism. In this formulation, any gauge is equally acceptable and gives an identical description of the interaction between radiation and matter. The recent attempt by Feuchtwang et al. (1982) to achieve gauge invariance of probability amplitudes is in fact related to older work shown to suffer from path ambiguity in a line integral. (13 refs.)

99288 General solution of the spherically symmetric Yang-Mills equations. B.S.Berman (Inst. for Problems in Mech., Acad. of Sci., Moscow, USSR).
Phys. Lett. A (Netherlands), vol.96A, no.9, p.451-2 (1 Aug. 1983).
A general solution of the spherically symmetric Yang-Mills equations is presented. (5 refs.)

99289 Relativistic quarkonium model based on instantaneous ladder BS equation. II. Mass levels of charmonium and bottonium. M.Hirano (Hokkaido Univ. of Education, Sapporo, Japan), K.Iwata, K.Kato, T.Murota, D.Tsuruda.
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1498-504 (May 1983).
For pt.I see ibid., vol.67, p.1251 (1982). The mass levels of the charmonium and the bottonium are calculated based on the instantaneous ladder BS equation. The agreement with experiment is fairly good. The authors get smaller α_s than nonrelativistic analyses. $\Gamma_{ms}$is estimated to be 80~130 MeV. The relativistic effects are not so small in the charmonium. (9 refs.)

99290 Axially symmetric gauge fields of magnetic monopoles. R.P.Mondaini, N.O.Santos (Inst. de Fisica, Univ. Federal do Rio de Janeiro, Rio de Janeiro, Brazil).
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1548-53 (May 1983).
A Weyl solution is presented for axially symmetric gauge fields of magnetic monopole sources. The authors give a motivation and a scheme of research for working in the solutions of coupled Einstein-Yang-Mills systems. (17 refs.)

99291 Stochastic quantization of nonAbelian gauge field—unitarity problem and Faddeev-Popov ghost effects. M.Namiki, I.Ohba, K.Okano, Y.Yamanaka (Dept. of Phys., Waseda Univ., Tokyo, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1580-99 (May 1983).
The stochastic quantization method is applied to the nonAbelian gauge field up to the second order perturbation. It is shown that the stochastic quantization method automatically produces the same correct results as given by the well-known Faddeev-Popov trick but never requires to introduce artificially any ghost field. The gauge fixing problem in this method is also examined in detail. Finally preliminary discussions are given as to whether the physical state condition is automatically satisfied. (4 refs.)

99292 Four-dimensional Ashkin-Teller gauge theory. F.C.Alcaraz, L.Jacobs (Inst. for Theoretical Phys., Univ. of California, Santa Barbara, CA, USA).
Phys. Rev. Lett. (USA), vol.51, no.7, p.530-3 (15 Aug. 1983).
The authors construct and analyze a lattice field theory of two Z_2 gauge fields which interact in a minimal gauge-invariant fashion. Although the theory presented here, a generalization of the two-dimensional Ashkin-Teller spin system, has no formal continuum limit, it is found that it has an electrodynamicslike phase similar to that observed in general Z_N theories for $N\geq4$. This model is probably the simplest generalization of the conventional Z_2 pure gauge theory which has a massless phase separated from the strong- and weak-coupling regions by lines of second-order phase transitions. (14 refs.)

99293 Faddeev-Popov zeros and confinement of color in a hyperspherical gauge model. R.E.Cutkosky (Dept. of Phys., Carnegie-Mellon Univ., Pittsburgh, PA, USA).
Phys. Rev. Lett. (USA), vol.51, no.7, p.538-41 (15 Aug. 1983).
A new rotationally invariant Hamiltonian method, formulated on a four-dimensional hyperspherical surface, is proposed for the numerical study of quantum gauge field models. It is shown that in the Coulomb gauge it is sufficient, as well as necessary, to restrict transverse potentials to the zero-free domain of the Faddeev-Popov determinant. Numerical studies of an SU(2) model support Gribov's suggestion (1978) that the zeros provide a natural way to understand the origin of confinement. (13 refs.)

99294 Explicit evaluation of physical quantities and supersymmetry properties of the lattice O(N) σ model at large N. P.Di Vecchia (Dept. of Phys., Univ. of Wuppertal, Wuppertal, Germany), R.Musto, F.Nicodemi, R.Pettorino, P.Rossi, P.Salomonson.
Phys. Lett. B (Netherlands), vol.127B, no.1-2, p.109-14 (21 July 1983).
The authors explicitly show how to extract physical quantities of the continuum theory from two lattice versions of the nonlinear σ model, that are exactly solvable for $N\to\infty$, they also build a lattice action which is supersymmetric in the large N limit and suggest how to recognize supersymmetry restoration in the continuum even when starting from a non-supersymmetric lattice formulation. (11 refs.)

99295 A study of finite sized Wilson Loops in the quenched Eguchi Kawai model. J.W.Carlson (Dept. of Phys., Univ. of California, Berkley, CA, USA).
Phys. Lett. B (Netherlands), vol.127B, no.1-2, p.115-18 10 4 (21 July 1983).
It is shown that expectation values of Wilson loops in a Monte Carlo calculation of quenched Eguchi Kawai on a lattice show unphysical behaviour as the size of the loop increases. Two reasons for this behaviour are discussed. (4 refs.)

99296 Perturbative fermion contribution to the average plaquette. H.Hamber, C.M.Wu (Inst. for Advanced Study, Princeton, NJ, USA).
Phys. Lett. B (Netherlands), vol.127B, no.1-2, p.119-22 (21 July 1983).
The fermion contribution to the average plaquette is evaluated analytically to lowest order in lattice perturbation theory for an arbitrary fermion regularization. To this order the effect of the fermions is to decrease it by an amount that is proportional to the number of fermion flavors. (7 refs.)

99297 Harmonic oscillator on a lattice. J.P.Ader, B.Bonnier, M.Hontebeyrie, C.Meyers (Lab. de Phys. Theorique, Univ. de Bordeaux I, Gradignan, France).
Phys. Lett. B (Netherlands), vol.127B, no.1-2, p.123-5 (21 July 1983).
The continuum limit of the ground state energy for the harmonic oscillator with discrete time is derived for all possible choices of the lattices derivative. The occurrence of unphysical values is shown to arise whenever the lattice laplacian is not strictly positive on its Brillouin zone. These undesirable limits can either be finite and arbitrary (multiple spectrum) or infinite (overlapping sublattices with multiple spectrum). (6 refs.)

99298 Zumino identities for super abelian gauge theories. J.Juer, G.Thompson (Dept. of Phys., Univ. of Southampton, Southampton, England).
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.204-8 (28 July 1983).
The authors derive Zumino identities relating Green's functions in different gauges, of the same class, for supersymmetric abelian gauge theories. They are shown to hold by a specific example at one loop order. Some comments are made on renormalisation and infrared divergences. (10 refs.)

99299 Monte Carlo measurement of the topological susceptibility in SU(3) lattice gauge theory. K.Fabricius (Dept. of Phys., Univ. of Wuppertal, Wuppertal, Germany), G.C.Rossi.
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.229-32 (28 July 1983).
A Monte Carlo measurement of the topological susceptibility $A=\int d^4x\langle 0|T(Q(x)Q(0))|0\rangle$, where $Q(x)$ is the topological charge density, is performed in the SU(3) case on a 4^4 lattice. The authors find in string tension units $A^{1/4}=(0.12\pm0.02)\sqrt{K}$ as in the SU(2) case. For $\sqrt{K}=420$ MeV this corresponds to $A^{1/4}=(50\pm10)$ MeV. (13 refs.)

99300 Limitations to the Coleman-Weinberg mechanism of spontaneous mass generation. H.Kleinert (Inst. of Theoretical Phys., Univ. of California, Santa Barbara, CA, USA).
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.69-72 (18 Aug. 1983).
The author points out that the second order phase transition of compact U(1) lattice gauge theory implies that a certain range of abelian Higgs models escapes the Coleman-Weinberg mechanism of spontaneous mass generation and suggests ways for a Monte Carlo investigation of the full range of its validity. (12 refs.)

99301 The connection between lattice gauge theories with Manton and Wilson actions. T.V.Shahbazyan (Yerevan Phys. Inst., Yerevan, USSR).
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.79-82 (18 Aug. 1983).
The SU(2) lattice gauge theory (LGT) with Manton's action is represented as the LGT with Wilson's action and effective coupling constant. A nonperturbative calculation of the ratio of Λ_L-parameters in the crossover region is performed and it is found that $\Lambda_L{}^M/\Lambda_L{}^W\approx3.7$. The β-dependence of the plaquette energy reproduces the Monte Carlo data for the LGT with Manton's action if the Monte Carlo data for the LGT with Wilson's action is known. (10 refs.)

99302 A practical scheme for SU(4) flavour symmetry breaking in lattice gauge theories. A.N.Burkitt, A.Kenway, R.D.Kenway (Dept. of Phys., Univ. of Edinburgh, Edinburgh, Scotland).
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.83-8 (18 Aug. 1983).
SU(4) flavour symmetry arises naturally in the continuum limit of free Susskind fermions on a four-dimensional lattice. It may be broken by including a mass term for each flavour. There is an optimum choice for the lattice mass term in the gauge theory, which breaks the flavour symmetry to SU(2) without increasing the non-locality of the action. (8 refs.)

99303 Renormalization-group study of four-dimensional SU(4) gauge theory. D.Barkai (Center for Appl. Vector Technol., Colorado State Univ., Fort Collins, CO, USA), M.Creutz, K.J.M.Moriarty.
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.86-90 (18 Aug. 1983).
Wilson loops for pure SU(4) gauge theory are calculated by Monte Carlo simulations on an 8^4 lattice. By comparing Wilson loops on different length scales, an ultraviolet stable attractive fixed point is located at vanishing bare coupling at which point asymptotic freedom is numerically verified. (10 refs.)

99304 Feynman path summation for the Dirac equation: an underlying one-dimensional aspect of relativistic particle motion. G.Rosen (Dept. of Phys., Drexel Univ., Philadelphia, PA, USA).
Phys. Rev. A (USA), vol.28, no.2, p.1139-40 (Aug. 1983).
It is observed that the Feynman path summation for the one-dimensional Dirac equation can be projected into three spatial dimensions to yield a path-summation formula for physical spin-$^1/_2$ particles of nonzero mass. Since the three-space projection matrix is independent of time and does not involve the particle's mass, relativistic motion governed by the Dirac equation has an underlying one-dimensional aspect. (4 refs.)

99305 Topological content of dimensional reduction. P.A.Zizzi (CERN, Geneva, Switzerland).
Phys. Rev. D (USA), vol.28, no.4, p.808-17 (15 Aug. 1983).
The author considers supersymmetric Yang-Mills theories which have nontrivial topological features and shows that in this case the dimensional-reduction technique has a topological content. It is found that a central charge of topological origin can be obtained, by dimensional reduction, from a topological charge in a higher-dimensional supersymmetry algebra (but not from an extra component of P_μ). This fact is interpreted in terms of commutative diagrams of spheres. (18 refs.)

99306 Supersymmetry on a lattice. J.Bartels (Dept. of Phys. & Astron., Rutgers Univ., New Brunswick, NJ, USA), J.B.Bronzan.
Phys. Rev. D (USA), vol.28, no.4, p.818-29 (15 Aug. 1983).
The authors develop Lagrangian and Hamiltonian lattice formulations of the Wess-Zumino model which preserve the superalgebra. The authors check that the lattice model passes into the continuum model in the zero-lattice-spacing limit, and obtain various perturbative results (nonrenormalization, effective-potential loop expansion) on the lattice. They study the phase structure with the one-loop effective potential and find dynamical symmetry breaking at large coupling in two dimensions, but not in four dimensions. Separately, they evaluate the strong-coupling limit in the Hamiltonian formulation and confirm the accuracy of the one-loop effective-potential predictions. These methods should apply to certain other supersymmetric theories. (19 refs.)

99307 Path-integral measure and anomalies for left-handed fermions. R.E.G.Saravi, F.A.Schaposnik (Dept. de Fisica, Univ. Nacional de La Plata, La Plata, Argentina), J.E.Solomin.
Phys. Rev. D (USA), vol.28, no.4, p.856-9 (15 Aug. 1983).
A path-integral measure for left-handed fermions is constructed for non-Abelian gauge theories and its properties under unitary transformations are discussed. (12 refs.)

99308 Monte Carlo computations in lattice gauge theories. M.Creutz (Phys. Dept., Brookhaven Nat. Lab., Upton, NY, USA), L.Jacobs, C.Rebbi.
Phys. Rep. (Netherlands), vol.95, no.4, p.201-82 (April 1983).
The formulation of gauge theories on Euclidean space-time lattices and the application of the Monte Carlo computational technique to the ensuing systems are reviewed. A variety of numerical results obtained for lattice gauge theories are presented and discussed. (120 refs.)

99309 The renormalization group and critical phenomena. K.G.Wilson (Lab. of Nuclear Studies, Cornell Univ., Ithaca, NY, USA).
Rev. Mod. Phys. (USA), vol.55, no.3, p.583-600 (July 1983).
This paper has three parts. The first part is a simplified presentation of the basic ideas of the renormalization group and the ϵ expansion applied to critical phenomena, following roughly a summary exposition given in 1972. The second part is an account of the history (as the author remembers it) of work leading up to the papers in 1971-1972 on the renormalization group. Finally, some of the developments since 1971 are summarized, and an assessment for the future given. (267 refs.)

99310 The lattice gauge theory approach to quantum chromodynamics. J.B.Kogut (Phys. Dept., Univ. of Illinois, Urbana, IL, USA).
Rev. Mod. Phys. (USA), vol.55, no.3, p.775-836 (July 1983).
The author reviews in a pedagogical fashion some of the recent developments in lattice quantum chromodynamics. This review emphasizes explicit examples and illustrations rather than general proofs and analyses. It begins with a discussion of the heavy-quark potential in continuum quantum chromodynamics. Asymptotic freedom and renormalization-group improved perturbation theory are discussed. A simple dielectric model of confinement is considered as an intuitive guide to the vacuum of nonAbelian gauge theories. Next, the Euclidean form of lattice gauge theory is introduced, and an assortment of calculational methods are reviewed. These include high-temperature expansions, duality, Monte Carlo computer simulations, and weak coupling expansions. A Λ-parameter calculation for asymptotically free-spin models is presented. The Hamiltonian formulation of lattice gauge theory is presented and is illustrated in the context of flux tube dynamics. Roughening transitions, Casimir forces, and the restoration of rotational symmetry are discussed. Mechanisms of confinement in lattice theories are illustrated in the two-dimensional electrodynamics of the planar model in the U(1) gauge theory in four dimensions. Generalized actions for SU(2) gauge theories and the relevance of monopoles and string to crossover phenomena are considered. A brief discussion of the continuity of fields and topological charge in asymptotically free lattice models is presented. The final major topic of this review concerns lattice fermions. The species doubling problem and its relation to chiral symmetry are illustrated. Staggered Euclidean fermion methods are discussed in detail, with an emphasis on species counting, remnants of chiral symmetry, Bloch spin variables, and the axial anomaly. Numerical methods for including fermions in computer simulations are considered. Jacobi and Gauss-Sidel inversion methods to obtain the fermion propagator in a background gauge field are reviewed. Langevin, pseudofermion Monte Carlo methods, and random walk methods are discussed, as are proposals for including the fermion determinant in computer simulations. Finally, spontaneous chiral symmetry breaking in lattice models is discussed. The review ends with brief remarks about present research directions. (120 refs.)

99311 Quantum non-local charge and exact S-matrix of the Gross-Neveu model. E.Abdalla, A.Lima-Santos (Inst. de Fisica, Univ. de Sao Paulo, Sao Paulo, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.2, p.293-304 (June 1982).
Using nonperturbative methods the author proves conservation of the non-local quantum charge of the Gross-Neveu model (1974) providing an exact *S*-matrix. (8 refs.)

99312 On the infrared divergences of the CP^{n-1} models. B.B.Cobra, M.Gomes (Inst. de Fisica, Univ. de Sao Paulo, Sao Paulo, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.4, p.693-705 (Dec. 1982).
The authors discuss some properties of the two-dimensional $SU(n)$ nonlinear sigma models, i.e. the CP^{n-1} models. They are $1/n$ expandable and ultraviolet renormalizable. Their main result is a proof that the infrared divergences associated with the topological gauge field are cancelled in the case of Green functions of gauge invariant operators. (10 refs.)

99313 Interaction constants as numerical characteristics of discrete spaces. V.N.Shchetochkin, V.N.Efremov (Geological Inst., Acad. of Sci., USSR).
Sov. Phys. J. (USA), vol.25, no.11, p.1030-4 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.62-7 (Nov. 1982).
On the basis of construction quantization of space, an expression is derived that gives a series of fundamental dimensionless constants in good agreement with experiment. (8 refs.)

99314 Dynamic mass formation and collective variables in a nonlinear spinor model. S.I.Kruglov (Inst. of Phys., Acad. of Sci., Belorussian SSR).
Sov. Phys. J. (USA), vol.25, no.11, p.1037-40 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.71-4 (Nov. 1982).
There exists many models in which the phase transition occurs from the symmetric (massless) to the nonsymmetric (mass) phase. Recently, interest in four-Fermion models has heightened because of the proof of their renormalizability upon decomposition into collective fields. The mechanism of dynamic mass formation in such theories can turn out to be an alternative to the known Higgs phenomenon. (11 refs.)

99315 Polarization symmetries of relativistic wave equations. V.I.Strazhev, P.L.Shkol'nikov (Inst. of Agriculture Mechanization, Belorussian SSR).
Sov. Phys. J. (USA), vol.25, no.11, p.1040-3 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.74-7 (Nov. 1982).
Generators of the group invariance of polarization origin U(2s+1) are constructed for relativistic wave equations (RWE), where s is the particle spin. Particular cases of the vector (mass) and Dirac fields are examined. (8 refs.)

99316 Multispin particles and non-abelian tensor gauge fields. S.I.Kruglov, V.I.Strazhev (Inst. of Agricultural Mechanization, Belorussian SSR).
Sov. Phys. J. (USA), vol.25, no.11, p.1043-5 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.78-81 (Nov. 1982).
A system of tensorial equations is suggested as a bipotential generalization of the Stuckelberg equations written for spin-tensors. These equations describe particles having two spin states: 1/2 and 3/2 (particles with the multispin 1/2, 3/2). The Lagrangian of the theory is invariant under the transformations of the field variables forming a group $U(1)\otimes SO(4, 2)\otimes SO(4, 2)$. Localization of the transformation parameters of this group of internal symmetry leads to introduction of a non-Abelian gauge field carrying the maximal spin 2. A possible physical interpretation of a multispin particle theory is discussed. (12 refs.)

99317 Radiative correction to the energy of a fermion in an external gauge field. V.Ch.Zhukovskii, I.B.Morozov, A.V.Borisov (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Sov. Phys. J. (USA), vol.25, no.11, p.1066-7 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.102-4 (Nov. 1982).
The first radiative correction in g^2 to the energy of the state of a fermion in a constant uniform gauge (for the SU(2) group) field of magnetic type is calculated. The expression obtained contains an indication of instability of the ground state. (10 refs.)

99318 Various U_1 gauge theories and Riemannian geometry on U_1 bundle with a scalar functional. An Ying, Chen Shi, Guo Hanying (Inst. of Theoretical Phys., Acad. Sinica, Beijing, China).
Sci. Sin. (China), vol.26, no.6, p.618-25 (June 1983).
By means of the Riemannian geometry on U_1 principal bundle with a gauge invariant scalar function or functional the authors reexamine various U_1 gauge theories including the Maxwell theory, Born-Infeld theory, Johnson type confinement theory, and massive U_1 gauge theory, and propose an 'electron bubble' model. All these theories can be expressed as some kind of the Kaluza type theories on the Minkowskian spacetime. They also propose an action for a scalar-vector U_1 gauge theory in which the scalar field is an independent dynamical variable and represents the property of the vacuum. Based on the assumption that the test particles in these fields move along the geodesics on the bundle space they obtain the conservation equation of the charge-to-mass ratio and the equation of motion of test particles. (14 refs.)

99319 The Pade method for the study of renormalization-group equations in the region of intermediate and strong coupling. S.A.Gadzhiev (Azerbaidjhan State Univ., Baku, Azerbaidzhan SSR), I.M.Dremin, V.Ya.Fainberg.
Sov. Phys.-Lebedev Inst. Rep. (USA), no.10, p.21-6 (1982). Translation of: *Sb. Kratk. Soobshch. Fiz. AN SSSR Fiz. Inst. P.N. Lebedeva*, no.10, p.24-30 (1982).
The Pade method is used for the summation of the perturbation series for the β function. By using the asymptotic behavior of the β function in the strong-coupling limit, one can obtain chromodynamic confinement (taking into account the three-loop approximation for β), and a resonable behavior of the renormalization-invariant charge. (13 refs.)

99320 Application of inverse scattering method to singular solutions of nonlinear equations. I. V.A.Arkad'ev, A.K.Pogrebkov, M.K.Polivanov (V.A. Steklov Math. Inst., Acad. of Sci., USSR).
Theor. & Math. Phys. (USA), vol.53, no.2, p.1051-62 (Nov. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.2, p.163-80 (Nov. 1982).
The Jost solutions and the transition matrix for the Zakharov-Shabat system are constructed in the case of potentials that have a finite number of 1/x singularities. The analytic properties of the transition matrix are investigated and scattering data are introduced. (12 refs.)

99321 Unitarity bounds for multiparticle interaction amplitudes. A.A.Arkhipov (Inst. of High Energy Phys., Serpukhov, USSR).
Theor. & Math. Phys. (USA), vol.53, no.2, p.1067-84 (Nov. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.2, p.188-215 (Nov. 1982).
A regular method is constructed for finding asymptotic bounds that generalise Froissart's well-known result (1961) to the case of multiparticle interaction. (17 refs.)

99322 Hidden symmetries for some classical field models. R.P.Zaikov (Joint Inst. for Nuclear Res., Dubna, USSR).
Theor. & Math. Phys. (USA), vol.53, no.2, p.1099-107 (Nov. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.2, p.238-49 (Nov. 1982).
The existence of hidden symmetries for an action invariant with respect to space-time transformations K and internal transformations G is investigated. For this purpose, transformations with generators that are functions of the coordinates are considered. For these functions, differential equations are obtained from the condition of invariance of the action. Solutions of these equations are found in the two-dimensional case. It is shown that the coordinate transformations depend on the fields and that the corresponding higher conserved quantities are of the Noether type. (10 refs.)

99323 Structure of the energy-momentum tensor and the spin tensor in a covariant theory of a spinor field. B.A.Levitskii, Yu.A.Yappa (Leningrad State Univ., Leningrad, USSR).
Theor. & Math. Phys. (USA), vol.53, no.2, p.1107-13 (Nov. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.2, p.250-9 (Nov. 1982).
A covariant generalisation of the second part of Noether's theorem (1918) is obtained for a spinor field in Riemannian space-time. Differential relations for the energy-momentum tensor and the spin tensor are derived from the conditions of invariance of the field equations with respect to arbitrary infinitesimal variations of the coordinates and the tetrad components. The symmetrisation of the energy-momentum tensor of the spinor field is considered. (15 refs.)

99324 Parastatistics and gauge symmetries. A.V.Govorkov (Joint Inst. for Nuclear Res., Dubna, USSR).
Theor. & Math. Phys. (USA), vol.53, no.2, p.1127-35 (Nov. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.2, p.283-95 (Nov. 1982).
It is shown that in Green's parafield theory it is possible to construct a unique nonlinear Lagrangian equivalent to the Yang-Mills gauge Lagrangian of SO(3) symmetry. Thus, Greenberg's paraquark hypothesis (1964) is not equivalent to the hypothesis of quark colour $SU(3)_c$ symmetry. The features of the SO(3) gauge are analysed and an interesting possibility of its use as an exact subgroup of broken $SU(3)_c$ is pointed out. (31 refs.)

99325 Connection between the sine-Gordon model and the massive Bose Thirring model. F.A.Smirnov (V.A. Steklov Math. Inst., Acad. of Sci., USSR).
Theor. & Math. Phys. (USA), vol.53, no.3, p.1153-60 (Dec. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.3, p.323-34 (Dec. 1982).
In the framework of the quantum inverse scattering technique connections are established between the sine-Gordon model and the massive Bose Thirring model. The classical significance of the vacuum filling in the sine-Gordon model is elucidated. (14 refs.)

99326 Invariant infrared regularization for supersymmetric Yang-Mills fields. A.A.Slavnov, B.A.Faizullaev (V.A. Steklov Math. Inst., Acad. of Sci., USSR).
Theor. & Math. Phys. (USA), vol.53, no.3, p.1161-4 (Dec. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.3, p.335-41 (Dec. 1982).
A scheme of infrared regularization for supersymmetric Yang-Mills fields is constructed. It is shown that it preserves the gauge symmetry. (5 refs.)

99327 A method of solving quasipotential equations. A.A.Arkhipov, V.I.Savrin (Inst. of High Energy Phys., Serpukhov, USSR).
Theor. & Math. Phys. (USA), vol.53, no.3, p.1165-75 (Dec. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.3, p.342-57 (Dec. 1982).
A method is proposed for solving quasipotential equations in the configuration space on the basis of a special integral transformation. The Coulomb problem is solved by this method. The class of potentials that admit exact solution of quasipotential equations with discrete spectrum is described. The connection between the proposed method and the approach based on expansion of the wave function with respect to irreducible unitary representations of the Lorentz group is established. (23 refs.)

99328 Explicitly integrable models of quantum field theory with exponential interaction in two-dimensional space. A.N.Leznov, I.A.Fedoseev (Inst. of High Energy Phys., Serpukhov, USSR).
Theor. & Math. Phys. (USA), vol.53, no.3, p.1175-85 (Dec. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.3, p.358-73 (Dec. 1982).
Explicit expressions are obtained for the Heisenberg operators of the two-dimensional models of quantum field theory described by the system of equations $\Box u_\alpha = g\ \exp(ku)_\alpha$ as functionals of asymptotic fields $\phi_\alpha{}^{in}$ satisfying the equations $\Box\phi_\alpha{}^{in}=0$ and appropriate commutation relations. It is shown that in the presence of a finite-dimensional internal symmetry group, when k is the Cartan matrix of a semisimple Lie group, the perturbation series for the operators $\exp(-{}^{u}{}_{\alpha})$ degenerate into polynomials in the coupling constant g, the degrees of the polynomials being related to the structure of the fundamental representations of the corresponding group. (10 refs.)

99329 Finite temperature SU(2) gauge theory with external magnetic field. Y.Fujimoto, T.Fukuyama (Internat. Centre for Theoretical Phys., Trieste, Italy).
Z. Phys. C (Germany), vol.19, no.1, p.11-17 (1983).
The authors employ the heat kernel method to evaluate the effective potential of the *SU*(2) gauge theory (with scalar triplet) when both external magnetic field and temperature are applied. The calculation is performed using high temperature approximation. (7 refs.)

99330 Gauge invariance and fermion doubling on the lattice. R.Stacey (Dept. of Appl. Math. & Theoretical Phys., Univ. of Liverpool, Liverpool, England).
Z. Phys. C (Germany), vol.19, no.1, p.75-8 (1983).
The author considers a possible chiral invariant solution of the lattice fermion doubling problem. This makes the unwanted states decouple in the continuum limit, at least in the noninteracting theory. The introduction of gauge interactions restores doubling. He examines how local gauge invariance makes all the species in a doubled spectrum act alike. He generalises earlier results to show how gauge invariance forces a doubled spectrum even when other considerations do not. (8 refs.)

99331 The generalized non-Abelian Toda lattice. Z.Popowicz (Inst. of Theoretical Phys., Univ. of Wroclaw, Wroclaw, Poland).
Z. Phys. C (Germany), vol.19, no.1, p.79-81 (1983).
The author constructs a Backlund transformation and inverse scattering form for the generalized nonAbelian Toda lattice. He investigates the continuum limit and shows that the model, in this limit, is equivalent to the self-dual sector of the three dimensional *SU*(*N*) Yang-Mills field theory. (9 refs.)

99332 Group contraction and macroscopic quantum systems. G.Vitiello (Istituto di Fisica, Univ. di Salerno, Salerno, Italy).
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.403-6
The physical significance of group contraction in quantum field theories with spontaneous breakdown of symmetry is discussed. Low-energy theorems and macroscopic ordered state symmetry patterns and structures are observable manifestations of group contraction. (14 refs.)

99333 The algebraic geometry of multimonopoles. W.Nahm.
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.456-66 (9 refs.)

99334 Dimensional reduction, spinor fields and characteristic classes. H.Romer (Facultat fur Phys., Univ. Freiburg, Freiburg, Germany).
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.467-80
The effect of dimensional reduction, both global and local, on natural vector bundles over higher dimensional manifolds and on characteristic classes is investigated. In particular spinor fields are considered and a new mechanism for introducing a generalized spin structure by dimensional reduction is proposed. (17 refs.)

99335 Fermion fractionization in physics. R.Jackiw (Center for Theoretical Phys., MIT, Cambridge, MA, USA).
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.169-83
Discusses a novel quantum mechanical/topological phenomenon that has become a focus for contemporary research in theoretical and experimental physics as well as in mathematics. The effect is as easy to describe as it is puzzling to comprehend: when a fermion is introduced to a soliton, the fermion can split up—it can fractionize—and its quantum numbers are shared by the resulting states. In this way, fractional charge can emerge in a theory where all basic constituents carry integral charges. The author describes relativistic field theory calculations. (16 refs.)

99336 Experimental tests of gauge theories. G.Barbiellini (Lab. Nazionali di Frascati, INFN, Frascati, Italy).
Proceedings of the 1982 CERN School of Physics (CERN 83-05), Cambridge, England, 5-18 June 1982 (Geneva, Switzerland: CERN 1983), p.1-68
The author presents recent results in elementary particle physics which support the most general properties of gauge theories, such as the Lorentz nature of the gauge interaction and the universality of the weak coupling constant. The standard Glashow-Salam-Weinberg model of electroweak interactions and its support from charged-current and neutral-current interactions is discussed. The author then reviews the verification experiments for QCD, with emphasis on the limitations found. Finally, the experimental search for baryon number isolation, the prediction of the grand unified theory, is described. (52 refs.)

99337 Introduction of gauge theories. B.de Wit (NIKHEF-H, Amsterdam, Netherlands).
Proceedings of the 1982 CERN School of Physics (CERN 83-05), Cambridge, England, 5-18 June 1982 (Geneva, Switzerland: CERN 1983), p.69-101
Local gauge invariance is discussed, and a class of field theories exhibiting this property, for both Abelian and non-Abelian gauge groups, is constructed. The general implications of gauge invariance are discussed, and the author outlines how gauge theories can spontaneously acquire mass. (7 refs.)

99338 Lattice gauge theory. C.Michael (DAMTP, Univ. of Liverpool, Liverpool, England).
Proceedings of the 1982 CERN School of Physics (CERN 83-05), Cambridge, England, 5-18 June 1982 (Geneva, Switzerland: CERN 1983), p.265-80
Monte Carlo simulation methods for quantum field theory on a lattice are motivated and applications to quantum chromodynamics are discussed. The extraction of physical information concerning confinement, asymptotic freedom and hadronic masses is described. (9 refs.)

99339 Elementary methods for statistical systems, mean field, large n, and duality. C.Itzykson (CENS, Gif-sur-Yvette, France).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.61-92
The author surveys approximation schemes developed in the context of statistical mechanics and applicable to renormalisable field theories. (18 refs.)

99340 Phases in gauge theories. S.Yankielowicz (Tel-Aviv Univ., Tel-Aviv, Israel).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.115-39
Gauge theories are believed to belong to the class of theories which describe nature. At each energy (distance) scale nature can be described in terms of an effective gauge theory. For example, at present available energies physics seem to be correctly described by the standard $SU_C(3)\times SU(2)\times U(1)$ theory. It is important to note that degrees of freedom which are considered elementary on a given scale may turn out to be composite at a higher energy scale. Given the (effective) gauge theory, its large distance properties (phase struc-

ture, symmetry realization, etc.) are determined by the structure of the vacuum. The author concentrates on two aspects of the vacuum structure in gauge theories (without and with fermions): phases in pure gauge theories, and dynamical symmetry breaking—chiral symmetry realization. (30 refs.)

99341 Some new integrable models in field theory and statistical mechanics. H.de Vega (Lab. de Phys. Theorique et Hautes Energies, Univ. Pierre et Marie Curie, Paris, France).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.179-89
The triangular relations (also called factorization equations or Yang-Baxter equations) are the clue of the resolution of two-dimensional integrable models in quantum field theory and statistical mechanics. (15 refs.)

99342 Calculating the large N phase transition in lattice gauge theories. S.Samuel (Phys. Dept., Columbia Univ., New York, NY, USA).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany. 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.191-9
Aspects of the large N phase transition in lattice gauge theories are reviewed. (21 refs.)

99343 The hidden fermions in Z(2) theories. M.Srednicki (Joseph Henry Labs., Princeton Univ., Princeton, NJ, USA).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.229-39
In 1964, Schultz, Mattis, and Lieb (SML) showed that the two dimensional Ising model is equivalent to a system of locally coupled fermions. After a canonical transformation, these fermions become noninteracting, and so SML were able to construct a simple, elegant, and exact solution. Recently, Fradkin, Susskind, and Srednicki (1980) (FSS) showed that the three dimensional Z(2) gauge theory could also be rewritten in terms of locally coupled fermionic degrees of freedom. Unfortunately, the coupling turned out to be quartic, and so they were unable to solve the theory. In order to make the change to fermionic variables, both FSS and SML used a Jordan-Wigner transformation. This technique is limited to low dimensions (two for the Ising model and three for the gauge theory) if one demands local couplings only. Nevertheless, it seems intuitively plausible that higher dimensional Z(2) theories are also fermionic theories in disguise. The author shows that this is correct. Ising models and Z(2) gauge theories, in any number of dimensions, are equivalent to systems of locally coupled fermions. (10 refs.)

99344 Remarks on alternative lattice actions and phase structure of lattice models. H.Grosse (Inst. fur Theoretische Phys., Univ. Wien, Wien, Austria).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.241-8
The author states the requirements of lattice gauge theories, remarks that Manton's action violates reflection positivity, mentions the equivalence of Z_4 and $Z_2 \times Z_2$ theories and discusses how well the SU(3) gauge theory is approximated by taking nonAbelian subgroups as a gauge group. (17 refs.)

99345 Functional integration for kinks and disorder variables. B.Schroer (Inst. fur Theoretische Phys., Freie Univ., Berlin, Germany).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.261-71
Kinks or topological solitons have been known for a long time in classical nonlinear field theories. The kink solution of the two-dimensional ϕ^4 model and the one-soliton solution of the sine-Gordon equation are important and well-known special cases. Arguments based on topological stability assert that particle quantum states corresponding to such classical solutions are expected to exist, and hence a quasiclassical approach for the particle spectrum and the S-matrix appears theoretically justified. A systematic study of this approach with a hindsight from Nuclear Physics suggests the introduction of collective coordinate methods. The many papers published on the semiclassical and collective coordinate approach to the kink problem allow one clearcut conclusion: the formalism becomes complicated and loses its aesthetical appeal if used for the construction of field theoretic ('off mass shell') objects such as vacuum expectation values or matrix elements of products of fields. This feature is in fact to be expected in a formalism which treats a Lagrangian field simultaneously with the quantum mechanical degrees of freedom of the kink states. (12 refs.)

99346 Continuum (scaling) limits of lattice field theories (triviality of $\lambda\phi^4$ in $d \geq 4$ dimensions). J.Frohlich (Inst. des Hautes Etudes Sci., Bures-sur-Yvette, France).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.273-86
The author describes some recent techniques for constructing the continuum (=scaling) limit of lattice field theories, including the one- and two-component $\lambda|\phi|^4$ theories and the Ising and rotator models in a space (imaginary time) of dimension $d \geq 4$. These techniques should have applications to other related models, like the self-avoiding random walk in five or more dimensions and bond percolation in seven or more dimensions. Some plausible conjectures concerning the Gaussian nature of the scaling limit of the $d \geq 2$ dimensional rotator model and the $d \geq 4$ dimensional U(1) lattice gauge theory in the low temperature (weak coupling) phase are described. (28 refs.)

99347 Schrodinger representation in renormalizable quantum field theory. K.Symanzik (DESY, Hamburg, Germany).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.287-99 (18 refs.)

99348 All self-dual multimonopoles for arbitrary gauge groups. W.Nahm (CERN, Geneva, Switzerland).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.301-10
The ADHM formalism is adapted to self-dual multimonopoles for arbitrary charge and arbitrary gauge group. Each configuration is characterized by a solution of a certain ordinary nonlinear differential equation, which has chances to be completely integrable. For axially symmetric configurations it reduces to the integrable Toda lattice equations. The construction of the potential requires the solution of a further ordinary linear differential equation. (14 refs.)

99349 Renormalization group aspects of 3-dimensional pure U(1) lattice gauge theory. M.Gopfert, G.Mack (Inst. fur Theoretische Phys., Univ. Hamburg, Hamburg, Germany).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.311-15
The authors have studied the 3-dimensional pure U(1) lattice gauge theory model with Villain action. It was expected on the basis of the work of Polyakov (1977), Banks, Myerson and Kogut (1977) and others that this model would show confinement for all values of the coupling constant. They have proved that this is indeed the case. There were also some surprises, however, and it is of interest to discuss these from the point of view of the renormalisation group theory. (11 refs.)

99350 Ground state metamorphosis for Yang-Mills fields on a finite periodic lattice. A.Gonzalez-Arroyo, J.Jurkiewicz, C.P.Korthals-Altes (CNRS, Marseille, France).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.339-58
The authors study the weak coupling behaviour of the partition function of nonAbelian gauge fields on a finite lattice. Periodic boundary conditions are imposed. Two different power laws in the coupling β^{-1} arise for the partition function, when the dimension d of space time is larger or smaller than a critical dimension d_c. For SU(2) $d_c=4$ the authors find at this dimension power behaviour corrected by log β. The phenomenon is of practical importance in Monte Carlo simulations of the twisted action. (13 refs.)

99351 Lattice fermions and Monte Carlo simulations. P.Hasenfratz (CERN, Geneva, Switzerland).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.359-67 (16 refs.)

Proceedings of the Conference on Mathematical Analysis and Applications .... See Entry 98633

Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop .... See Entry 98651

Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981 .... See Entry 98660

Dirac-bracket quantisation of a constrained nonlinear system: the rigid rotator .... See Entry 98695

Self-triality in statistical mechanics and field theory .... See Entry 98723

Radiation gauge covariance. II. Quantization of free electromagnetic field .... See Entry 98861

Canonical quantization of local scalar fields over quantum space-time .... See Entry 98865

Magnetic monopole in the general theory of relativity .... See Entry 98898

Green's functions, states and renormalisation .... See Entry 98909

Yang-Mills vacua in a general three-space .... See Entry 98913

Octonionic torsion on S^7 and Englert's compactification of $d=11$ supergravity .... See Entry 98915

Supergravity in high dimensions .... See Entry 98922

Building linearised extended supergravities .... See Entry 98923

The multiple structure of solitons in the O(2) supergravity theory .... See Entry 98925

Ultraviolet properties of supersymetric gauge theories .... See Entry 98926

A geometrical approach to Bose and Fermi statistics .... See Entry 98943

Rotation generators in two-dimensional space and particles obeying unusual statistics .... See Entry 98945

A generalization of the proof of the triviality of scalar field theories .... See Entry 99021

Darboux transformations for non-Abelian and nonlocal equations of the Toda chain type .... See Entry 99034

Anderson transition and nonlinear σ-models .... See Entry 99041

Geometric aspects of supersymmetry and quantisation of fermions .... See Entry 99357

A variational approach to Backlund and infinitesimal Backlund transformation for Kadomtsev-Petviashvili equation .... See Entry 99361

SUSY-breaking without sliding VEV .... See Entry 99364

Extended supercurrents and the ultraviolet finiteness of N=4 supersymmetric Yang-Mills theory .... See Entry 99367

Fermion currents in 1+1 dimensions .... See Entry 99369

Thermodynamic potential of grand unified gauge theories .... See Entry 99379

Proton lifetime in an *SO*(10) grand unified theory .... See Entry 99382

Finite temperature SUSY GUT phase transitions determined by radiative corrections .... See Entry 99384

Next to leading enhancement factor for proton decay in SU_5 .... See Entry 99385

Radiative corrections of $\sin^2 \theta_W^{exp}$ in the SU(5) model .... See Entry 99392

Unification of gauge and gravity interactions from compositeness .... See Entry 99394

Conformal quantisation of electrodynamics .... See Entry 99401

Infrared coherence and the QED path integral .... See Entry 99405

Classical chromodynamics, a geometrical approach .... See Entry 99407

Restoration of the local gauge symmetry and color confinement in non-abelian gauge theories. II. .... See Entry 99408

Technicolor gymnastics .... See Entry 99409

Anomalous-dimension matrices for four-quark operators .... See Entry 99413

Asymptotic behavior of the fixed-angle on-shell quark scattering amplitudes in non-Abelian gauge theories .... See Entry 99414

Chiral invariance in the soliton bag model .... See Entry 99426

Dynamical correlations in the dual parton model .... See Entry 99430

Dual preon models. I. The SU(7)×SU(7) model .... See Entry 99432

Dual preon models. II. The SO(10)⊗SO(10) model .... See Entry 99433

Family gauge symmetry from a composite model ....See Entry 99434

Mass splitting of the pseudoscalar mesons by Monte Carlo technique ....See Entry 99443

Possible explanation for scaling violation in hadron interactions above 10^3 TeV ....See Entry 99487

A connection between the relativistic mean field approach and effective interactions ....See Entry 99530

Neutrinoless $\beta\beta$-decay in gauge theories ....See Entry 99541

Gauge invariance in heavy-ion collisions ....See Entry 99586

Geometry of multidimensional universes ....See Entry 104994

11.20 S-MATRIX THEORY

99352 Strong coupling problems of *S*-matrix equations. J.Kupsch (Fachbereich Phys., Univ. Kaiserslautern, Kaiserslautern, Germany).
Fortschr. Phys. (Germany), vol.31, no.6, p.339-56 (1983).
The analytic continuation of the solutions of nonlinear *S*-matrix equations for large values of a coupling parameter is investigated. (19 refs.)

The analytically continued *S* matrix for potentials defined as a sum of exponentials. II. The multichannel problem ....See Entry 98813

A description of virtual scattering in the rigged Hilbert space formulation of quantum mechanics ....See Entry 98821

Quantum non-local charge and exact S-matrix of the Gross-Neveu model ....See Entry 99311

11.30 SYMMETRY AND CONSERVATION LAWS

(see also 02.20 Group theory)

99353 Linear potential and spontaneous breakdown of chiral symmetry. O.Pene (Lab. de Phys. et Hautes Energies, Univ. Paris XI, Orsay, France).
Acta Phys. Pol. B (Poland), vol.B14, no.7, p.499-509 (July 1983).
After a brief pedagogical reminder of the standard ideas about spontaneous chiral symmetry breaking, the author shows, after Nambu (1961) how the ideas of BCS theory of superconductivity can be applied to explain dynamically spontaneous chiral symmetry breaking. More specifically, the Bogoliubov-Valatin variational method is applied to a model of massless quarks interacting via a chiral invariant attractive color linear potential. It is shown analytically that due to the quark's negative self energy, chiral symmetry is spontaneously broken in this model for any value of the parameters. (5 refs.)

99354 Space and time reversals. III. Pseudo-linear wave equations; special broken symmetries. A.Blandin (Lab. de Phys. des Solides, Univ. de Paris-Sud, Orsay, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.19, p.1477-80 (30 May 1983). In French.
For pt.II see ibid., vol.295, p.641 (1982). The author defines the concept of pseudolinear equations: equations linear to the functions and their derivatives; but both equation operator and functions may have terms proportional to I, i, K or iK. A primary example of pseudolinear equations exhibits clearly the new features: special broken symmetry, two kinds of modes, crossing of the modes through reversal. A second example, taken from quantum mechanics, exhibits the same features which appear completely new. The conclusion emphasizes the new properties of pseudolinear equations and the notion of special broken symmetries and its possible applications: irreversibility, complete nonconservation of parity. (1 ref.)

99355 .A property of the structure constants of finite dimensional compact simple Lie algebras. M.L.Metha, J.M.Normand (CENS, Gif-sur-Yvette, France), V.Gupta.
Commun. Math. Phys. (Germany), vol.90, no.1, p.69-78 (1983).
Considers products of structure constants of a finite-dimensional compact simple Lie algebra, in which all indices except a few are contracted in pairs. The authors prove that such a product is zero if only one index is free, is proportional to the Cartan-Killing tensor if two indices are free and is proportional to a structure constant itself if three indices are free. For SU(n), $n\geq 3$ they also consider products of usual d (related to the anti-commutator) and structure constants f. The results for one and two free indices are still valid. For three free indices the product is proportional to either an f or a d according to whether the number of fs in the product is odd or even. (7 refs.)

99356 Kronecker product of Sp(2*n*) representations using generalised Young tableaux. G.Girardi, A.Sciarrino, P.Sorba (LAPP, Annecy-le-Vieux, France).
J. Phys. A (GB), vol.16, no.12, p.2609-14 (21 Aug. 1983).
Using generalised Young tableaux, the authors obtain an explicit formula for the reduction of the Kronecker product of irreducible representations of the symplectic groups. This extends a previous work devoted to the case of orthogonal groups. (11 refs.)

99357 Geometric aspects of supersymmetry and quantisation of fermions. V.Aldaya, J.A.de Azcarraga (Dept. de Fisica Teorica, Univ. de Valencia, Valencia, Spain).
J. Phys. A (GB), vol.16, no.12, p.2633-9 (21 Aug. 1983).
The authors analyse the geometric content of some aspects of supersymmetry by generalising a procedure of geometric quantisation recently proposed. The method is entirely based on a group, the 'quantum group'; by generalising it to a supergroup they are able to quantise simultaneously bosons and fermions and to exhibit the geometric origin of the so-called covariant derivatives. The paper is restricted to Galilean supersymmetry, but this is not a limitation of the procedure which applies to extended super-Poincare supersymmetry as well. (27 refs.)

99358 Clebsch-Gordan coefficients for SU(5)⊃SU(3)×SU(2)×U(1) theories. In-Gyu Koh, J.Patera, C.Rousseau (Centre de Recherche de Math. Appliquees, Univ. de Montreal, Montreal, Quebec, Canada).
J. Math. Phys. (USA), vol.24, no.8, p.1955-67 (Aug. 1983).
The Clebsch-Gordan coefficients are calculated for the following tensor products of SU(5) representations: $5\otimes 5$, $5\otimes 10$, $5\otimes\overline{10}$, $15\otimes 5$, $15\otimes\bar{5}$, $10\otimes 10$, $5\otimes\bar{5}$, $10\otimes\overline{10}$, $5\otimes 24$, and $10\otimes 24$. Each case is calculated twice: once in a weight vector basis independent of any semisimple subgroup, the second time in a basis which refers to SU(3)×SU(2)×U(1)⊂SU(5). (9 refs.)

99359 Octonionic description of exceptional Lie superalgebras. A.Sudbery (Dept. of Maths., Univ. of York, Heslington, England).
J. Math. Phys. (USA), vol.24, no.8, p.1986-8 (Aug. 1983).
The structures of the exceptional Lie superalgebras G(3) and F(4) are expressed in terms of octonions. (6 refs.)

99360 Reduction of the U(∞) supersymmetry theory to a random-matrix model. R.L.Mkrtchyan, S.B.Khokhlachev (L.D. Landau Inst. of Theoretical Phys., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.3, p.193-5 (5 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.3, p.160-1 (5 Feb. 1983).
The limit $N\rightarrow\infty$ is analysed for U(N)-invariant supersymmetry theories. It is shown that it is not necessary to to freeze the momenta when such theories are reduced to a random matrix model by the Eguchi-Kawai method (1982). This assertion significantly simplifies numerical calculations in such theories. (7 refs.)

99361 A variational approach to Backlund and infinitesimal Backlund transformation for Kadomtsev-Petviashvili equation. A.Roy Chowdhury, S.Ahmad (Dept. of Phys., Jadavpur Univ., Calcutta, India).
Phys. Lett. A (Netherlands), vol.97A, no.3, p.81-4 (15 Aug. 1983).
A new form of the Backlund transformation for the Kadomtsev-Petviashvili equation is obtained through the variational formalism. At no stage do the authors use the equation of motion for the deduction of the Backlund transformation. So they follow the method of Steudel (1975) for the derivation of the infinite number of conservation laws using Noether's theorem in three dimensions and the corresponding infinitesimal Backlund transformation. (9 refs.)

99362 Search for supersymmetry at the $\bar{p}p$ collider. J.Ellis, J.S.Hagelin (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA), D.V.Nanopoulos, M.Srednicki.
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.233-41 (28 July 1983).
Many models of broken supersymmetry predict the existence of supersymmetric fermions $\chi^{\pm,0}$ with masses less than the $W^{\pm}$ and Z^0. Often there are two light neutral fermions χ^0, even in models with large gaugino masses. The $W^{\pm}$ have large branching ratios for decays into $\chi^{\pm}+\chi^0$, with the $\chi^{\pm}$ subsequently decaying into χ^0 plus hadrons or leptons. The authors propose looking at the CERN $\bar{p}p$ collider for $W^{\pm}$ production and decay into supersymmetric fermions, a likely signature being 'zen' events with one broadened hadronic jet system recoiling against invisible missing transverse energy. (19 refs.)

99363 Flavour changes in locally supersymmetric theories. J.F.Donoghue (Dept. of Phys. & Astron., Univ. of Massachusetts, Amherst, MA, USA), H.P.Nilles, D.Wyler.
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.55-60 (18 Aug. 1983).
Locally supersymmetric models lead in general to flavour-changing gluino exchanges. The authors derive the necessary expressions for describing them in detail. They show that the K^0-$\bar{K}^0$ mixing puts a lower bound on the gravitino mass and gives new restrictions on the Kobayashi-Maskawa angles. (14 refs.)

99364 SUSY-breaking without sliding VEV. N.Dragon (Inst. fur Theoretische Phys., Univ. Heidelberg, Heidelberg, Germany).
Z. Phys. C (Germany), vol.19, no.2, p.115-17 (1983).
In the absence of gauge interactions the spontaneous breakdown of supersymmetry (SUSY) is accompanied by a scalar field whose vacuum expectation value is not determined by the tree potential. Inclusion of the gauge interactions can fix this VEV at the tree level. The situation is exemplified by a simple *SU*(2)-model yielding nonvanishing *F*- and *D*-VEVs. (5 refs.)

99365 SU(3) in an O(3) basis: eigenvalue spectrum of the Q_l^0 and O_l^0 operators. G.Vanden Berghe, H.De Meyer, J.Van der Jeugt (Rijksuniv. Gent, Gent, Belgium).
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.452-3
Hughes (1973) introduced for the SU(3)⊃O(3) group-subgroup system two invariants which he denoted as O^0 and Q_l^0. He developed a method based on shift operator techniques by which it was possible to derive general expressions in closed form for the eigenvalue spectra of both operators. The analysis was based upon relations between O(3) quadratic and triple scalar product operators of the O_l^k ($k=0, \pm 1, \pm 2$) type. Recently the authors have improved Hughes' method by considering also the relations between the O(3) non-scalar quadratic product operators of the O_l^k type. The new approach which they comment on here, consists in constructing shift operators Q_l^k ($-2\leq k\leq 2$), which are quadratic in the generators q_μ ($|\mu|\leq 2$), forming together with the three O(3) generators l_O, $l_{\pm}$ the algebra SU(3). The scalar Q_l^O introduced previously by Hughes, belongs to that class. It can be proven that all Q_l^s operators are expressible in terms of products of the type $O_{l+k}{}^jO_l^k$ ($j+k=s$). (2 refs.)

99366 SU(4) in an SO(4) basis: shift operator technique. J.Van der Jeugt, G.Vanden Berghe, H.De Meyer (Rijksuniv. Gent, Gent, Belgium).
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.454-5
The reduction of irreducible representations (IRs) (p p′p″) of SU(4) into IRs (s,t) of SO(4)=SU(2)⊗SU(2) leads to a two missing label problem. Within the shift operator formalism a basis of four functionally independent SO(4) scalars in the enveloping algebra of SU(4) can be constructed. The basis consists of the SO(4) scalar shift operator of lowest degree (which is proportional to Ω) and three linear combinations of quadratic shift operator product of scalar type. A vast amount of relations connecting these basis elements can be set up. With the aid of these, closed analytic formulae producing Ω- and Π- eigenvalues are easily deduced, even for cases of degeneracy in the SO(4) labels. (3 refs.)

99367 Extended supercurrents and the ultraviolet finiteness of N=4 supersymmetric Yang-Mills theory. K.S.Stelle (Lab. de Phys. Theorique, Ecole Normale Superieure, Paris, France).
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.337-61
Examines the questions of renormalization and stress tensor multiplet structure for N=1 to N=4 supersymmetries. The most interesting question to be faced is why the N=4 supersymmetric. Yang-Mills theory appears to have a vanishing β-function, as has been discovered by explicit calculations carried out to the three loop order (Tarasov et al. 1980; Grisaru et al. 1980, 1981; Caswell and Zanon 1981). Since a manifestly N=4 supersymmetric set of Feynman rules for this theory is not known, any attempt to explain the vanishing of the β-function from fundamental principles must rely upon a set of assumptions concerning the preservation of the extended supersymmetries or of the internal symmetries of the model. Arguments directed toward a demonstration that the β-function vanishes have been given by Ferrara and Zumino (1978) and by Sohnius and West (1981). These arguments rely on properties of the stress tensor multiplet in the presence of anomalies in N=1 and N=2 supersymmetry. After a discussion of the multiplet structure for anomalies in N=1 and N=2 supersymmetries, the author re-examines the arguments given concerning N=4 Yang-Mills theory in the light of the structure of the full N=4 stress tensor supermultiplet. (45 refs.)

99368 Strong CP violation and axions. C.Jarlskog (Dept. of Phys., Univ. of Bergen, Bergen, Norway).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.159-70
The axionic solution of the strong CP-violation is quite an exciting possibility. Its ingredients span over a large domain of theoretical ideas. The problem involves the vacuum structure of QCD, the so-called θ-vacua, topological charges and instantons. The essential elements of the solution are the axial anomaly, chiral symmetry and its spontaneous breakdown, Goldstone bosons, current algebra, Higgs scalars, gauge theories and more recently grand unification. (16 refs.)

Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop .... See Entry 98651

Spontaneous symmetry breaking in curved space-time .... See Entry 98911

Spontaneous symmetry breaking near a black hole .... See Entry 98912

$N=1$ supergravity with nonminimal coupling: a class of models .... See Entry 98914

Gravitation and symmetry breaking .... See Entry 98917

Supergravity in high dimensions .... See Entry 98922

Building linearised extended supergravities .... See Entry 98923

Ultraviolet properties of supersymetric gauge theories .... See Entry 98926

The finite-temperature phase transition at infinite N .... See Entry 99263

On the nature of the phase transition in a class of lattice gauge theories .... See Entry 99264

Four dimensional theories with composite gauge fields and their supersymmetric generalizations .... See Entry 99268

The soliton solutions of the $(1+1)$-dimensional real ϕ^4 field at finite temperature .... See Entry 99270

Intrinsic geometry of the $N=1$ supersymmetric Yang-Mills theory .... See Entry 99273

Numerical studies of Wilson loops in SU(6) gauge theory in four dimensions .... See Entry 99282

Axially symmetric gauge fields of magnetic monopoles .... See Entry 99290

Faddeev-Popov zeros and confinement of color in a hyperspherical gauge model .... See Entry 99293

Explicit evaluation of physical quantities and supersymmetry properties of the lattice $O(N)$ σ model at large N .... See Entry 99294

Perturbative fermion contribution to the average plaquette .... See Entry 99296

Zumino identities for super abelian gauge theories .... See Entry 99298

Monte Carlo measurement of the topological susceptibility in SU(3) lattice gauge theory .... See Entry 99299

Limitations to the Coleman-Weinberg mechanism of spontaneous mass generation .... See Entry 99300

A practical scheme for SU(4) flavour symmetry breaking in lattice gauge theories .... See Entry 99302

Renormalization-group study of four-dimensional SU(4) gauge theory .... See Entry 99303

Topological content of dimensional reduction .... See Entry 99305

Supersymmetry on a lattice .... See Entry 99306

On the infrared divergences of the CP^{n-1} models .... See Entry 99312

Radiative correction to the energy of a fermion in an external gauge field .... See Entry 99317

Parastatistics and gauge symmetries .... See Entry 99324

Invariant infrared regularization for supersymmetric Yang-Mills fields .... See Entry 99326

Finite temperature SU(2) gauge theory with external magnetic field .... See Entry 99329

Gauge invariance and fermion doubling on the lattice .... See Entry 99330

The generalized non-Abelian Toda lattice .... See Entry 99331

Group contraction and macroscopic quantum systems .... See Entry 99332

Introduction of gauge theories .... See Entry 99337

Phases in gauge theories .... See Entry 99340

Minimally extended electroweak gauge theories in SO(10) and E_6 .... See Entry 99372

Second-order fermion masses .... See Entry 99373

Particles, antiparticles, and generalized anomalies in grand unified theories .... See Entry 99376

One possibility of extension of symmetry group of Weinberg-Salam model. I. Formulation of model .... See Entry 99377

Branching rules and even-dimensional rotation groups SO_{2k} .... See Entry 99378

Thermodynamic potential of grand unified gauge theories .... See Entry 99379

Finite temperature SUSY GUT phase transitions determined by radiative corrections .... See Entry 99384

Next to leading enhancement factor for proton decay in SU_5 .... See Entry 99385

Mass spectra in SU(5) supersymmetric models of grand unification with Higgs particles in representations 75 or 24 .... See Entry 99386

The DEMON of local SUSY .... See Entry 99387

The symmetry breaking pattern $SU(5)\rightarrow SU(3)\times U(1)$ including one loop radiative corrections .... See Entry 99391

Radiative corrections of $\sin^2\theta_W^{exp}$ in the SU(5) model .... See Entry 99392

Unification and grand unification .... See Entry 99393

Radiative symmetry breaking in grand unified theories .... See Entry 99395

The $1/N$ expansion in A U(N)-symmetric SQED in four dimensions .... See Entry 99404

Restoration of the local gauge symmetry and color confinement in non-abelian gauge theories. II. .... See Entry 99408

Technicolor gymnastics .... See Entry 99409

On the nucleon residues into quark currents .... See Entry 99420

Chiral invariance in the soliton bag model .... See Entry 99426

Dual preon models. I. The $SU(7)\times SU(7)$ model .... See Entry 99432

Dual preon models. II. The $SO(10)\otimes SO(10)$ model .... See Entry 99433

Family gauge symmetry from a composite model .... See Entry 99434

Weak interaction symmetry and generation structure in the quasi-Nambu-Goldstone fermion picture of quarks and leptons .... See Entry 99435

An ISU(3) hadron mass formula .... See Entry 99441

Search of *CP* violation in the $K^0\rightarrow 3\pi^0$ decay .... See Entry 99447

ϵ'/ϵ and $\Delta I=1/2$ matrix element enhancement .... See Entry 99450

An explicit spin-isospin dependence of the nucleon partial decay amplitudes .... See Entry 99452

More about proton decay due to $d=5$ operators .... See Entry 99453

Meson-exchange corrections to the nuclear weak axial charge density in the hard pion model and $0^+\rightleftarrows 0^-$ transitions in $A=16$ nuclei .... See Entry 99505

SO(2n+1) in an $[SU(2)]^n$ basis: symmetric representations .... See Entry 99523

Geochemical double beta decay experiments .... See Entry 99539

Recent results obtained in experiments on double beta decay of ^{76}Ge and other nuclides .... See Entry 99540

Neutrinoless $\beta\beta$-decay in gauge theories .... See Entry 99541

Improved experimental test of detailed balance and time reversibility in the reactions $^{27}Al+p\rightleftharpoons ^{24}Mg+\alpha$ .... See Entry 99576

A study of charge symmetry breaking effects in elastic $\pi^{\pm}d$ scattering .... See Entry 99601

Parity violation in atomic cesium and alternatives to the standard model of electroweak interactions .... See Entry 100590

Dynamic symmetries in quantum electronics .... See Entry 100720

Mechanism of generating isothermal perturbation by a strong *CP* nonconservation .... See Entry 104998

11.40 CURRENTS AND THEIR PROPERTIES

99369 Fermion currents in 1+1 dimensions. A.L.Carey (Dept. of Pure Math., Univ. of Adelaide, Adelaide, Australia), C.A.Hurst, D.M.O'Brien.
J. Math. Phys. (USA), vol.24, no.8, p.2212-21 (Aug. 1983).
Let $\mathcal{F}$ denote the Fock space for a free massless fermion field in two space-time dimensions. If Q and Q_5 denote the charge and chiral charge operators, then $\mathcal{F}=\oplus\mathcal{F}_{n1,n2}$, where $\mathcal{F}_{n1,n2}$ is the joint eigenspace of Q and Q_5 with corresponding eigenvalues n_1 and n_2. The smeared time-zero free fermion currents formally given by $J_\mu(f)=\int:\bar\psi(x)\gamma_\mu\psi(x):f(x)dx[\mu=0,1;f\$G\in s(\mathbf{R})]$ are in fact self-adjoint densely defined operators on $\mathcal{F}$ and their exponentials generate a C^* algebra which leaves each subspace $\mathcal{F}_{n1,n2}$ invariant. If a peridoic box cutoff for the fermions is introduced, Uhlenbrock (1967) has shown that this C^* algebra acts irreducibly in each 'sector' $\mathcal{F}_{n1,n2}$. The authors prove this same result without any cutoffs and determine the properties of the representations in each sector. The importance of this result for the problem of constructing fermion fields from 'observables' in two-dimensional models, such as those of Thirring and Schwinger, is discussed. (17 refs.)

Experimental tests of gauge theories .... See Entry 99336

Extended supercurrents and the ultraviolet finiteness of $N=4$ supersymmetric Yang-Mills theory .... See Entry 99367

On the nucleon residues into quark currents .... See Entry 99420

11.50 DISPERSION RELATIONS AND SUM RULES

On the nucleon residues into quark currents .... See Entry 99420

What do the data for the Υ family say about $\langle 0|(\alpha_s/\pi)G^a_{\mu\nu}G^a_{\mu\nu}|0\rangle$? .... See Entry 99422

11.60 COMPLEX ANGULAR MOMENTUM; REGGE FORMALISM

(see also 03.80 General theory of scattering, 12.40M in strong interactions)

(Super)gravity in the complex angular momentum plane .... See Entry 98924

11.80 RELATIVISTIC SCATTERING THEORY

(see also 03.80 General theory of scattering)

99370 Eikonal representation of N-body Coulomb scattering amplitudes. J.M.Fried, K.Kang (Dept. of Phys., Brown Univ., Providence, RI, USA), B.H.J.McKellar.
Phys. Rev. A (USA), vol.28, no.2, p.738-50 (Aug. 1983).
A new technique for the construction of N-body Coulomb scattering amplitudes is proposed, suggested by the simplest case of $N=2$. Calculate the scattering amplitude in eikonal approximation, discard the infinite phase factors which appear upon taking the limit of a Coulomb potential, and treat the remainder as an amplitude whose absolute value squared produces the exact, Coulomb differential cross section. The method easily generalizes to the N-body Coulomb problem for elastic scattering, and for inelastic rearrangement scattering of Coulomb bound states. The authors give explicit results for $N=3$ and 4; in the $N=3$ case they extract amplitudes for the processes $(12)+3\rightarrow 1+2+3$ (breakup), $(12)+3\rightarrow 1+(23)$ (rearrangement), and $(12)+3\rightarrow(12)'+3$ (inelastic scattering) as residues at the appropriate poles in the free-free amplitude. The method produces scattering amplitudes f_N given in terms of explicit quadratures over $(N-2)^2$ distinct integrands. (11 refs.)

12.00 SPECIFIC THEORIES AND INTERACTION MODELS; PARTICLE SYSTEMATICS

Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981 .... See Entry 98660

12.10 UNIFIED FIELD THEORIES AND MODELS

99371 Neutrino oscillations in grand unified theories. K.A.Milton (Oklahoma State Univ., Stillwater, OK, USA).

AIP Conf. Proc. (USA), no.99, p.187-92 (1983). (Neutrino Mass and Gauge Structure of Weak Interactions, Cable, WI, USA, Sept. 1982).

The natural scale of ν_e mixing angles in SO(10) is small, of order $\theta_c/3$. It is possible to achieve large ν_e mixing angles θ, but such solutions are unstable, in the sense that $\alpha\partial\tan\theta/\partial\alpha \sim 100$, where α is a Majorana mass parameter. This difficulty reflects the quark mass hierarchy. On the other hand, ν_μ-ν_τ mixing could naturally be substantial. These qualitative features would be expected to hold any grand unified model where the Gell-Mann-Ramond-Slansky mechanism generates naturally small neutrino masses. (21 refs.)

99372 Minimally extended electroweak gauge theories in SO(10) and E_6. R.W.Robinett (Dept. of Phys., Univ. of Wisconsin, Madison, WI, USA), J.L.Rosner.

AIP Conf. Proc. (USA), no.99, p.193-201 (1983). (Neutrino Mass and Gauge Structure of Weak Interactions, Cable, WI, USA, Sept. 1982).

The possibility of minimally extending the standard $SU(2)_L \times U(1)$ electroweak theory within the context of SO(10) and E_6 grand unification by adding U(1) factors is explored. The neutrino neutral current interactions in these schemes are arranged to coincide with the standard model predictions. Limits on the masses of the extra Z's generated by these U(1) factors are obtained by considering other parity violating effects. Additional Z's as light as 2.5-3.0 times the standard model Z° mass are allowed. (23 refs.)

99373 Second-order fermion masses. C.N.Leung (School of Phys. & Astron., Univ. of Minnesota, Minneapolis, MN, USA), R.W.Robinett, J.L.Rosner.

AIP Conf. Proc. (USA), no.99, p.202-6 (1983). (Neutrino Mass and Gauge Structure of Weak Interactions, Cable, WI, USA, Sept. 1982).

An SO(10) model with the lowest-energy symmetry breaking arising from two members of a 16-plet of Higgs bosons can lead to fermion masses if, in addition to fermion 16-plets, there are heavy fermions belonging to SO(10) singlets. Some consequences of this model for neutrino masses are explored briefly. (13 refs.)

99374 New limits on oscillation parameters for electron antineutrinos. J.-L.Vuilleumier.

AIP Conf. Proc. (USA), no.99, p.252-63 (1983). (Neutrino Mass and Gauge Structure of Weak Interactions, Cable, WI, USA, Sept. 1982).

The positron spectrum from the reaction $\bar{\nu}_e + p \rightarrow e^+ + n$ has been measured at $L = 37.9$ m from the core of the Goesgen power reactor to search for neutrino oscillations of the type $\bar{\nu}_e \rightleftharpoons x$ in the low mass parameter range. The results are consistent with the no oscillation hypothesis. Upper limits of $\Delta^2 < 0.016$ eV^2 (90% C.L.) for full mixing, and $\sin^2 2\theta < 0.17$ (90% C.L.) in the limit of large mass parameters were determined. For the ratio of the integrated experimental yield to that predicted for the case of no oscillations a value of 1.05 ± 0.02 (statistical) ± 0.5 (systematics; 68% C.L.) was obtained. (8 refs.)

99375 Neutrino oscillation experiments at CERN. M.Baldo-Ceolin (Istituto di Fisica, Univ. di Padova, Padova, Italy).

AIP Conf. Proc. (USA), no.99, p.264-71 (1983). (Neutrino Mass and Gauge Structure of Weak Interactions, Cable, WI, USA, Sept. 1982).

A review is given of the three neutrino oscillation experiments which will be started in Spring 1984 at CERN-PS. Their main characteristics are presented. Possible analyses with three oscillation parameters are also discussed. (6 refs.)

99376 Particles, antiparticles, and generalized anomalies in grand unified theories. M.Singer (Dept. of Phys., Simon Fraser Univ., Burnaby, BC, Canada).

Can. J. Phys. (Canada), vol.61, no.8, p.1169-71 (Aug. 1983).

Grand unified theories of strong-weak electromagnetic interactions require both chiral states of all charged fermions to be present so that the theories will have no massless charged particles. For a large class of theories this condition requires not only the absence of all triangle anomalies, but the absence of 'odd-number generalized anomalies' as well. Conversely, the requirement that these theories be odd-number generalized anomaly free guarantees that both chiral states of all charged fermions are present, and thus all charged fermions can acquire mass. (9 refs.)

99377 One possibility of extension of symmetry group of Weinberg-Salam model. I. Formulation of model. S.F.Sultanov.

Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.4, p.58-64 (1982). In Russian.

The extension of the symmetry group of the Weinberg-Salam model up to $SU(2) \times U(1) \times U'(1)$ has been considered. This extension may be connected with the version of lepton charge assignments in which only one additive lepton number having various values for (ν_e, e^-), (ν_μ, μ^-) and (ν_τ, τ^-) was introduced. The part of lagrangian responsible for interaction of photon. $W^\pm$- and Z-bosons coincides with the Weinberg-Salam lagrangian. The model also contains neutral vector boson X having arbitrary mass and interacting with leptonic currents. (9 refs.)

99378 Branching rules and even-dimensional rotation groups SO_{2k}. G.R.E.Black, B.G.Wybourne (Phys. Dept., Univ. of Canterbury, Christchurch, New Zealand).

J. Phys. A (GB), vol.16, no.11, p.2405-21 (1 Aug. 1983).

Unambiguous methods are developed for calculating branching rules for the classical subgroups of the even-dimensional rotation group SO_{2k}. Complete results are given for the subgroups $SU_k \times U_1$, $SO_{2k-2} \times U_1$, $SO_{2p} \times SO_{2q}$ and $SO_{2p+1} \times SO_{2q+1}$. A number of examples relevant to problems in supergravity and unification theories are given. A complete resolution of the antisymmetric powers of the basic spinor irrep of SO_{10} is given and the results extended to SO_{11}. (23 refs.)

99379 Thermodynamic potential of grand unified gauge theories. T.Toimela (Res. Inst. for Theoretical Phys., Univ. of Helsinki, Helsinki, Finland).

J. Phys. G (GB), vol.9, no.8, p.L153-8 (Aug. 1983).

The thermodynamic potential for an arbitrary asymptotically free unified gauge theory is considered at higher temperatures. The calculations are performed up to $O(g^4 \ln g)$. The results are further specialised in an SU(5) model and within this model the equation of state is derived for the matter in the very early universe. (12 refs.)

99380 Three-quark fusion in a proton electromagnetic vertex. R.A.Buchl (Dept. of Phys., Univ. of Petroleum & Minerals, Dhahran, Saudi Arabia), B.P.Nigam.

Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.13, p.465-6 (30 July 1983).

The three-quark fusion process $(3q \rightarrow e^+)$ is used twice to form a proton electromagnetic vertex. According to a grand unified theory an extremely small contribution to the proton electromagnetic vertex is calculated and expressible in terms of the electric form factor as $F_1^{\text{fusion}}(0) \approx 1.1 \times 10^{-62}$. (7 refs.)

99381 Neutrino oscillations with large oscillation length in spite of large (Majorana) neutrino masses?. S.M.Bilenky, B.Pontecorvo (Joint Inst. for Nuclear Res., Moscow, USSR).

Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.13, p.467-71 (30 July 1983).

A model is given in which neutrino oscillations with two Majorana mass eigenstates are entirely similar to $K^0 \rightleftarrows K^0$ oscillations: with a maximum oscillation amplitude, a mass difference $(m_1$-$m_2)$ much less than m_1, m_2, and opposite PC-eigenvalues of the Majorana neutrinos. It is plausible that a realistic situation with more than two Majorana neutrinos could well have similar features. (16 refs.)

99382 Proton lifetime in an $SO(10)$ grand unified theory. T.Matsuki (Nat. Lab. for High Energy Phys., Ibaraki, Japan), N.Yamamoto.

Prog. Theor. Phys. (Japan), vol.69, no.5, p.1505-23 (May 1983).

The mass of lepto-quark gauge boson and the nucleon lifetime are estimated in an $SO(10)$ grand unified theory. The authors use the β-function including the gauge boson mass effects explicitly, and solve renormalization group equation numerically. They also discuss the dependence of results on the various parameters of this theory. (18 refs.)

99383 Comment on 'Upper bounds on the Higgs-Boson mass and the coupling constant'. M.Sher (Dept. of Phys., Univ. of California, Irvine, CA, USA).

Phys. Rev. Lett. (USA), vol.51, no.5, p.434 (1 Aug. 1983).

Recently Uchiyama has claimed (ibid., vol.50, p.946, 1983) that upper bounds on the Higgs mass, m_H, and on the scalar coupling, λ, could be obtained in the Glashow-Weinberg-Salam model by considering scalar-loop corrections to the effective potential. The author points out an error in this analysis which, when corrected, eliminates this bound. (3 refs.)

99384 Finite temperature SUSY GUT phase transitions determined by radiative corrections. J.Kripfganz, H.Perlt (Sektion Phys., Karl-Marx-Univ., Leipzig, Germany).

Phys. Lett. B (Netherlands), vol.127B, no.1-2, p.95-6 (21 July 1983).

Studying the two-loop perturbative contribution to the free energy of grand unified theories a sequence of phase transitions is found, with $SU(3) \times SU(2) \times U(1)$ being the preferred low temperature phase. The transition temperatures are still within the weak coupling regime. (3 refs.)

99385 Next to leading enhancement factor for proton decay in SU_5. M.Daniel (Rutherford & Appleton Lab., Didcot, England), J.A.Penarrocha.

Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.219-23 (28 July 1983).

The authors give a complete calculation within the SU(5) GUT model of the next to leading enhancement factor for nucleon decay due to renormalisation effects arising from hard gluons, W's and B's in processes involving (u,d,e,ν_e). The result is sensitive to the ratios $x_i = M_{H(i)}/M_X$ where $M_{H(i)}$ are the masses of the superheavy Higgs scalars in the 24 multiplet which breaks $SU_5 \rightarrow SU_3 \times SU_2 \times U_1$. (16 refs.)

99386 Mass spectra in SU(5) supersymmetric models of grand unification with Higgs particles in representations 75 or 24. I.G.Koh, J.Patera (Dept. of Phys., Sogang Univ., Seoul, Korea).

Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.224-81 (28 July 1983).

The results of a computation of mass spectra in SUSY models of grand unification in SU(5) are presented. The method uses systematically weight vectors as bases for representation spaces. It is briefly explained on an SU(3) model which, in this formalism, has all technical features occurring in higher groups. General criteria for the choice of Higgs representation are pointed out. (12 refs.)

99387 The DEMON of local SUSY. D.V.Nanopoulos, M.Srednicki (CERN, Geneva, Switzerland).

Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.61-4 (18 Aug. 1983).

The authors discuss the dipole electric moment of the neutron (DEMON) in locally supersymmetric models, with particular attention to axionless theories with $\theta = 0$ at the Planck scale. They find that the DEMON in these theories should be near, but not above, the present experimental upper bound of $\sim 6 \times 10^{-25}$ e cm. (18 refs.)

99388 Algebraic unification. G.Dixon (Dept. of Phys., Brandeis Univ., Waltham, MA, USA).

Phys. Rev. D (USA), vol.28, no.4, p.833-43 (15 Aug. 1983).

A symplectic geometric algebra is proffered as a setting for a strong-weak-electromagnetic unification theory. Four families of leptons and quarks arise and the neutrinos acquire completely chargeless right-handed components and Dirac masses. A single mathematical origin is found for an exact, nonchiral color SU(3) and a broken chiral isospin SU(2). (10 refs.)

99389 Are weak and electromagnetic interactions unified?. N.Dombey (Phys. Div., Univ. of Sussex, Brighton, England).

Surv. High Energy Phys. (Switzerland), vol.3, no.1, p.1-25 (1982).

The standard electroweak model is described, and critically reviewed. An alternative model which is consistent with all known features of the weak interaction but which does not unify it with electromagnetism is presented. (34 refs.)

99390 Radiative corrections to masses in the standard model with two scalar doublets. J.-M.Frere (Faculte des Sci., Univ. Libre de Bruxelles, Bruxelles, Belgium), J.A.M.Vermaseren.

Z. Phys. C (Germany), vol.19, no.1, p.63-7 (1983).

The authors calculate the one loop corrections to the vector boson masses and the ρ parameter in a standard model with two scalar doublets and a complex scalar singlet, the so-called 'superlight axion' model. They find that the deviations from the corrections of the Weinberg-Salam model are practically unobservable when the spectator higgses are very heavy. (9 refs.)

99391 The symmetry breaking pattern $SU(5) \rightarrow SU(3) \times U(1)$ including one loop radiative corrections. C.M.Fraser (Dept. of Theoretical Phys., Univ. of Oxford, Oxford, England), H.Huffel.

Z. Phys. C (Germany), vol.19, no.2, p.101-5 (1983).

The authors derive conditions on the Higgs parameters of the minimal SU(5) model under which the phenomenologically desired symmetry breaking pattern $SU(5) \rightarrow SU(3) \times U(1)$ persists at the one loop level. (10 refs.)

99392 Radiative corrections of $\sin^2 \theta_W{}^{\text{exp}}$ in the SU(5) model. C.Deom, J.Pestieau (Inst. de Phys. Theorique, Univ. Catholique de Louvain, Louvain-la-Neuve, Belgium).

Z. Phys. C (Germany), vol.19, no.2, p.133-5 (1983).

The authors compute perturbatively in the SU(5) grand unification theory the radiative corrections to $\sin^2\theta_W{}^0$ through a phenomenological weak mixing angle, $\sin^2\theta_W{}^{\text{exp}}(q^2)$, defined in the $\nu_\mu e$ elastic scattering. They essentially recover the results obtained by using the renormalization group analysis. (10 refs.)

99393 Unification and grand unification. R.D.Peccei (Werner-Heisenberg-Inst. fur Phys., Max-Planck-Inst. fur Phys. und Astrophys., Munich, Germany).
Proceedings of the 1982 CERN School of Physics (CERN 83-05), Cambridge, England, 5-18 June 1982 (Geneva, Switzerland: CERN 1983), p.187-246
The author reviews the salient features of the standard model of electroweak and strong interactions and considers possible left-right symmetric extensions of this model. The motivations for further unification of the known forces are examined and an introduction is given to grand unified theories. The predictions of the minimal SU(5) model are critically analyzed and a brief discussion is given for some of the extant problems associated with grand unified theories. (75 refs.)

99394 Unification of gauge and gravity interactions from compositeness. G.Veneziano (CERN, Geneva, Switzerland).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.141-58
The author proposes and discusses a theoretical framework in which all gauge symmetries are introduced in the same way, i.e. in terms of fundamental fermionic fields only. Gauge bosons, as well as gravitons, will be composite and their interactions will be automatically unified (and strong) at the same scale, the inverse radius of compositeness. (8 refs.)

99395 Radiative symmetry breaking in grand unified theories. N.Dragon, B.Stech (Inst. fur Theoretische Phys., Univ. Heidelberg, Heidelberg, Germany).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.327-37
Motivated by composite models, the authors start from O(n)-invariant tree potentials for the scalar fields of unified theories and calculate the dynamical symmetry breaking caused by radiative effects. A phenomenologically interesting variety of breaking patterns is obtained. In reducible representations of the scalar fields only the field with the largest Casimir number obtains vacuum expectation values. Right-left symmetric models experience a spontaneous parity breakdown for a range of values of the coupling parameter. (15 refs.)

Proceedings of the 1982 CERN School of Physics (CERN 83-05) ..... See Entry 98658
Magnetic monopole in the general theory of relativity ..... See Entry 98898
Experimental tests of gauge theories ..... See Entry 99336
Flavour changes in locally supersymmetric theories ..... See Entry 99363
Technicolor gymnastics ..... See Entry 99409
On the nucleon residues into quark currents ..... See Entry 99420
Dual preon models. I. The SU(7)×SU(7) model ..... See Entry 99432
Dual preon models. II. The SO(10)⊗SO(10) model ..... See Entry 99433
ϵ'/ϵ and $\Delta I=1/2$ matrix element enhancement ..... See Entry 99450
An explicit spin-isospin dependence of the nucleon partial decay amplitudes ..... See Entry 99452
More about proton decay due to $d=5$ operators ..... See Entry 99453
Resonant neutrino activation and neutrino oscillations ..... See Entry 99543
Parity violation in atomic cesium and alternatives to the standard model of electroweak interactions ..... See Entry 100590
Neutron oscillation and the primordial magnetic field ..... See Entry 104983
On dissipational processes in the cosmological GUT era ..... See Entry 104986
Mechanism of generating isothermal perturbation by a strong *CP* nonconservation ..... See Entry 104998
Irregularities formed by a cosmological axion field ..... See Entry 105000
Phase transitions in the early Universe ..... See Entry 105004

12.20 MODELS OF ELECTROMAGNETIC INTERACTIONS

99396 Field asymptotic behaviour of a polarization operator. Yu.M.Loskutov, B.A.Lysov, V.V.Skobelev (Moscow State Univ., Moscow, USSR).
Theor. & Math. Phys. (USA), vol.53, no.3, p.1252-5 (Dec. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.3, p.469-73 (Dec. 1982).
In the framework of the two-dimensional approximation of quantum electrodynamics the field asymptotic behaviour of the photon polarization operator in a superstrong magnetic field is analyzed. It is shown that in the region $10^3 \lesssim (B/B)_0 \lesssim 10^4$, $B_0 = m^2/e$, transition toa superstrong field in the individual orders of perturbation theory with subsequent summation over α leads to a nonsingular expression for the photon propagator, i.e. there is no 'zero-charge' problem. (10 refs.)

12.20D Specific calculations and limits of quantum electrodynamics

99397 A quantization of the electromagnetic field. A.Z.Capri, G.Grubl, R.Kobes (Theoretical Phys. Inst., Univ. of Alberta, Edmonton, Alberta, Canada).
Can. J. Phys. (Canada), vol.61, no.8, p.1172-83 (Aug. 1983).
Quantization of the electromagnetic field in a class of covariant gauges is performed on a positive metric Hilbert space. Although losing manifest covariance, the authors find at the free field level the existence of two physical spaces where Poincare transformations are implemented unitarily. This gives rise to two different physical interpretations of the theory. Unitarity of the *S* operator for an interaction with an external source then forces one to postulate that a restricted gauge invariance must hold. This singles out one interpretation, the one where two transverse photons are physical. (11 refs.)

99398 Portraits of the flux tube in QED$_3$: a Monte Carlo simulation with external sources. T.Sterling (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA), J.Greensite.
Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B220(FS8), no.3, p.327-50 (25 July 1983).
The authors determine numerically, and display graphically, the electromagnetic energy distribution due to static sources in compact QED$_3$. Using the polymer formulation of the functional integral Monte Carlo simulations are performed with external sources included in the lattice action. Both the Wilson and Villain forms of the action are studied, and the string tension is determined in a small range of weak couplings. For the Villain action, their values for the string tension σ are in agreement with Polyakov's formula. For the Wilson action, they are able to detect a string tension in a range of weak couplings $2.1 \leq \beta \leq 2.3$ below the weak-to-strong coupling cross-over point. In the same range, standard Monte Carlo results for up to 8×8 Wilson loops are consistent with ordinary perturbation theory (no confinement). A possible explanation of this discrepancy is discussed, and it is suggested that the standard (source-free) Monte Carlo might miss configurations which are important for flux-tube formation. (12 refs.)

99399 Aspects of the infrared problem in quantum electrodynamics. K.Kraus (Phys. Inst., Univ. Wurzburg, Wurzburg, Germany).
Found. Phys. (USA), vol.13, no.7, p.701-13 (July 1983).
Scattering states in quantum electrodynamics cannot be represented in Fock space (i.e. as states with finitely many incoming and outgoing free photons), since most collisions involve the emission of infinitely many soft photons. At present, there exist two alternative proposals for an appropriately modified structure of the asymptotic state space of quantum electrodynamics. According to the 'infraparticle' proposal, each charged particle which would be accompanied by an appropriate cloud of infinitely many soft photons, whereas according to the 'infravacuum' proposal these clouds would be replaced by a common soft photon background. The second (less popular) idea is illustrated and motivated here by simple model calculations. (14 refs.)

99400 Finite temperature and density corrections to quantum electrodynamics. J.Z.Kaminski (Inst. of Theoretical Phys., Warsaw Univ., Warsaw, Poland).
J. Phys. A (GB), vol.16, no.11, p.2587-98 (1 Aug. 1983).
The effective Lagrangian and the electric current of quantum electrodynamics at weak electromagnetic field and low temperature is investigated. With the help of the effective Lagrangian the permittivity and permeability are obtained. The effective potential at finite temperature and density induced by the classical Coulomb potential is also obtained. It is shown that the heat corrections modify the Coulomb potential to such an extent that the effective potential adopts the Yukawa form. Some remarks are made about the electron *g* factor at finite temperature and density. (37 refs.)

99401 Conformal quantisation of electrodynamics. G.M.Sotkov, D.T.Stoyanov (Inst. for Nuclear Res. & Nuclear Energy, Sofia, Bulgaria).
J. Phys. A (GB), vol.16, no.12, p.2817-26 (21 Aug. 1983).
A new treatment of Maxwell's equations is proposed. It is shown that these equations can play the role of subsidiary conditions which separate the conformal symmetric solutions of a fixed third-order differential equation. On the basis of this equation a quantisation of Maxwell's equations is constructed such that the conformal symmetry is preserved only in the physical state space. The proposed procedure of conformal quantisation is illustrated by the example of a free electromagnetic field. (10 refs.)

99402 Weakly bound states of an electron in an external electromagnetic field. S.P.Andreev, B.M.Karnakov, V.D.Mur (Moscow Engng. Phys. Inst., Moscow, USSR).
JETP Lett. (USA), vol.37, no.3, p.187-90 (5 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.3, p.155-7 (5 Feb. 1983).
A model-independent method has been developed for calculating the spectra of weakly bound states of an electron with an arbitrary angular momentum l in an external electromagnetic field. Some results for specific fields are reported. (3 refs.)

99403 Confinement criteria and compact (QED)$_{2+1}$. T.Suzuki, K.Shimada (Dept. of Phys., Kanazawa Univ., Kanazawa, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1537-47 (May 1983).
The authors reformulate the Georgi-Glashow model in 2+1 dimensions, namely, compact (QED)$_{2+1}$ following the quantization method developed by Kugo and Ojima. It is shown that the model does not satisfy confinement criteria proposed by Kugo and Ojima, although electrically charged objects are confined in the sense of the area-law behaviour of the Wilson loop. Restoration of residual 'local gauge symmetry' is not realized either. (12 refs.)

99404 The $1/N$ expansion in A U(N)-symmetric SQED in four dimensions. O.Yasdua (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).
Phys. Lett. B (Netherlands), vol.127B, no.1-2, p.97-100 (21 July 1983).
The author investigates the possibility for a spontaneous breakdown of supersymmetry (SUSY) in a supersymmetric QED (SQED) with U(N) supersymmetry in four dimensions by using the 1/N expansion. It is shown that a pathological SUSY breaking does not occur to the leading order of the $1/N$ expansion, as long as the effective potential is real. If the reality condition of the effective potential is removed, however, there appears a pathological SUSY breaking. The difference between this model and the O(N)-symmetric Wess-Zumino model is discussed. (5 refs.)

99405 Infrared coherence and the QED path integral. M.S.Swanson (Dept. of Phys., Univ. of Connecticut, Storrs, CT, USA).
Phys. Rev. D (USA), vol.28, no.4, p.798-807 (15 Aug. 1983).
The infrared coherent states developed by Faddeev and Kulish are used to construct the path-integral representation of quantum electrodynamics. The result shows that the time-ordered products of the asymptotic fields, previously evaluated within the operator formulation, can be derived from the functional formalism. This is accomplished by retaining a nonlocal piece of the original vertex when defining the perturbation series. The resulting path integral allows exact evaluation through a nonperturbative change of spinor variables and the use of the classical solution to the gauge field equation of motion in the presence of a point source moving at constant velocity. Extension of this functional technique to the renormalized theory and to massless nonlinear theories is briefly discussed. (15 refs.)

99406 New method of allowing for the Coulomb interaction in the Logunov-Tavkhelidze quasipotential approach. Yu.N.Tyukhtyaev (Saratov State Univ., Saratov, USSR).
Theor. & Math. Phys. (USA), vol.53, no.3, p.1217-23 (Dec. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.3, p.419-28 (Dec. 1982).
The problem of taking into account Coulomb interactions of ladder type in the investigation of bound states in quantum electrodynamics by the quasipotential method is considered. The basic quasipotential equation and the expression for the quasipotential are written down in terms of two-time positive-frequency Coulomb Green's functions. A corresponding perturbation theory is developed, which makes it possible to calculate the shifts of the energy levels of hydrogen-like atoms to accuracy $\alpha^6 \ln \alpha$. (15 refs.)

On the solutions of the Dirac equation ..... See Entry 99280
Zumino identities for super abelian gauge theories ..... See Entry 99298
Gauge invariance and fermion doubling on the lattice ..... See Entry 99330

Gauge invariance in heavy-ion collisions .... See Entry 99586

Vacuum polarisation and electron screening effects on leptonic bremsstrahlung .... See Entry 102982

12.30 MODELS OF WEAK INTERACTIONS

Experimental tests of gauge theories .... See Entry 99336

Strong CP violation and axions .... See Entry 99368

Minimally extended electroweak gauge theories in SO(10) and E_6 .... See Entry 99372

12.35 COMPOSITE MODELS OF PARTICLES

99407 Classical chromodynamics, a geometrical approach. F.J.Vanhecke (Univ. Federal do Rio Grande do Norte, Natal, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.2, p.343-60 (June 1982).
Wong's equations for point-particles with non-abelian charge interacting with Yang-Mills field, can be derived in a geometrical way without resorting to field theory. Equations of motion for extended objects are derived using the same method. A short discussion of the point-particle case shows the appearance of non-local features in the Yang-Mills-Wong equations. (17 refs.)

12.35C General properties of quantum chromodynamics (dynamics, confinement, etc.)

99408 Restoration of the local gauge symmetry and color confinement in non-abelian gauge theories. II.. H.Hata (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1524-36 (May 1983).
For pt.I see ibid., vol.67, p.1607 (1982). The author considers in the covariantly gauge-fixed continuum theory of QCD formulated by the Euclidean path integral a specific local gauge symmetry transformation which changes the boundary condition of the gauge fields. This local gauge symmetry is spontaneously broken in perturbation theory. The author shows that if this symmetry is restored dynamically, then the total confinement of color is realized. The restoration condition is found to coincide with the color confinement condition proposed earlier by Kugo and Ojima. The correspondence with the symmetry restoration in the non-linear σ-models in two dimensions and the relation with our previous indirect approach are also discussed. (17 refs.)

99409 Technicolor gymnastics. S.Dimopoulos, H.Georgi, S.Raby (Dept. of Phys., Stanford Univ., Stanford, CA, USA).
Phys. Lett. B (Netherlands), vol.127B, no.1-2, p.101-5 (21 July 1983).
The authors propose a Glashow-Iliopoulos-Maiani mechanism for extended technicolor theories and illustrate it in an explicit model. They find that flavor changing neutral current effects are adequately suppressed if $m_t \ll 50$ GeV. (1 ref.)

99410 The self-energy of a heavy quark in the gluonic vacuum and the effective mass. W.Ishizuka, Y.Kikuchi (Dept. of Phys., Tohoku Univ., Sendai, Japan).
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.251-3 (28 July 1983).
The authors calculate, by use of the multipole expansion, the self-energy of the heavy quark in the gluonic vacuum from which the momentum dependent effective mass is derived. A phenomenological consequence is also discussed. (13 refs.)

99411 Universal signals of a quark-gluon plasma. B.Sinha (Nuclear Phys. Div., Bhabha Atomic Res. Centre, Bombay, India).
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.91-4 (18 Aug. 1983).
It is shown that the ratio of the production rates $(\gamma/\mu^+\mu^-)$ and $(\pi^{0,\pm}/\mu^+\mu^-)$ from a quark-gluon plasma is independent of the space-time evolution of the plasma fireball and thus universal signals of the quark phase. (15 refs.)

99412 Self-consistency correlations between QCD parameters from e^+e^- annihilation. C.Verzegnassi (Phys. Div., Univ. of Sussex, Brighton, England).
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.101-6 (18 Aug. 1983).
The author proposes a method to generate correlations between QCD parameters using the available e^+e^- data. The method reproduces 'standard' results, but needs a rather large strange quark 'mass' $\bar{m}_s \gtrsim 250$ MeV assuming 'standard' values for the non perturbative parameters. (12 refs.)

99413 Anomalous-dimension matrices for four-quark operators. R.D.C.Miller, B.H.J.McKellar (School of Phys., Univ. of Melbourne, Parkville, Victoria, Australia).
Phys. Rev. D (USA), vol.28, no.4, p.844-55 (15 Aug. 1983).
The authors present one-loop calculations of anomalous-dimension matrices γ for four-quark operators. Flavor-space indexing determines the nature of γ. Four important possibilities are considered for operators with left-left, left-right, and right-right chiral structures. (10 refs.)

99414 Asymptotic behavior of the fixed-angle on-shell quark scattering amplitudes in non-Abelian gauge theories. A.Sen (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
Phys. Rev. D (USA), vol.28, no.4, p.860-75 (15 Aug. 1983).
In this paper the author finds the asymptotic behavior of the fixed-angle on-shell quark-quark scattering amplitude in non-Abelian gauge theories in the limit of very large center-of-mass energy $\sqrt{s}$. He sums the perturbation series to all orders in the coupling constant and all powers of $\ln s$, but ignores terms which are suppressed by a power of s order by order in perturbation theory. In the $s \to \infty$ limit the amplitude vanishes as $\exp(-\alpha \ln s \ln s)$, where α is a constant. The phase of the amplitude is shown to be free from infrared divergences. Hence the phase is a perturbatively calculable function and may provide important tests of QCD. (12 refs.)

99415 Quantum chromodynamics: theory and experiment. J.F.Owens (Phys. Dept., Florida State Univ., Tallahassee, FL, USA).
Surv. High Energy Phys. (Switzerland), vol.3, no.2, p.65-96 (1982).
For more than a decade a substantial fraction of the high energy experimental program has been devoted to the gathering of data which are sensitive to the short distance behavior of the strong interaction. During the same time period a theory of the strong interaction, quantum chromodynamics (QCD), has been developed. The use of perturbation theory techniques allows some definite predictions to be made which can be tested by such data. This review is intended to give an overview of the program of testing QCD in large momentum transfer processes. For each example considered, the sensitivities of the proposed tests will be discussed and various technical difficulties will be outlined. (73 refs.)

99416 Colored scalars and new hadrons. A.Yu.Ignat'ev, V.A.Matveev, A.N.Tavkhelidze, K.G.Chetyrkin, M.E.Shaposhnikov (Inst. of Nuclear Res., Acad. of Sci., Kiev, Ukrainian SSR).
Theor. & Math. Phys. (USA), vol.53, no.2, p.1063-7 (Nov. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.2, p.181-7 (Nov. 1982).
It is shown that the introduction of light scalar quarks into quantum chromodynamics leads to the appearance of a new family of hadronic states with physical properties qualitatively different from the known mesons and baryons. The characteristic mass scale of the new hadrons is tens of GeV. It is possible that these states lie in an energy region already accessible to the existing accelerators. (17 refs.)

99417 Fundamentals of QCD. J.C.Taylor (Dept. of Appl. Math. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
Proceedings of the 1982 CERN School of Physics (CERN 83-05), Cambridge, England, 5-18 June 1982 (Geneva, Switzerland: CERN 1983), p.103-44
The author presents the Lagrangian density for quarks and their interaction with the gluon field, and discusses its form, a further term is then added to describe the gluons and their self-interaction. The Feynman rules for QCD are presented, and these are used in a discussion of Ward identities, unitary and virtual ghosts, dimensional regularisation, and coupling constant renormalisation. (no refs.)

Proceedings of the 1982 CERN School of Physics (CERN 83-05) .... See Entry 98658

A quenching scenario for lattice gauge theories .... See Entry 99266

Abelian dominance in a space-time lattice .... See Entry 99281

Faddeev-Popov zeros and confinement of color in a hyperspherical gauge model .... See Entry 99293

A study of finite sized Wilson Loops in the quenched Eguchi Kawai model .... See Entry 99295

Perturbative fermion contribution to the average plaquette .... See Entry 99296

The lattice gauge theory approach to quantum chromodynamics .... See Entry 99310

The Pade method for the study of renormalization-group equations in the region of intermediate and strong coupling .... See Entry 99319

Parastatistics and gauge symmetries .... See Entry 99324

Lattice gauge theory .... See Entry 99338

Lattice fermions and Monte Carlo simulations .... See Entry 99351

Linear potential and spontaneous breakdown of chiral symmetry .... See Entry 99353

A property of the structure constants of finite dimensional compact simple Lie algebras .... See Entry 99355

Confinement criteria and compact $(QED)_{2+1}$ .... See Entry 99403

What do the data for the Υ family say about $\langle 0|(\alpha_s/\pi)G^a_{\mu\nu}G^a_{\mu\nu}|0\rangle$? .... See Entry 99422

Large P_T spectrum as a possible signal for quark matter formation .... See Entry 99437

The exact $q\bar{q}$ potential in Nambu string theory .... See Entry 99438

Mass splitting of the pseudoscalar mesons by Monte Carlo technique .... See Entry 99443

Deep inelastic Compton process and large QCD corrections .... See Entry 99460

Nuclear physics research requirements for electron and heavy ion machines .... See Entry 99916

Irregularities formed by a cosmological axion field .... See Entry 105000

12.35E Applications of quantum chromodynamics to particle properties and reactions

99418 A deformable bag model of hadrons. I.. H.Ui, K.Saito (Dept. of Phys., Tohoku Univ., Sendai, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1467-83 (May 1983).
As a generalization of the MIT spherical bag model the authors construct the spheroidal bag model of hadron with an arbitrary eccentricity. This generalization is made by slightly modifying the MIT linear boundary condition: The model always satisfies two necessary requirements of the MIT bag model—i.e. $\mathbf{n}.\mathbf{j}=0$, no quark colour flux leaves the bag, and $\bar{q}q=0$, the scalar density of quark should vanish on the bag surface—and it reduces to the MIT spherical bag model in the limit of zero-eccentricity. Lagrangian formalism of the model is briefly described. The eigenfrequencies of a single massless quark confined in this spheroidal bag are numerically calculated. They obtain the level-splitting of the excited quark orbits, which is analogous to the well-known Nilsson's splitting of single particle orbits in deformed nuclei. By using the numerical results of the lowest orbit, the effect of the bag-deformation on the mass of low-lying hadrons is estimated. It is found that, although the spherical bag is stable, the quark bag is extremely soft against the quadrupole deformation. (10 refs.)

99419 Higgs boson production in high energy lepton-nucleon scattering. Z.Hioki, S.Midorikawa, H.Nishiura (Res. Inst. for Fundamental Phys., Kyoto Univ., Kyoto, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1484-97 (May 1983).
Higgs boson productions are studied in high energy $\nu(\bar{\nu})N$ and $l^\pm N$ scatterings. Total cross-sections are calculated at the lowest order of perturbation by taking into account two kinds of mechanisms, i.e., bremsstrahlungs from (I) strange-and charm-quark and from (II) $W^\pm$, Z boson, and detailed numerical results are presented in the framework of QCD improved parton model. In νN process, it is shown that the contribution of the mechanism (II) is dominant for an extensive range of the energy although that of the mechanism (I) increases rapidly with energy. On the contrary, both mechanisms give comparable contributions in $l^\pm N$ processes. The total cross-sections are found to be rather small for both reactions even at very high energy. (13 refs.)

99420 On the nucleon residues into quark currents. V.M.Belyaev (Inst. of Theoretical & Experimental Phys., Moscow, USSR).
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.254-6 (28 July 1983).
The amplitudes of the virtual transition of a nucleon into quark currents are discussed. The amplitude which determines the proton life time in SUSY grand unified models is found using the QCD sum rules method. (9 refs.)

99421 Light cone expansion and scaling laws for radiative orthoquarkonium decays. J.H.Kuhn (Inst. fur Theoretische Phys., RWTH Aachen, Aachen, Germany).
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.257-61 (28 July 1983).
In the framework of perturbative QCD scaling laws are derived for the decay of a heavy orthoquarkonium state into a photon and a light pseudoscalar.

From the leading term in the light cone expansion a ratio of decay widths $\Gamma({}^3S_1 \rightarrow \gamma + \text{light meson})/\Gamma({}^3S_1 \rightarrow e^+e^-)$ is obtained which decreases with the square of the mass of the heavy meson. Predictions for the rates of radiative ψ and Υ decays are given and the extension of these results to 0^{++}, 1^{++} and 2^{++} states is discussed. (10 refs.)

99422 What do the data for the Υ family say about $\langle 0|(\alpha_s/\pi)G^a_{\mu\nu}G^a_{\mu\nu}|0\rangle$?. L.J.Reinders (CERN, Geneva, Switzerland).
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.262-4 (28 July 1983).
The author shows that the data on ${}^3S_1$ upsilonium are consistent with the standard value for the gluon condensate parameter $\langle 0|(\alpha_s/\pi)G^a_{\mu\nu}G^a_{\mu\nu}|0\rangle$ contrary to a claim recently made by Zalewska and Zalewski (1983). (3 refs.)

99423 Fine and hyperfine structures of heavy quarkonia and perturbative quantum chromodynamics. J.Morishita, M.Oka (Graduate School of Sci. & Technol., Kobe Univ., Kobe, Japan), M.Kaburagi, H.Munakata, T.Kitazoe.
Z. Phys. C (Germany), vol.19, no.2, p.167-78 (1983).
Spectroscopies of the heavy quarkonia, $c\bar{c}$, $b\bar{b}$ and $t\bar{t}$, are analysed with a potential model. Relativistic effects are taken into account and spin dependent interactions are investigated in detail. The authors propose a flavor independent potential which has a Lorentz vector term determined by the perturbative QCD at short distances and a Lorentz scalar term confining quarks at large distances. It is stressed that the short range attenuation of the vector Coulomb potential has significant effects on the fine and hyperfine structures of the $c\bar{c}$ and $b\bar{b}$ systems, and also on the $t\bar{t}$ level structure. They study the decay property of the $t\bar{t}$ system, using the calculated wave functions. (22 refs.)

99424 Applications of QCD. P.V.Landshoff (Dept. of Appl. Math. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
Proceedings of the 1982 CERN School of Physics (CERN 83-05), Cambridge, England, 5-18 June 1982 (Geneva, Switzerland: CERN 1983), p.145-86
The author discusses deep inelastic scattering ($lN \rightarrow l'X$) and how it is analysed through the parton model. The Drell-Yan mechanism, e^+e^- annihilation, and photon-photon collisions are also discussed in the parton framework. How the parton model is modified by QCD effects is then considered. QCD perturbation theory is applied to wide-angle quark-quark scattering; higher order terms are discussed. (17 refs.)

Proceedings of the 1982 CERN School of Physics (CERN 83-05) .... See Entry 98658
Experimental tests of gauge theories .... See Entry 99336
The self-energy of a heavy quark in the gluonic vacuum and the effective mass .... See Entry 99410
Quantum chromodynamics: theory and experiment .... See Entry 99415
Light and heavy hadron masses in a relativistic quark potential model with diquark clustering .... See Entry 99442
Proton and neutron magnetic moments in quantum chromodynamics .... See Entry 99456
Structure functions of pseudoscalar mesons in a composite model with chromodynamic interaction .... See Entry 99458
QCD analysis of non-singlet neutrino structure functions .... See Entry 99459
Inclusive production of soft pions .... See Entry 99466
Hadroproduction of $\psi\psi$ .... See Entry 99481
Large p_T hadron production in nucleus-nucleus collisions .... See Entry 99482
Correlation of charm particles from gluon-gluon fusion in hadronic collisions .... See Entry 99484
Kinetic theory for plasmas with non-Abelian interactions .... See Entry 99528

12.35H Phenomenological composite models of particle structure and reactions (partons, bags, etc.)

99425 Growth of total cross sections and the quark structure of hadrons. S.M.Roshin, N.E.Tyurin (Inst. of High-Energy Phys., USSR).
JETP Lett. (USA), vol.37, no.2, p.139-42 (20 Jan. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.2, p.113-15 (20 Jan. 1983).
The authors have derived the dependence of the cross sections on parameters related to the hadron structure: the number and masses of the valence quarks. The dependence of the cross sections on the quark masses explains the difference in the magnitudes of the cross sections on the basis of different quark compositions of the hadrons. The limitation on the growth of the total interaction cross sections found from the general principles of field theory suggests that the mass of the $u(d)$ quark must have a lower limit of the π-meson mass. (6 refs.)

99426 Chiral invariance in the soliton bag model. R.Goldflam (Dept. of Phys., Univ. of Washington, Seattle, WA, USA), I.Duck, E.Umland.
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.155-6 (28 July 1983).
The soliton bag model of quark confinement is shown to give the same pionic coupling as the cloudy bag model, explicitly independent of details of the soliton field. The Goldberger-Treiman relation is satisfied in this development. (7 refs.)

99427 Are there baryons with constituent glue?. C.E.Carlson (Dept. of Phys., State Univ. of New York, Stony Brook, NY, USA), T.H.Hansson.
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.95-8 (18 Aug. 1983).
The authors point out that Λ-like baryons with a constituent gluon can be light because of large color electromagnetic attractions. Mass estimates from the MIT bag model suggest that some observed baryons may be (qqqg) states. (14 refs.)

99428 Is there need for baryons with constituent glue?. U.G.Meissner (Phys. Dept., State Univ. of New York, Stony Brook, NY, USA).
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.99-100 (18 Aug. 1983).
The author investigates the breathing-mode spectrum of the Λ-particle in the framework of a general bag model including confinement via surface tension and volume energy. It is shown that the experimental states Λ 1/2 (1600) and Λ 1/2 (1800) can be described as radial surface excitations of the Λ. He further comments on a recent paper describing these Λ-excitations as baryons with constituent glue. (12 refs.)

99429 On an inverse method in one dimension. P.Asthana, A.N.Kamal (Dept. of Phys., Univ. of Alberta, Edmonton, Alberta, Canada).
Z. Phys. C (Germany), vol.19, no.1, p.37-52 (1983).
Given a sequence of bound-state energies the inverse Gel'fand-Levitan theory for the one-dimensional Schrodinger equation enables one to construct uniquely a symmetric reflectionless potential which supports those bound states. The authors test the reliability of this technique by applying it to some known symmetric potentials (confining and nonconfining) in one dimension. They also study the systematics under which the method may be reliable. (16 refs.)

99430 Dynamical correlations in the dual parton model. F.W.Bopp (Dept. of Phys., Siegen Univ., Siegen, Germany).
Z. Phys. C (Germany), vol.19, no.2, p.137-42 (1983).
The effect of multiple 'chain' contributions to particle production, which appears in the Dual Parton Model at collider energies, is investigated in an exploratory model, in which other sources of correlations are largely neglected. Attention is given to the question of KNO scaling for the multiplicities observed in restricted or unrestricted rapidity ranges. The rapidity distribution associated with a fixed number of particles within a suitably chosen interval is found to be sensitive to details of the mechanism of multiple chain production. (18 refs.)

99431 Quark masses in a BCS-like approach using $Q\bar{Q}$ potentials. A.Datta (Dept. of Phys., Jadavpur Univ., Calcutta, India), J.Dey, M.Dey, P.Ghose.
Z. Phys. C (Germany), vol.19, no.2, p.179-87 (1983).
Using a BCS like equation the authors have computed constituent quark masses as a function of a parameter C. This parameter is a measure of the effective strength of the interaction for off-the-mass-shell, localised $q\bar{q}$ pairs and is given by $C=R/E$, where E is the energy required to separate the pair to a distance R. Several phenomenological flavour independent $q\bar{q}$ potentials and correlation functions yield results similar in nature. Predictions for distribution functions of intrinsic sea quarks have been made. (14 refs.)

Proceedings of the 1982 CERN School of Physics (CERN 83-05) .... See Entry 98658
Three-quark fusion in a proton electromagnetic vertex .... See Entry 99380
Applications of QCD .... See Entry 99424
Light and heavy hadron masses in a relativistic quark potential model with diquark clustering .... See Entry 99442
ϵ'/ϵ and $\Delta I = 1/2$ matrix element enhancement .... See Entry 99450
Amplitude zeroes—tests of the magnetic moment of the W boson and the quarks .... See Entry 99455
Structure functions of pseudoscalar mesons in a composite model with chromodynamic interaction .... See Entry 99458
Probing spin-1 diquarks in deep inelastic structure functions .. See Entry 99461
Revelations of charm, beauty, and truth in high energy e^+e^- collisions .... See Entry 99465
A phenomenological investigation of the $\bar{p}p$ slope parameter at $\sqrt{s}=540$ GeV .... See Entry 99473
The rapidity distribution of the cascade inside deuteron in πd high energy collisions .... See Entry 99479
Correlations in the dual parton model .... See Entry 99483
Possible explanation for scaling violation in hadron interactions above 10^3 TeV .... See Entry 99487
Parameters of the six-quark component of the deuteron .... See Entry 99509
Kinetic theory for plasmas with non-Abelian interactions .... See Entry 99528
Quark-abnormal neutron stars .... See Entry 104904

12.35K Other composite models

(inc. composite quarks and leptons)

99432 Dual preon models. I. The SU(7)×SU(7) model. M.Ida (Dept. of Phys., Kobe Univ., Kobe, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1554-68 (May 1983).
The dual preon model with a quasi-simple gauge group $G=SU_{hc}(7)\otimes SU_{ht}(7)$ is studied. It automatically has a global symmetry $U_x(1)$ of Peccei and Quinn, with an invisible composite axion. The group for the anomaly condition is taken to be the symmetry group at preon confinement, which is further enlarged to a classification group of massless composite fermions. By taking it to be $SU(5)\otimes U_x(1)$, four generations of $\mathbf{5}^*\oplus\mathbf{10}$ are obtained. Numerical estimates of some scales of the model are also given. (17 refs.)

99433 Dual preon models. II. The SO(10)⊗SO(10) model. M.Ida (Dept. of Phys., Kobe Univ., Kobe, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1569-79 (May 1983).
For pt.I, see ibid., vol.69, no.5, p.1554-58 (1983). The dual preon model with a quasi-simple guage group of $G=SO(10)\otimes SO(10)$ is studied. A global symmetry $U_x(1)$ required by a dual pair of preon multiplets can be used to determine the number of generations, though it may break above the scale Λ_{hc} of preon confinement. At Λ_{hc} six generations of 16s with preon configuration mixing are obtained for quarks and leptons. An invisible composite axion emerges by spontaneous breaking of $U_x(1)$ and QCD effects. (10 refs.)

99434 Family gauge symmetry from a composite model. Bang-Rong.Zhou (Fermi Nat. Accelerator Lab., Batavia, IL, USA), Chao-Hsi.Chang.
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.209-14 (28 July 1983).
A family gauge symmetry $SU^F(2)$ could emerge from a composite model of quarks and leptons under some assumptions of chiral hyperflavour symmetry-breaking pattern. Possible dynamical mechanisms which break the family and electroweak gauge group and produce quark-lepton masses are indicated and their phenomenologies are discussed qualitatively. (23 refs.)

99435 Weak interaction symmetry and generation structure in the quasi-Nambu-Goldstone fermion picture of quarks and leptons. O.W.Greenberg, R.N.Mohapatra, M.Yasue (Dept. of Phys. & Astron., Univ. of Maryland, College Park, MD, USA).
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.65-8 (18 Aug. 1983).
The authors discuss composite models where massless quarks and leptons arise as superpartners of composite Goldstone bosons, resulting from the spontaneous breakdown of global symmetry, in a supersymmetric theory in which the preons are confined by nonabelian hypercolor dynamics. They present different schemes for including the generations. Finally, they note some problems with this approach. (8 refs.)

99436 An introduction to the possible substructure of quarks and leptons. L.Lyons (Nuclear Phys. Lab., Univ. of Oxford, Oxford, England).
Prog. Part. & Nucl. Phys. (GB), vol.10, p.227-304 (1983).
After an introductory discussion of the history of substructure and of the motivations for examining the possible compositeness of quarks and leptons, experiments which could be relevant to the non-point-like nature of these fermions are reviewed. Where possible the data are used to deduce limits on the substructure energy scale. Starting with very early ideas about quark and lepton substructure, the author goes on to summarise some of the specific models which have recently been proposed. They are very varied, but a general discussion is given about common topics which such models consider (e.g. the nature of the binding mechanism, the problem of the masses of the

composite systems, the way in which fermion generations arise, whether to make weak intermediate bosons composite, etc.). In considering individual models, emphasis is placed on what specific predictions can be tested experimentally. The author concludes that experiments in the near future could significantly increase the energy range in which substructure can be probed. This may then provide a more realistic basis on which the judge whether quarks and leptons are composite. (288 refs.)

12.40 MODELS OF STRONG INTERACTIONS

Strangeness distributions in hadronic collisions .... See Entry 99478

12.40E Statistical models

99437 Large P_T spectrum as a possible signal for quark matter formation. S.Kagiyama, T.Hirose (Dept. of Phys., Kagoshima Univ., Kagoshima, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1457-66 (May 1983).
Assuming the quark-gluon plasma formation in high energy $pp(p\bar{p})$ collisions, the temperature of the plasma is calculated on the basis of the statistical quark bag model. The temperature is shown to agree well with the effective temperature estimated from the medium p_t data at ISR and SPS energies. (41 refs.)

Mass splitting of the pseudoscalar mesons by Monte Carlo technique .... See Entry 99443

Large missing-mass clusters in hydrodynamical approach .... See Entry 99467

Wounded nucleons in α-α collisions at high energies .... See Entry 99475

12.40H Duality and dual models

99438 The exact q$\bar{q}$ potential in Nambu string theory. J.F.Arvis (Lab. de Phys. Theorique Ecole Normal Superieure, Paris, France).
Phys. Lett. B (Netherlands), vol.127B, no.1-2, p.106-8 (21 July 1983).
The Nambu string model with fixed ends is solved exactly. The corresponding static potential is found to be: $V(R)=[R^2/(2\pi\alpha')^2-(D-2)/24\alpha']^{1/2}$. Rotational invariance checks imply the space-time dimension $D=26$. (6 refs.)

Monte Carlo measurement of the topological susceptibility in SU(3) lattice gauge theory .... See Entry 99299

Dynamical correlations in the dual parton model .... See Entry 99430

Correlations in the dual parton model .... See Entry 99483

12.40M Complex angular momentum plane; Regge poles and cuts (Reggeons)

(see also 11.60 for general theory)

99439 Reggeon calculus at collider energies. C.Pajares, A.Varias, P.Yepes (Dept. de Fisica Teorica, Univ. de Santiago, Santiago de Compostela, Spain).
Z. Phys. C (Germany), vol.19, no.1, p.89-93 (1983).
The phenomenology of the perturbative reggeon calculus at collider energies is studied. It is found that the graphs which were neglected at ISR energies are still negligible at $\sqrt{s}=540$ GeV. The perturbative series for the total cross section still converges reasonably fast. The values of the different parameters which describe rightly the data up to ISR energies give rise to a total cross section of around 60 mb at $\sqrt{s}=540$ GeV. For these values, the corresponding low mass and high mass eikonal series converges much more slowly. The nonperturbative reggeon calculus gives rise to a total cross section less than 60 mb. (19 refs.)

A phenomenological investigation of the p̄p slope parameter at $\sqrt{s}=540$ GeV . ... See Entry 99473

The reactions $pp\rightarrow pp\pi^+\pi^-$, $K^+p\rightarrow K^+p\pi^+\pi^-$, $\pi^+p\rightarrow\pi^+p\pi^+\pi^-$ and $\pi^-p\rightarrow\pi^-p\pi^+\pi^-$ at 147 GeV/c .... See Entry 99477

Correlations in the dual parton model .... See Entry 99483

Possible explanation for scaling violation in hadron interactions above 10^3 TeV .... See Entry 99487

12.40P Absorptive, optical, and eikonal models

(for diffraction and diffractive production models, see 12.40S)

Reggeon calculus at collider energies .... See Entry 99439

A phenomenological investigation of the p̄p slope parameter at $\sqrt{s}=540$ GeV . ... See Entry 99473

12.40Q Potential models

On an inverse method in one dimension .... See Entry 99429

Light and heavy hadron masses in a relativistic quark potential model with diquark clustering .... See Entry 99442

12.40S Multiperipheral and multi-Regge models

(inc. diffraction and diffractive production models)

The reactions $pp\rightarrow pp\pi^+\pi^-$, $K^+p\rightarrow K^+p\pi^+\pi^-$, $\pi^+p\rightarrow\pi^+p\pi^+\pi^-$ and $\pi^-p\rightarrow\pi^-p\pi^+\pi^-$ at 147 GeV/c .... See Entry 99477

12.40V Vector-meson dominance

99440 Tensor meson dominance and e^+e^--physics. H.Genz (Center for Theoretical Studies, Univ. of Miami, Coral Gables, FL, USA), S.Mallik.
Fortschr. Phys. (Germany), vol.31, no.5, p.297-311 (1983).
The authors report on the phenomenological status of tensor meson dominance. Some new results, mainly concerning hadronic decays of the 2^{++}-meson $\chi_2(3.55)$ and the heavy lepton τ are also included. Considering experimental errors, they find agreement of tensor meson dominance with experiment. (22 refs.)

12.70 HADRON MASS FORMULAS

99441 An ISU(3) hadron mass formula. Z.Perjes (Central Res. Inst. for Phys., Budapest, Hungary), G.A.J.Sparling.
Surv. High Energy Phys. (Switzerland), vol.3, no.1, p.27-36 (1982).
A universal mass expression is derived for non-charm hadrons which unites GMO formulae for various multiplets. Mass splitting is achieved via the generators of the 14-parameter ISU(3) group. The spectrum depends on three parameters which vary with the spin. Comparison with particle data shows a nearly linear dependence. (9 refs.)

99442 Light and heavy hadron masses in a relativistic quark potential model with diquark clustering. D.B.Lichtenberg, W.Namgung, J.G.Wills (Dept. of Phys., Indiana Univ., Bloomington, IN, USA), E.Predazzi.
Z. Phys. C (Germany), vol.19, no.1, p.19-27 (1983).
Meson masses are calculated in the quark model with a phenomenological spin-dependent potential of form motivated by QCD. For comparison, the potential is used in two different wave equations, both of which incorporate the feature of relativistic two-body kinematics. The masses of light and heavy pseudoscalar and vector mesons are calculated in the model with only a small number of adjustable parameters, and good qualitative agreement with experiment is obtained. The masses of diquarks are calculated without any additional parameters, using the same potential as for mesons except for a QCD color factor. Then baryon masses are calculated, also without additional parameters, in an approximation in which a baryon is a composite of a quark and a diquark. Again the results are in good qualitative agreement with experiment. Both wave equations yield similar solutions, although there are differences in detail. One distinctive feature of the model is that quark current masses are used as input, and effective constituent quark masses are obtained as a result of the calculation. (40 refs.)

99443 Mass splitting of the pseudoscalar mesons by Monte Carlo technique. P.Di Vecchia (Phys. Dept., Univ. of Wuppertal, Wuppertal, Germany).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.317-26
In the last couple of years it has been shown that a long standing problem of hadron physics, that goes under the name of the $U_A(1)$ problem, can be explicitly solved in large N QCD. The result of this analysis is summarized by the effective Lagrangian for the nonet of the pseudoscalar mesons. The resolution of the $U_A(1)$ problem as well as the successful description of the dynamics of the pseudoscalar mesons can be reduced to explain why $A\neq0$ in the quarkless theory, although it vanishes in perturbation theory. The most promising non-perturbative way to compute A is by using the lattice gauge theory. The author discusses a recent attempt to extract A with the Monte Carlo technique in the case of a SU(2) lattice guage theory. (8 refs.)

Mass spectra in SU(5) supersymmetric models of grand unification with Higgs particles in representations 75 or 24 .... See Entry 99386

13.00 SPECIFIC REACTIONS AND PHENOMENOLOGY

13.10 WEAK AND ELECTROMAGNETIC INTERACTIONS OF LEPTONS

Applications of QCD .... See Entry 99424

τ branching ratios and polarization limits in e^+e^- interactions at $\sqrt{s}=34$ GeV .... See Entry 99454

13.15 NEUTRINO INTERACTIONS

(inc. interactions involving cosmic rays)

99444 Neutrino experiment involving inverse beta decay at a nuclear reactor. A.I.Afonin, S.A.Bogatov, A.A.Borovoi, A.G.Veshinskii, S.L.Gavrilov, S.N.Ketov, Yu.V.Klimov, V.I.Kopeikin, L.A.Levina, L.A.Mikaelyan, K.V.Ozerov, V.V.Sinev, A.N.Kheruvimov (I.V. Kurchatov Inst. of Atomic Energy, Moscow, USSR).
JETP Lett. (USA), vol.37, no.2, p.150-3 (20 Jan. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.2, p.122-4 (20 Jan. 1983).
An experiment of the reaction $\bar{\nu}_e+p\rightarrow n+^+$ is being started at an underground neutrino laboratory at a nuclear power plant. Some preliminary data on the cross section are reported. The question of searching for Pontekorvo oscillations in reactor experiments is discussed. (13 refs.)

99445 Measurement of the rate of increase of neutrino cross sections with energy. R.Blair, B.Barish, Y.K.Chu, B.Jin, D.MacFarlane, R.L.Messner, J.Lee, J.Ludwig, D.B.Novikoff, M.V.Purohit (California Inst. of Technol., Pasadena, CA, USA), P.S.Auchincloss, F.Sciulli, M.H.Shaevitz, F.Bartlett, D.Edwards, H.Edwards, H.E.Fisk, Y.Fukushima, Q.A.Kerns, T.Kondo, P.A.Rapidis, S.L.Segler, R.J.Stefanski, D.Theriot, D.Yovanovitch, A.Bodek, R.Coleman, W.Marsh, O.Fackler, K.A.Jenkins.
Phys. Rev. Lett. (USA), vol.51, no.5, p.343-6 (1 Aug. 1983).
The energy dependence of the cross section for neutrino- and antineutrino-nucleon charged-current interactions has been determined from data in Fermilab's dichromatic neutrino beam. $\sigma^\nu/E=(0.669\pm0.003\pm0.024)\times10^{-38}$ cm^2/GeV and $\Sigma^{\bar{\nu}}/E=(0.340\pm0.003\pm0.02)\times10^{-38}$ cm^2/GeV are found. These results are higher than some previous measurements. (16 refs.)

99446 Experimental study of x-distributions in semileptonic neutral-current neutrino reactions. M.Jonker, F.Udo (NIKHEF, Amsterdam, Netherlands), J.V.Allaby, U.Amaldi, G.Barbiellini, A.Capone, W.Flegel, W.Kozanecki, K.H.Mess, M.Metcalf, J.Meyer, R.S.Orr, J.Panman, A.M.Wetherell, K.Winter, V.Blobel, F.W.Busser, P.D.Gall, H.Grote, B.Kroger, E.Metz, F.Niebergall, K.H.Ranitzsch, P.Stahelin, P.Gorbunov, E.Grigoriev, V.Kaftanov, V.Khovansky, A.Rozanov, A.Baroncelli, B.Borgia, C.Bosio, F.Ferroni, E.Longo, P.Monacelli, F.de Notaristefani, P.Pistilli, C.Santoni, V.Valente.
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.117-23 (18 Aug. 1983).
Neutral-current differential cross sections as a function of the scaling variable x for deep inelastic neutrino-nucleon and antineutrino-nucleon scattering on an isoscalar target were measured in the CERN SPS 200 GeV/c Narrow-Band Beam with the CHARM fine-grained calorimeter. The data have been corrected for the experimental resolutions using a novel unfolding procedure. Its validity is tested on charged-current reactions. The x-distributions deter-

mined in neutral-current reactions are found to be compatible with the results obtained in charged-current reactions, as expected by the quark model of the nucleon and by the standard model of the weak interactions. (12 refs.)

Minimally extended electroweak gauge theories in SO(10) and E_6 ....See Entry 99372

New limits on oscillation parameters for electron antineutrinos ....See Entry 99374

Coherent interaction of galactic neutrinos with material targets ....See Entry 104698

Interaction of solar neutrinos with the cosmic background ....See Entry 104827

13.20 LEPTONIC AND SEMILEPTONIC DECAYS OF MESONS

99447 Search of *CP* violation in the $K^0 \rightarrow 3\pi^0$ decay. V.V.Barmin, V.G.Barylov, T.A.Chistykova, I.V.Chuvilo, G.V.Davidenko, V.S.Demidov, A.G.Dolgolenko, V.A.Ergakov, V.N.Golubchikov, A.G.Meshkovsky, G.S.Mirosidi, V.I.Moskalev, V.A.Shebanov, N.N.Shishov, Yu.V.Trebukhovsky, N.K.Zombkovskaya (Inst. for Theoretical & Experimental Phys., Moscow, USSR), M.Baldo-Ceolin, E.Calimani, S.Ciampolillo, F.Mattioli, G.Miari, A.Sconza.
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.129-32 (18 Aug. 1983).
Out of a total of 1.8×10^6 photographs of the 180 liter xenon bubble chamber exposed to a K^+ beam with 0.85 GeV/c momentum, 632 identified $K^0 \rightarrow 3\pi^0$ decays were selected. The ratio of the *CP* violating to the *CP* conserving amplitudes $\eta_{000} = A(K_S{}^0 \rightarrow 3\pi^0)/A(K_L{}^0 \rightarrow 3\pi^0) = (-0.08 \pm 0.18) + i(-0.05 \pm 0.27)$ was obtained. This result is compatible within one standard deviation with the value $\eta_{000} = 0$ and is independent of any assumption about *CPT* invariance. Assuming *CPT* invariance and $\Delta I < 5/2$ the authors obtained $|\eta_{000}|^2 < 0.1$ at the 90% CL. The corresponding upper limit for $\Gamma(K_S{}^0 \rightarrow 3\pi^0)/\Gamma(K_S{}^0)$ is 0.37×10^{-4}. (8 refs.)

99448 On the hadronic production of lepton pairs from heavy flavour decay. H.G.Fischer, W.M.Geist (CERN, Geneva, Switzerland).
Z. Phys. C (Germany), vol.19, no.2, p.159-66 (1983).
The production of dilepton states by semileptonic decay of charm-anticharm and beauty-antibeauty meson pairs is studied for proton-proton collisions. It is shown that the measured features of dilepton production can be well described by this nonelectromagnetic process up to masses of at least 5 GeV. Upper limits for hadronic heavy flavour production are derived. (19 refs.)

13.25 HADRONIC DECAYS OF MESONS

99449 D^0 spectrum from *B*-meson decay. J.Green, R.G.Hicks, F.Sannes, P.Skubic, A.Snyder, R.Stone (Rutgers Univ., New Brunswick, NJ, USA), A.Chen, M.Goldberg, N.Horwitz, A.Jawahery, M.Jibaly, P.Lipari, G.C.Moneti, C.G.Trahern, H.Van Hecke, M.S.Alam, S.E.Csorna, L.Garren, M.D.Mestayer, R.S.Panvini, R.Xia Yi Giles, J.Hassard, M.Hempstead, K.Kinoshita, W.W.Mackay, F.M.Pipkin, R.Wilson, H.Kagan, D.Andrews, P.Avery, C.Bebek, K.Berkelman, D.G.Cassel, J.W.DeWire, R.Ehrlich, T.Ferguson, R.Galik, M.G.D.Gilchriese, B.Gittelman, M.Halling, D.L.Hartill, D.Herrup, S.Holzner, M.Ito, J.Kandaswamy, V.Kistiakowsky, D.L.Kreinick, Y.Kubota, N.B.Mistry, F.Morrow, E.Nordberg, M.Ogg, R.Perchonok, R.Plunkett, A.Silverman, P.C.Stein, S.Stone, D.Weber, R.Wilcke, A.J.Sadoff, S.Behrends, K.Chadwick, J.Chauveau, P.Ganci, T.Gentile, J.M.Guida, J.A.Guida, R.Kass, A.C.Melissinos, S.L.Olsen, G.Parkhurst, D.Peterson, R.Poling, C.Rosenfeld, G.Rucinski, E.H.Thorndike.
Phys. Rev. Lett. (USA), vol.51, no.5, p.347-50 (1 Aug. 1983).
The inclusive branching fraction for *B*-meson decay into D^0 mesons and the momentum spectrum of the D^0's have been measured. $0.8 \pm 0.2 \pm 0.2$ D^0 per *B* decay was found. The shape of the spectrum suggests an interesting picture of *B*-meson decay. (9 refs.)

99450 ϵ'/ϵ and $\Delta I = 1/2$ matrix element enhancement. P.Ginsparg (Lyman Lab. of Phys., Harvard Univ., Cambridge, MA, USA), M.B.Wise.
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.265-9 (28 July 1983).
The authors derive a lower bound on $|c_2 s_2 s_3 s_\delta|$ as a function of the B meson lifetime and the top quark mass. The quantity $c_2 s_2 s_3 s_\delta$ relates a certain $\Delta I = 1/2$ matrix element to ϵ'/ϵ. Their bound can be useful in determining the explanation for the enhancement of $\Delta I = 1/2$ matrix elements in nonleptonic kaon and hyperon decays. (16 refs.)

Light cone expansion and scaling laws for radiative orthoquarkonium decays ... .See Entry 99421

Tensor meson dominance and e^+e^--physics ....See Entry 99440

13.30 DECAYS OF BARYONS

99451 Determination of G_A/G_V from the set of three angular-correlation coefficients observed in the decay of the free neutron. Yu.A.Mostovoi (I.V. Kurchatov Inst. of Atomic Energy, Moscow, USSR).
JETP Lett. (USA), vol.37, no.3, p.196-7 (5 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.3, p.162-3 (5 Feb. 1983).
An equation relating $\lambda = G_A/G_V$ to the three angular-correlation coefficients yields the value $\lambda = -1.226 \pm 0.042$. The indicated error is determined entirely by the error in the measurements of the antineutrino-spin correlation. This quantity may thus be regarded as the result of a new measurement of λ, the first based on this correlation. (5 refs.)

99452 An explicit spin-isospin dependence of the nucleon partial decay amplitudes. C.S.Warke (Tata Inst. of Fundamental Res., Bombay, India).
J. Phys. G (GB), vol.9, no.8, p.L159-63 (Aug. 1983).
The general spin-isospin dependence of the nucleon partial decay amplitude and the corresponding width are derived. The effects of spin-flavour SU(6) symmetry breaking and the quark correlations on the nucleon lifetime are studied. Keeping the same baryon spectroscopic data, the calculated proton decay partial lifetime varies from $T(p \rightarrow e^+\pi^0) = 1.14$ to 2.02×10^{31} yr for $M_x = 4.2 \times 10^{14}$ GeV. (23 refs.)

99453 More about proton decay due to $d=5$ operators. V.M.Belyaev, M.I.Vysotsky (Inst. of Theoretical & Experimental Phys., Moscow, USSR).
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.215-18 (28 July 1983).
The authors demonstrate that gluino exchange does not lead to proton decay through $d=5$ operators: the sum of the corresponding Feynman diagrams equals zero. The experimental bound for the proton life time leads to the following constraints for the W-bozino Majorana mass: $M_{\tilde{W}} < 1$ GeV or $M_{\tilde{W}} > 10^3$ TeV. These constraints must be taken into account in constructing realistic SUSY grand unified models. (12 refs.)

Three-quark fusion in a proton electromagnetic vertex ....See Entry 99380

Proton lifetime in an *SO*(10) grand unified theory ....See Entry 99382

Next to leading enhancement factor for proton decay in SU_5 .See Entry 99385

ϵ'/ϵ and $\Delta I = 1/2$ matrix element enhancement ....See Entry 99450

13.35 DECAYS OF LEPTONS

99454 τ branching ratios and polarization limits in e^+e^- interactions at $\sqrt{s} = 34$ GeV. H.J.Behrend, Ch.Chen, H.Fenner, U.Gumpel, M.-J.Schachter, V.Schroder, H.Sindt (DESY, Hamburg, Germany), G.D'Agostini, W.-D.Apel, S.Banerjee, J.Bodenkamp, J.Engler, G.Flugge, D.C.Fries, W.Fues, K.Gamerdinger, G.Hopp, H.Kuster, H.Muller, H.Randoll, G.Schmidt, H.Schneider, W.de Boer, G.Buschhorn, G.Grindhammer, P.Grosse-Wiesmann, B.Gunderson, C.Kiesling, R.Kotthaus, U.Kruse, H.Lierl, D.Luers, H.Oberlack, P.Schacht, P.Colas, A.Cordier, M.Davier, D.Fournier, J.F.Grivas, J.Haissinski, V.Journe, A.Klarsfeld, F.Laplanche, U.Mallik, J.-J.Veillet, J.H.Field, R.George, M.Goldberg, B.Grossetete, O.Hamon, F.Kapusta, F.Kovacs, G.London, L.Poggioli, M.Rivoal, R.Aleksan, J.Bouchez, G.Carnesecchi, G.Cozzika, Y.Ducros, A.Gaidot, Y.Lavagne, J.Pamela, J.P.Pansart, F.Pierre.
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.270-6 (28 July 1983).
Results on the dominant decays of τ leptons produced in e^+e^- interactions at $\sqrt{s} = 34$ GeV are presented. The authors obtain the branching ratios $BR(\tau \rightarrow \rho\nu) = 0.228 \pm 0.033$, $BR(\tau \rightarrow \pi\nu) = 0.099 \pm 0.021$, $BR(\tau \rightarrow e\nu\nu) = 0.183 \pm 0.031$, $BR(\tau \rightarrow \mu\nu\nu) = 0.176 \pm 0.003$. From the laboratory momentum spectra of the observed decay products they determine the τ polarization asymmetry to $(1 \pm 22)\%$ and thereby derive limits for the vector coupling constant ν_τ of the τ to the weak neutral current. Tests on universality and factorization are discussed. (21 refs.)

Tensor meson dominance and e^+e^--physics ....See Entry 99440

13.40 ELECTROMAGNETIC PROCESSES AND PROPERTIES

13.40F Electromagnetic form factors; electric and magnetic moments

99455 Amplitude zeroes—tests of the magnetic moment of the W boson and the quarks. M.A.Samuel (Oklahoma State Univ., Stillwater, OK, USA).
AIP Conf. Proc. (USA), no.99, p.165-86 (1983). (Neutrino Mass and Gauge Structure of Weak Interactions, Cable, WI, USA, Sept. 1982).
The author considers the general phenomenon of amplitude zeroes, first discovered in the process $d\bar{u} \rightarrow W^-\gamma$. The effect of the quarks having an anomalous magnetic moment on the observed zeros (dips) in the angular distribution for the process $d\bar{u} \rightarrow W^-\gamma$ ($p\bar{p} \rightarrow W^-\gamma X$) is studied. It is found that for small values ($\leq 10^{-3}$) of the quark anomaly $[a \equiv (g-2)/2]$ the distributions are practically unaffected and as a increases, the dips gradually disappear. This study might provide one with a way of obtaining an upper bound for the anomalous magnetic moment of the W bosons. Using spin-0 particles, the author investigates the circumstances for amplitude zeroes to occur in the physical region and, as well, their location in phase space. Furthermore, the author asks whether or not these zeroes persist in higher order. The zeroes persist for internal line radiation and for radiation from internal bubbles. However, when one considers the 1-loop correction to the scalar three-point function (with a photon attached in all possible ways), it is shown, by an explicit calculation, that amplitude zeroes do not persist in general. (15 refs.)

99456 Proton and neutron magnetic moments in quantum chromodynamics. B.L.Ioffe, A.V.Smilga (Inst. of Experimental & Theoretical Phys., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.5, p.298-301 (5 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.5, p.250-2 (5 March 1983).
The magnetic moments of the nucleons are calculated in nonperturbative quantum chromodynamics without the use of any models. The magnetic susceptibility of the quark condensate plays an important role in determining the magnetic moments. The calculated results agree well with experiment. (5 refs.)

99457 Comparison of the deep-inelastic structure functions of deuterium and aluminum nuclei. A.Bodek, N.Giokaris (Dept. of Phys. & Astron., Univ. of Rochester, Rochester, NY, USA), W.B.Atwood, D.H.Coward, D.L.Dubin, M.Breidenbach, J.E.Elias, J.I.Friedman, H.W.Kendall, J.S.Poucher, E.M.Riordan.
Phys. Rev. Lett. (USA), vol.51, no.7, p.534-7 (15 Aug. 1983).
The deep-inelastic electromagnetic structure functions of deuterium and aluminum nuclei have been measured. The kinematic dependence of the ratio of aluminium and deuterium structure functions is similar to the dependence of the ratio of steel and deuterium structure functions, and provides further evidence for the distortion of the quark momentum distributions of nucleons bound in a nucleus. (22 refs.)

99458 Structure functions of pseudoscalar mesons in a composite model with chromodynamic interaction. V.N.Kapshai, A.D.Linkevich, V.I.Savrin, N.B.Skachkov (Joint Inst. for Nuclear Res., Dubna, USSR).
Theor. & Math. Phys. (USA), vol.53, no.3, p.1196-203 (Dec. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.3, p.388-98 (Dec. 1982).
The solution of the equation for the wave function of a quark-antiquark system with interaction kernel taken in the form of the single-gluon exchange amplitude is used to calculate the asymptotic behaviour of meson structure functions. The obtained expressions contain terms leading to both power-law and logarithmic breaking of scaling. (25 refs.)

99459 QCD analysis of non-singlet neutrino structure functions. I.S.Barker (Dept. of Maths., City Univ., London, England), B.R.Martin, G.Shaw.
Z. Phys. C (Germany), vol.19, no.2, p.147-53 (1983).
The authors present a systematic analysis of all available neutrino xF_3 data, using an analytic parametrisation which incorporates second order QCD predictions for Q^2 evolution. They find $\Lambda_{\bar{M}\bar{S}} = 0.30 \pm 0.13$ GeV where the error is statistical, and both Fermi and *W*-boson propagator corrections have been made to the data. Neglect of the former has negligible effects, but neglect of the latter would increase Λ by ~ 0.1 GeV. They find that higher-twist effects are small and negative, and estimate their effect on the determination of Λ. They are unable to fit the data with higher-twist terms alone. (23 refs.)

The DEMON of local SUSY ....See Entry 99387

Probing spin-1 diquarks in deep inelastic structure functions ..See Entry 99461

A possible explanation of the difference between the structure functions of iron and deuterium .... See Entry 99506

On the non-relativistic approach to elastic ed scattering and the dependence on nucleon form factors .... See Entry 99565

13.40H Electromagnetic decays

Light cone expansion and scaling laws for radiative orthoquarkonium decays .... See Entry 99421

13.40K Electromagnetic corrections to strong and weak interaction processes

Radiative correction to the energy of a fermion in an external gauge field .... See Entry 99317

Finite temperature SUSY GUT phase transitions determined by radiative corrections .... See Entry 99384

Radiative corrections to masses in the standard model with two scalar doublets .... See Entry 99390

The symmetry breaking pattern SU(5)—SU(3)×U(1) including one loop radiative corrections .... See Entry 99391

Radiative corrections of $\sin^2 \theta_W{}^{exp}$ in the SU(5) model .... See Entry 99392

13.60 PHOTON AND CHARGED-LEPTON INTERACTIONS WITH HADRONS

(for neutrino interactions, see 13.15)

13.60F Elastic and Compton scattering

99460 Deep inelastic Compton process and large QCD corrections. A.Czechowski (Inst. of Theoretical Phys., Warsaw Univ., Warsaw, Poland), M.Krawczyk, T.Hofmokl, A.Jacholkowska, M.Gorski.
Z. Phys. C (Germany), vol.19, no.2, p.95-100 (1983).
It is shown that so-called deep inelastic Compton process corresponding to the hard γq scattering at the parton level can provide information about the origin of large QCD corrections which manifest themselves as K-factors. Assuming that the K-factors of the Compton scattering are predominantly a soft gluon effect the authors obtain a significant difference between K-factors corresponding to different inclusive distributions. The numerical calculations for the incoming photon energy 100 GeV and 150 GeV are presented. (18 refs.)

Higgs boson production in high energy lepton-nucleon scattering .... See Entry 99419

On the non-relativistic approach to elastic ed scattering and the dependence on nucleon form factors .... See Entry 99565

13.60H Total and inclusive cross sections

(inc. deep-inelastic processes)

99461 Probing spin-1 diquarks in deep inelastic structure functions. S.Fredriksson, M.Jandel, T.Larsson (Dept. of Theoretical Phys., Royal Inst. of Technol., Stockholm, Sweden).
Z. Phys. C (Germany), vol.19, no.1, p.53-5 (1983).
Within the scope of a new diquark model for deep inelastic structure functions presented by the authors recently, they use the existing data on $F_1{}^{ep}(x, Q^2)$ to learn about the admixture of spin-1 diquarks in nucleons. It turns out that they are so rare, heavy and extended compared to spin-0 diquarks that they are presumably accidental and not dynamical. Their number and form factors can be understood qualitatively within this picture. The spin-1 diquarks give interesting structures in data and, together with quarks and spin-0 diquarks, carry enough momentum to account for the full nucleon energy. A gluon component is hence not needed in the nucleon. (11 refs.)

Applications of QCD .... See Entry 99424

Comparison of the deep-inelastic structure functions of deuterium and aluminum nuclei .... See Entry 99457

Structure functions of pseudoscalar mesons in a composite model with chromodynamic interaction .... See Entry 99458

13.60K Meson production

99462 Photoproduction of an isoscalar 3π resonance at 1.67 GeV. M.Atkinson, T.J.Axon, D.Barberis, T.J.Brodbeck, G.R.Brookes, J.J.Bunn, P.J.Bussey, A.B.Clegg, J.B.Dainton, M.Davenport, B.Dickinson, B.Diekmann, A.Donnachie, R.J.Ellison, P.Flower, P.J.Flynn, W.Galbraith, K.Heinloth, R.C.W.Henderson, R.E.Hughes-Jones, J.S.Hutton, M.Ibbotson, H.P.Jakob, M.Jung, M.A.R.Kemp, B.R.Kumar, J.Laberrigue, G.D.Lafferty, J.B.Lane, J.C.Lassalle, J.M.Levy, V.Liebenhau, R.H.McClatchey, D.Mercer, J.A.G.Morris, J.V.Morris, D.Newton, C.Paterson, G.N.Patrick, E.Paul, C.Raine, M.Reidenbach, H.Rotscheidt, A.Schlosser, P.H.Sharp, I.O.Skillicorn, K.M.Smith, K.M.Storr, R.J.Thompson, C.de la Vaissiere, A.P.Waite, T.P.Yiuo.
Phys. Lett. B (Netherlands), vol.127B, no.1-2, p.132-6 (21 July 1983).
A $\sigma\pi$ enhancement with mass 1.67 ± 0.02 GeV and width 0.16 ± 0.02 GeV is observed in the channel $\gamma p \rightarrow p\pi^+\pi^-\pi^0$. Assuming an incoherent background, the cross section×branching ratio is 100 ± 20 nb. A spin-parity analysis favours $J^P = 1^-$. The enhancement is most simply interpreted as a radial recurrence of the ω meson. (14 refs.)

13.65 HADRON PRODUCTION BY ELECTRON-POSITRON COLLISIONS

99463 The radiative annihilation of a lepton pair into a hadron pair. S.K.Abdullaev, A.I.Mukhtarov, V.Z.Mustafaev.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.6, p.83-90 (1982). In Russian.
The radiative annihilation of an e^-e^+-pair into an antiproton and nucleaon resonance was investigated. The cross section of the process is obtained taking into account spin correlations of particles. Numerical results are presented in the case of small angle photon emission. Invariant integration was used for obtaining integral cross sections and photon angles and energy distributions. The possibility of the determination of different structure functions of the process was investigated. (8 refs.)

99464 Experimental study of inclusive muon spectra from electron-positron collisions in the energy region $33 \leq \sqrt{s} \leq 38.54$ GeV. B.Adeva (III. Phys. Inst., Tech. Hochschule, Aachen, Germany), D.P.Barber, U.Becker, J.Berdugo, G.Berghoff, A.Boehm, J.G.Branson, J.D.Burger, M.Capell, M.Cerrada, C.C.Chang, H.S.Chen, M.Chen, M.L.Chen, M.Y.Chen, Y.S.Chu, R.Clare, E.Deffur, M.Demarteau, P.Duinker, Z.Y.Feng, H.S.Fesefeldt, D.Fong, M.Fukushima, D.Harting, T.Hebbeker, G.Herten, M.C.Ho, M.M.Ilyas, D.Z.Jiang, W.Krenz, P.Kuijer, Q.Z.Li, D.Luckey, E.J.Luit, C.Mana, M.A.Marquina, G.G.G.Massaro, R.Mount, H.Newman, M.Pho, F.P.Poschmann, R.R.Rau, J.P.Revol, S.Rodriguez, M.Rohde, J.A.Rubio, H.Rykaczewski, J.Salicio, I.Schulz, K.Sinram, M.Steuer, G.M.Swider, H.W.Tang, D.Teuchert, S.C.C.Ting, K.L.Tung, M.Q.Wang, M.White, H.G.Wu, S.X.Wu, B.Wyslouch, B.Zhou, R.Y.Zhu, Y.C.Zhu.
Phys. Rev. Lett. (USA), vol.51, no.6, p.443-6 (8 Aug. 1983).
The results of a high-statistics study of inclusive muon spectra at PETRA are reported. Improved mass limits have been obtained for heavy quarks, heavy leptons, and charged Higgs particles. It is shown that the fragmentation properties of b quarks and c quarks are different, with the mean fragmentation variables $\langle z_b \rangle = 0.75 \pm 0.03 \pm 0.06$, $\langle z_c \rangle = 0.46 \pm 0.02 \pm 0.05$ and the average semileptonic branching ratio for the B and C hadrons $R(B) = (10.5 \pm 1.5 \pm 1.3)\%$, $R(C) = (11.5 \pm 1.0 \pm 1.7)\%$. (16 refs.)

99465 Revelations of charm, beauty, and truth in high energy e^+e^- collisions. R.S.Panvini (Vanderbilt Univ., Nashville, TN, USA).
Surv. High Energy Phys. (Switzerland), vol.3, no.2, p.39-63 (1982).
Results from high energy e^+e^- experiments are surveyed for the purpose of showing striking features of the data that infer the existence of heavy quarks. A rich spectroscopy of hadronic states composed of heavy quarks is clearly revealed, and the decays of these states yields important information about the weak transitions of the quarks. All the current data favors the standard six quark model which includes the light u-, d-, and s-quarks as well as the newly discovered heavy c (charm) and b (beauty or bottom) quarks. The sixth quark in the standard model, t (truth or top), has yet to be discovered; however, a class of models without the t-quark is ruled out by the absence of flavor changing neutral currents that should have been seen in b-quark decays, according to these models. (42 refs.)

99466 Inclusive production of soft pions. H.D.Politzer, M.P.Shatz (California Inst. of Technol., Pasadena, CA, USA).
Z. Phys. C (Germany), vol.19, no.2, p.129-32 (1983).
Amplitudes for inclusive production of pions at zero four-momentum in e^+-e^-, hadron-hadron, and lepton-hadron collisions are computed using traditional soft pion techniques. However, the extrapolation to physical momenta appears to be problematical. Tests involving difference cross sections at relatively low energies are suggested. (6 refs.)

Self-consistency correlations between QCD parameters from e^+e^- annihilation .... See Entry 99412

Tensor meson dominance and e^+e^--physics .... See Entry 99440

13.75 HADRON-INDUCED LOW- AND INTERMEDIATE-ENERGY REACTIONS AND SCATTERING, ENERGY ≤ 10 GEV

(for higher energies, see 13.85)

99467 Large missing-mass clusters in hydrodynamical approach. Y.Hama, F.W.Pottag (Inst. de Fisica, Univ. de Sao Paulo, Sao Paulo, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.2, p.247-60 (June 1982).
The previously proposed hydrodynamical description of the large missing-mass systems in hadron-hadron collisions is applied to analysing recent large-mass data obtained at ISR. The results are still consistent with the data, indicating the usefulness of the large-cluster concept. (20 refs.)

A study of charge symmetry breaking effects in elastic $\pi^\pm d$ scattering .... See Entry 99601

13.75C Nucleon-nucleon interactions, including antinucleon, deuteron, etc. (energy ≤ 10 GeV)

(for N-N interactions in nuclei, see 21.30)

A description of virtual scattering in the rigged Hilbert space formulation of quantum mechanics .... See Entry 98821

13.75G Pion-baryon interactions (energy ≤ 10 GeV)

99468 A partial wave dispersion relation analysis of pion-nucleon scattering amplitudes. R.Koch, M.Hutt (Inst. fur Theoretische Kernphys., Univ. Karlsruhe, Karlsruhe, Germany).
Z. Phys. C (Germany), vol.19, no.2, p.119-28 (1983).
Partial wave dispersion relations have been evaluated, using various new πN partial wave solutions and the authors' results for the $\pi\pi NN$ amplitudes. The Karlsruhe-Helsinki 80 and CMU-LBL-79 solution for S; P, D, F waves are well compatible with this constraint, which follows from the Mandelstam representation. The VPI 80 solution leads to serious discrepancies in some cases, for instance for the P11 wave. In both the KH 80 and CMU-LBL 79 solutions the higher partial waves are not yet satisfactory. They can be improved by adding constraints based on the information on the nearby part of the left hand cuts. Properties of nucleon resonances are discussed in connection with their results for the 'generalized potentials'. (37 refs.)

13.75J Kaon-baryon interactions (energy ≤ 10 GeV)

99469 Anomalous Coulomb correction to the scattering length in connection with the shift of the ground level to the K^-p atom. B.O.Kerbikov (Inst. of Theoretical & Experimental Phys., USSR).
JETP Lett. (USA), vol.37, no.2, p.146-50 (20 Jan. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.2, p.118-21 (20 Jan. 1983).
It is shown for the case of an exactly solvable model that in an absorbing system the Coulomb correction to the scattering length is large where the scattering length itself is small. The anomalously large Coulomb correction to the $\bar{K}N$ scattering length is discussed as a possible explanation of the contradiction between the values of the $\bar{K}N$ scattering length obtained from low-energy $\bar{K}N$ scattering and those obtained from the shift of the ground level of the K^-p atom. (12 refs.)

99470 Charge-exchange scattering in K^-p interactions below 300 MeV/c. D.Evans (Dept. of Phys., Univ. of Durham, Durham, England), J.V.Major, E.Rondio, J.A.Zakrzewski, J.E.Conboy, D.J.Miller, T.Tymieniecka.
J. Phys. G (GB), vol.9, no.8, p.885-94 (Aug. 1983).
Cross sections for K^-p charge exchange, based on new data equal in statistics to the sum of those of all previous determinations below 300 MeV/*c*, are presented. The results confirm an earlier observation by this collaboration that the previous measurements of these cross sections at low momentum were significantly underestimated. Evidence for the presence of P wave scattering is presented. (14 refs.)

13.85 HADRON-INDUCED HIGH- AND SUPER-HIGH-ENERGY INTERACTIONS, ENERGY > 10 GEV

(for low energies, see 13.75)

99471 Correlations and fluctuations in hadronic multiplicity distributions: the meaning of KNO scaling. P.Carruthers, C.C.Shih (Theoretical Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.242-50 (28 July 1983).
Charged hadronic multiplicity distributions at Fermilab, ISR and collider energies are shown to be described by generalized Bose-Einstein distributions of the type encountered in quantum optics. Systematic energy-dependent deviations from KNO scaling are well described by simple cases of this formula, which in the limit of large $\bar{n}$ have a simple and explicit scaling form, valid to a few percent at the CERN collider energy. It is suggested that this framework is generic, i.e. practically independent of dynamical details. The essential feature is that the field variables of the 'radiant surface' for hadronic emission are distributed as gaussian random variables (with k effective sources) as suggested by a typical central limit theorem argument. In order to bring the lower energy data into a form easily comparable with higher energy data, particularly for the crucial large multiplicity events $(n/\bar{n})\gg 1$, it is essential to remove the two charges of the 'leading' particles from the counting rules. The long tail of the KNO distribution is to be identified with coherent fluctuations analogous to those occurring in the Hanbury-Brown-Twiss (1956, 1957) effect. (27 refs.)

Reggeon calculus at collider energies ....See Entry 99439

Large missing-mass clusters in hydrodynamical approach .... See Entry 99467

13.85D Elastic scattering (energy > 10 GeV)

99472 Real part of the forward elastic scattering amplitude and high-energy behaviour of the total cross sections. I.M.Dremin, M.T.Nazirov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
JETP Lett. (USA), vol.37, no.3, p.198-201 (5 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.3, p.163-6 (5 Feb. 1983).
Dispersion-relation calculations show that data obtained on the ratio of the real and imaginary parts of the forward elastic scattering amplitude at the SPS colliding-beam installation will simplify extrapolation of the total *pp* cross sections to ultrahigh energies. (7 refs.)

99473 A phenomenological investigation of the $\bar{p}p$ slope parameter at $\sqrt{s}=540$ GeV. M.Kamran (Dept. of Phys., Punjab Univ., Lahore, Pakistan).
J. Phys. G (GB), vol.9, no.8, p.861-9 (Aug. 1983).
The author calculates and compares with experiment the predictions of a large number of model parametrisations on the $\bar{p}p$ slope parameter at $\sqrt{s}=540$ GeV. He finds that, apart from RFT fits, only a simple P-pole fit of Collins et al. (1973, 1974, 1978) comes close to a correct description of the collider data. Several well known models/fits which agree with the ISR data are found to fail at collider energies. The author also finds that a large pomeron slope in itself is not sufficient for a correct description of the *b* data at 540 GeV. (33 refs.)

99474 Proton-proton elastic scattering at 50 GeV/*c* incident momentum in the momentum transfer range $0.8<4.0$ $(\text{GeV}/c)^2$. Z.Asa'd, C.Baglin, R.Bock, J.M.Brom, L.Bugge, T.Buran, A.Buzzo, M.Coupland, D.G.Davis, B.G.Duff, T.Fearnley, S.Ferroni, I.Kenyon Gjerpe, J.P.Guillaud, V.Gracco, F.F.Heymann, D.C.Imrie, K.Kirsebom, A.Lundby, G.J.Lush, M.Macri, J.Myrheim, M.Phillips, M.Poulet, A.Santroni, G.Skjevling, S.O.Sorensen.
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.124-8 (18 Aug. 1983).
A measurement of the proton-proton elastic differential cross section at 50 GeV/*c* incident momentum in the momentum transfer range $0.8<|t|<4.0(\text{GeV}/c)^2$ is presented. The data are compared to pp data at lower and higher energies, and to some model predictions. (31 refs.)

Physics results from the CERN proton-antiproton collider ...... See Entry 99486

13.85H Inelastic scattering, many-particle final states (energy>10GeV)

99475 Wounded nucleons in α-α collisions at high energies. A.Bialas, A.Kolawa (Inst. of Phys., Jagellonian Univ., Cracow, Poland).
Acta Phys. Pol. B (Poland), vol.B14, no.7, p.539-54 (July 1983).
Distribution of the number w of wounded nucleons and of number v of inelastic collisions in α-α scattering at high energies is calculated using nuclear probability calculus. Correlations between w and v are also studied. The results are compared with generalized optical approximation. (9 refs.)

99476 Deck-coulombian effect calculation in the $\pi^\pm p\to\rho\pi^\pm p$ process. G.Missonnier, J.J.Dugne (Lab. de Phys., Corpusculaire, Aubiere, France).
Phys. Lett. B (Netherlands), vol.127B, no.1-2, p.126-8 (21 July 1983).
The authors display the big contribution of the Deck-coulombian effect for the π interaction at high energy and very small four-momentum transfers. This effect is calculated with a Williams-Weizsacker spectrum for the proton coulombian field and in the Born approximation for the $\pi^\pm\gamma\to\pi^\pm p$ process. (6 refs.)

99477 The reactions $pp\to pp\pi^+\pi^-$, $K^+p\to K^+p\pi^+\pi^-$, $\pi^+p\to\pi^+p\pi^+\pi^-$ and $\pi^-p\to\pi^-p\pi^+\pi^-$ at 147 GeV/c. D.H.Brick, H.Rudnicka, A.M.Shapiro, M.Widgoff (Brown Univ., Providence, RI, USA), R.E.Ansorge, W.W.Neale, D.R.Ward, B.M.Whyman, R.A.Burnstein, H.A.Rubin, E.D.Alyea,Jr., L.Bachman, C.-Y.Chien, P.Lucas, A.Pevsner, J.T.Bober, R.Dolfini, T.A.J.Frank, E.S.Hafen, P.Haridas, D.Huang, R.I.Hulsizer, V.Kistiakowsky, P.Lutz, S.Noguchi, S.H.Oh, I.A.Pless, T.B.Stoughton, V.Suchorebrow, S.Tether, P.C.Trepagnier, Y.Wu, R.K.Yamamoto, F.Grard, J.Hanton, V.Henri, P.Herquet, J.M.Lesceux, P.Pilette, R.Windmolders, H.de Bock, F.Crijns, W.Kittel, W.Metzger, C.Pols, M.Schouten, R.Van de Walle, H.O.Cohn, G.Bressi, E.Calligarich, C.Castoldi, S.Ratti, R.DiMarco, P.F.Jacques, M.Kalelkar, R.J.Plano, P.E.Stamer, T.L.Watts, E.B.Brucker, E.L.Koller, S.Taylor, L.Berny, S.Dado, J.Goldberg, S.Toaff, G.Alexander, O.Benary, J.Grunhaus, R.Heifetz, A.Levy, W.M.Bugg, G.T.Condo, T.Handler, E.L.Hart, A.H.Rogers, Y.Eisenberg, D.Hochman, U.Karshon, E.E.Ronat, A.Shapira, R.Yaari, G.Yekutieli, T.W.Ludlam, R.V.Steiner, H.D.Taft.
Z. Phys. C (Germany), vol.19, no.1, p.1-9 (1983).
All four reactions were detected with the same apparatus and analyzed in the same way. The energy dependence of the channel cross section was found to be $Ap^{-0.6}+B$ for the *pp* reaction and $Ap^{-1}+B$ for the other three. About 90% of the cross section can be accounted for by either beam or target diffraction. Some of the remaining cross section may come from double Pomeron exchange reactions which the authors have tried to isolate. They have tested the hypothesis of a factorizable Pomeron and the data indicates a violation of this hypothesis. They show that the 3π mass enhancement in the mass region 1.2-1.4 GeV is diffractively produced in the $\pi^\pm$ beam reactions. (22 refs.)

99478 Strangeness distributions in hadronic collisions. C.Pajares, A.Varias (Dept. de Fisica Teorica, Univ. de Santiago, Santiago de Compostela, Spain).
Z. Phys. C (Germany), vol.19, no.2, p.143-5 (1983).
The distribution of strangeness versus rapidity is studied in the multichain fragmentation model and in the one chain fragmentation model. It is shown that the multichain model describes rightly the K^+p strangeness distribution data. (14 refs.)

99479 The rapidity distribution of the cascade inside deuteron in πd high energy collisions. D.Kisielewska (Inst. of Nuclear Phys. & Tech., Acad. of Mining & Metall., Krakow, Poland).
Z. Phys. C (Germany), vol.19, no.2, p.155-8 (1983).
The problem of the existence of internuclear cascade and its characteristics are analysed in the π^-d experiment at 205 GeV/c. Two versions of the additive quark model are used to obtain the mean multiplicity and the rapidity distribution of charged particles produced through cascading. It is shown that the cascading effect does exist. The particles produced through this effect have the rapidity distribution very similar as in elementary low energy hadron-nucleon interactions. Both the rapidity distribution and the mean multiplicity do not depend on the version of the additive quark model which was used to obtain them. (12 refs.)

13.85K Inclusive reactions, including total cross sections, (energy > 10 GeV)

99480 Monotonically increasing hadronic temperature in high-multiplicity events at the CERN proton-antiproton collider. S.Barshay (III Phys. Inst., Tech. Hochschule Aachen, Aachen, Germany).
Phys. Lett. B (Netherlands), vol.127B, no.1-2, p.129-31 (21 July 1983).
High-multiplicity central events at the $\bar{p}p$ collider occur preferentially at small collision impact parameters. If the effective hadronic temperature increases monotonically with decreasing impact parameter, the mean transverse momentum of all produced particles will increase with the event complexity, in agreement with the new collider data and cosmic-ray observations. (14 refs.)

99481 Hadroproduction of $\psi\psi$. R.E.Ecclestone, D.M.Scott (Dept. of Appl. Math. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
Z. Phys. C (Germany), vol.19, no.1, p.29-35 (1983).
The authors calculate the cross sections $q\bar{q}\to\psi\psi$ and $gg\to\psi\psi$ in $0(\alpha^4_s)$ QCD. They compare their results with measurements in πN interactions, and give predictions for pN and $\bar{p}N$ interactions. The cross section for $\gamma\gamma\to\psi\psi$ is computed. (27 refs.)

99482 Large p_T hadron production in nucleus-nucleus collisions. M.Staszel (Inst. of Experimental Phys., Warsaw Univ., Warsaw, Poland), G.Wilk.
Z. Phys. C (Germany), vol.19, no.1, p.57-62 (1983).
The previously presented relations between inclusive cross sections for nucleus-nucleus nucleon-nucleus and nucleon-nucleon scatterings with large p_T production were generalized to include effects of large momentum tail of nucleons inside the nucleus. Simple numerical estimations show that these effects are likely to dominate the inclusive cross section for nucleus-nucleus collisions at very large p_T. (15 refs.)

99483 Correlations in the dual parton model. C.Pajares, A.Varias (Dept. de Fisica Teorica, Univ. de Santiago, Santiago de Compostela, Spain).
Z. Phys. C (Germany), vol.19, no.1, p.69-73 (1983).
The authors show that the dual parton model with the help of the recursive cascade model for the fragmentation functions is able to describe rightly the single and two-particle inclusive distributions at ISR energies. No free parameter is needed in such a description. (20 refs.)

99484 Correlation of charm particles from gluon-gluon fusion in hadronic collisions. S.N.Ganguli, M.Schouten (CERN, Geneva, Switzerland).
Z. Phys. C (Germany), vol.19, no.1, p.83-7 (1983).
In the framework of fusion process, ≈90% of which is $g+g\to c+\bar{c}$, the authors have calculated rapidity correlation and p^2_T of charm particles produced in hadronic collisions. The experimental observation of rapidity correlation by the LEBC-EHS Collaboration is in good agreement with the calculation. From the ratio of double to single charm production an estimate of fusion cross section is made. (11 refs.)

99485 The annihilation interaction, mean collision number and average multiplicity in antiproton-nucleus collisions. H.Sumiyoshi (Inst. for Nuclear Study, Univ. of Tokyo, Tokyo, Japan), H.Kondo, M.Uehara.
Z. Phys. C (Germany), vol.19, no.2, p.107-14 (1983).
Within the multiple scattering model it is discussed how to treat the annihilation interaction in antiproton-nucleus ($\bar{p}$-A) collisions by imposing the constraint that the real annihilation of the incident $\bar{p}$ can take place only once. The cross sections, mean collision numbers and average multiplicities are given both for the $\bar{p}$-A annihilation and non-annihilation events. The multiplicity difference between $\bar{p}$-A and p-A collisions is shown to be useful as a test of the annihilation mechanism. (26 refs.)

99486 Physics results from the CERN proton-antiproton collider. J.D.Dowell (Dept. of Phys., Univ. of Birmingham, Birmingham, England).
Proceedings of the 1982 CERN School of Physics (CERN 83-05), Cambridge, England, 5-18 June 1982 (Geneva, Switzerland: CERN 1983), p.247-64
Results from the 1981 operation of the CERN p$\bar{p}$ collider at 540 GeV obtained in experiments UA1, UA2, UA4 and UA5 are presented. The total cross section of 66±7 mb shows the expected rise from lower energies. Elastic scattering measurements are consistent with a lns shrinkage of the forward peak. The central pseudorapidity density for inclusive charged particle production rises as lns reaching a value of 3.3 particles per unit of rapidity and the multiplicity distribution exhibits KNO scaling when compared to ISR results below 63 GeV. Results for inclusive photon, strange particle and proton production are also given. The single particle p_t-spectrum for p_t up to 10 GeV/c is considerably flatter than at the ISR and shows a dependence on multiplicity. Evidence for jets is given. Both jet and single particle cross sections at high p_t agree with QCD predictions. Negative searches for Centauro events and free quarks are reported. Finally, future prospects are outlined. (41 refs.)

Proceedings of the 1982 CERN School of Physics (CERN 83-05) .... See Entry 98658

Search for supersymmetry at the $\bar{p}$p collider .... See Entry 99362

Applications of QCD .... See Entry 99424

Amplitude zeroes−tests of the magnetic moment of the W boson and the quarks .... See Entry 99455

13.85M Cosmic ray interactions

(see also 94.40 Cosmic rays)

99487 Possible explanation for scaling violation in hadron interactions above 10^3 TeV. N.N.Kalmykov, G.B.Khristiansen (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
JETP Lett. (USA), vol.37, no.5, p.294-7 (5 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.5, p.247-9 (5 March 1983).
The discrepancy between the experimental data from extensive air showers and the predictions of the scaling model at energies above 10^3 TeV can be explained by the theory of a supercritical pomeron and the additive quark model. (17 refs.)

99488 Chirons, Geminions, Centauros, decays into pions: A phenomenological and theoretical analysis. P.Ammiraju, E.Recami, W.A.Rodrigues,Jr..
Report INFN/AE-83/3, Ist. Naz. Fis. Nucl., Catania, Italy (7 March 1983), 31 pp.
The authors analyse the data on multiple production of hadrons from very high-energy interactions, both at cosmic ray energies and at accelerator energies. They show that these data are compatible with a discrete mass spectrum of fireballs, which are formed in the very high-energy collisions and trail the colliding hadrons after the interaction. Such fireballs seem to possess different decay-modes: either into pions only, or into baryons only. The decays are statistical and they derive their temperature; for instance, in the so-called 'Chiron-mode' the temperature is about 10 GeV, which shows that the existence of a limiting temperature of 160 MeV in high-energy collisions is violated. Moreover, they present a theoretical model for decay-events like Chirons, Centauros and Geminions in terms of evaporating 'strong black-holes'. The analysis seems to suggest−among the others−that in the considered collisions some 'phase transitions' can take place, associated with the collapse of the colliding matter inside its strong-Schwarzschild horizons. The horizon radii are in good agreement with experience and, on their turn, yield the transition temperature through a Hawking-like relation. At these very high temperatures the emission of heavy objects is expected to be enhanced, so as it is observed experimentally. Many aspects of the data are reasonably well explained by the theoretical model. (25 refs.)

13.88 POLARISATION IN INTERACTIONS AND SCATTERING

τ branching ratios and polarization limits in e^+e^- interactions at $\sqrt{s}=34$ GeV .... See Entry 99454

On the non-relativistic approach to elastic ed scattering and the dependence on nucleon form factors .... See Entry 99565

13.90 OTHER TOPICS IN SPECIFIC REACTIONS AND PHENOMENOLOGY OF ELEMENTARY PARTICLES

99489 Search for high-mass sequential leptons through the change of charge asymmetry in $W^\pm \rightarrow \gamma^\pm$+(neutrinos) decay. D.B.Cline, C.Rubbia (CERN, Geneva, Switzerland).
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.277-80 (28 July 1983).
The authors show that very massive charged heavy leptons can be detected as decay products in $W^\pm$ decays produced by proton-antiproton collisions. This technique is sensitive up to masses of 60 GeV/c^2 leptons if the associated neutrino is nearly massless. They show how this technique can be applied for W production at the CERN p$\bar{p}$ collider experiments and how it may be extended to the experiments at the 2 TeV p$\bar{p}$ collider at FNAL. (9 refs.)

Applications of QCD .... See Entry 99424

14.00 PROPERTIES OF SPECIFIC PARTICLES AND RESONANCES

14.20 BARYONS AND BARYON RESONANCES

(inc. antiparticles)

Three-quark fusion in a proton electromagnetic vertex .... See Entry 99380

Proton lifetime in an *SO*(10) grand unified theory .... See Entry 99382

Next to leading enhancement factor for proton decay in SU_5 . See Entry 99385

The DEMON of local SUSY .... See Entry 99387

On the nucleon residues into quark currents .... See Entry 99420

Are there baryons with constituent glue? .... See Entry 99427

Is there need for baryons with constituent glue? .... See Entry 99428

An ISU(3) hadron mass formula .... See Entry 99441

Light and heavy hadron masses in a relativistic quark potential model with diquark clustering .... See Entry 99442

Determination of G_A/G_V from the set of three angular-correlation coefficients observed in the decay of the free neutron .... See Entry 99451

An explicit spin-isospin dependence of the nucleon partial decay amplitudes .... See Entry 99452

More about proton decay due to $d=5$ operators .... See Entry 99453

Proton and neutron magnetic moments in quantum chromodynamics .... See Entry 99456

Energy loss and energy straggling of protons and pions in the momentum range 0.7 to 115 GeV/*c* .... See Entry 100216

Neutron oscillation and the primordial magnetic field .... See Entry 104983

14.40 MESONS AND MESON RESONANCES

Relativistic quarkonium model based on instantaneous ladder BS equation. II. Mass levels of charmonium and bottonium .... See Entry 99289

Light cone expansion and scaling laws for radiative orthoquarkonium decays .... See Entry 99421

What do the data for the Υ family say about $\langle 0|(\alpha_s/\pi)G^a_{\mu\nu}G^a_{\mu\nu}|0\rangle$? .... See Entry 99422

Fine and hyperfine structures of heavy quarkonia and perturbative quantum chromodynamics .... See Entry 99423

An ISU(3) hadron mass formula .... See Entry 99441

Light and heavy hadron masses in a relativistic quark potential model with diquark clustering .... See Entry 99442

Search of *CP* violation in the $K^0 \rightarrow 3\pi^0$ decay .... See Entry 99447

Structure functions of pseudoscalar mesons in a composite model with chromodynamic interaction .... See Entry 99458

Revelations of charm, beauty, and truth in high energy e^+e^- collisions .... See Entry 99465

Hadroproduction of $\psi\psi$ .... See Entry 99481

Energy loss and energy straggling of protons and pions in the momentum range 0.7 to 115 GeV/*c* .... See Entry 100216

14.60 LEPTONS

Neutrino oscillations in grand unified theories .... See Entry 99371

Second-order fermion masses .... See Entry 99373

New limits on oscillation parameters for electron antineutrinos .... See Entry 99374

Neutrino oscillation experiments at CERN .... See Entry 99375

Neutrino oscillations with large oscillation length in spite of large (Majorana) neutrino masses? .... See Entry 99381

Family gauge symmetry from a composite model .... See Entry 99434

An introduction to the possible substructure of quarks and leptons .... See Entry 99436

τ branching ratios and polarization limits in e^+e^- interactions at $\sqrt{s}=34$ GeV .... See Entry 99454

QCD analysis of non-singlet neutrino structure functions .... See Entry 99459

Experimental study of inclusive muon spectra from electron-positron collisions in the energy region $33 \leq \sqrt{s} \leq 38.54$ GeV .... See Entry 99464

Search for high-mass sequential leptons through the change of charge asymmetry in $W^\pm \rightarrow \gamma^\pm$+(neutrinos) decay .... See Entry 99489

Geochemical double beta decay experiments .... See Entry 99539

Future double beta decay experiments .... See Entry 99542

Resonant neutrino activation and neutrino oscillations .... See Entry 99543

Double beta decay of ^{128}Te/^{130}Te and the question of a neutrino Majorana mass .... See Entry 99546

Coherent interaction of galactic neutrinos with material targets .... See Entry 104698

Neutrino astrophysics and the rest mass of the neutrino .... See Entry 104729

Nuclei with an extra quark, stellar burning, and the solar neutrino problem .... See Entry 104730

New constraints on neutrino masses from cosmology .... See Entry 105001

14.80 OTHER AND HYPOTHETICAL PARTICLES

Magnetic monopole in the general theory of relativity .... See Entry 98898

Axially symmetric gauge fields of magnetic monopoles .... See Entry 99290

The algebraic geometry of multimonopoles .... See Entry 99333

Search for supersymmetry at the $\bar{p}$p collider .... See Entry 99362

Minimally extended electroweak gauge theories in SO(10) and E_6 .... See Entry 99372

One possibility of extension of symmetry group of Weinberg-Salam model. I. Formulation of model .... See Entry 99377

Comment on 'Upper bounds on the Higgs-Boson mass and the coupling constant' .... See Entry 99383

Mass spectra in SU(5) supersymmetric models of grand unification with Higgs particles in representations 75 or 24 .... See Entry 99386

Radiative corrections to masses in the standard model with two scalar doublets .... See Entry 99390

The self-energy of a heavy quark in the gluonic vacuum and the effective mass .... See Entry 99410

Higgs boson production in high energy lepton-nucleon scattering .... See Entry 99419

Quark masses in a BCS-like approach using $Q\bar{Q}$ potentials .... See Entry 99431

Family gauge symmetry from a composite model .... See Entry 99434

An introduction to the possible substructure of quarks and leptons .... See Entry 99436

Amplitude zeroes−tests of the magnetic moment of the W boson and the quarks .... See Entry 99455

Probing spin-1 diquarks in deep inelastic structure functions .. See Entry 99461

Experimental study of inclusive muon spectra from electron-positron collisions in the energy region $33 \leq \sqrt{s} \leq 38.54$ GeV .... See Entry 99464

Search for high-mass sequential leptons through the change of charge asymmetry in $W^{\pm} \to \gamma^{\pm}$ + (neutrinos) decay .... See Entry 99489

Mechanism of generating isothermal perturbation by a strong *CP* nonconservation .... See Entry 104998

Irregularities formed by a cosmological axion field .... See Entry 105000

Phase transitions in the early Universe .... See Entry 105004

20.00 NUCLEAR PHYSICS

21.00 NUCLEAR STRUCTURE

21.10 GENERAL AND AVERAGE PROPERTIES OF NUCLEI; PROPERTIES OF NUCLEAR ENERGY LEVELS

(for properties of specific nuclei listed by mass ranges, see 27.)

99490 Crossing of single-particle energy levels resulting from neutron excess in the sd shell. M.H.Storm, A.Watt, R.R.Whitehead (Dept. of Natural Philosophy, Univ. of Glasgow, Glasgow, Scotland).
J. Phys. G (GB), vol.9, no.8, p.L165-8 (Aug. 1983).
It has been shown that the large discrepancies between calculation and experiment in the binding energies of neutron-rich isotopes of sodium and magnesium can be removed by extending the model space to include the $f_{7/2}$ shell. It is shown that the physical explanation of this result lies in the severe distortion of the underlying single-particle spectrum by the large neutron excess. (12 refs.)

99491 Strong and weak coupling to the octupole-deformed mode in $_{89}{}^{227}$Ac. R.K.Sheline (Dept. of Nuclear Phys., Australian Nat. Univ., Canberra, Australia), G.A.Leander.
Phys. Rev. Lett. (USA), vol.51, no.5, p.359-62 (1 Aug. 1983).
Hybrid values of the intrinsic gyromagnetic ratio and the absolute values of the decoupling parameters have been found for two sets of approximately degenerate opposite-parity bands with $K={}^3/_2{}^{\pm}$ and $K={}^1/_2{}^{\pm}$ in ^{227}Ac, as would be expected for intrinsic parity mixing in the single-particle states due to octupole deformation. These properties are able to test quantitatively the change in the Nilsson wave functions resulting from octupole deformation. (17 refs.)

99492 Algebraic methods for a direct calculus of observables in the theory of nuclear band structure. A.Klein (Dept. of Phys., Univ. of Pennsylvania, Philadelphia, PA, USA).
Prog. Part. & Nucl. Phys. (GB), vol.10, p.39-129 (1983).
The basis of much of the present understanding of nuclear structure derives from the study of mean field approximations (such as Hartree-Fock or Bardeen-Cooper-Schrieffer) and of small deviations from the mean field (random phase approximation and the cranking model). This review is devoted to the study of a theoretical framework (and of some applications of it) which provides not only a sound derivation of all these approximations but a basis for going beyond them. The approach may be characterized broadly as the application of Heisenberg matrix mechanics to the nuclear many-body problem. Various investigations carried out over two decades are described, including theoretical foundations, applications to schematic models, and applications to vibrational and rotational problems. In the concluding remarks, the author points to new developments which may alter these considerations profoundly by enlarging the framework in which they may be carried out. (134 refs.)

99493 Phonon operators in deformed nuclei. V.G.Solov'ev (Joint Inst. for Nuclear Res., Dubna, USSR).
Theor. & Math. Phys. (USA), vol.53, no.3, p.1203-7 (Dec. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.3, p.399-405 (Dec. 1982).
For the description of excited states of deformed nuclei, the mathematical formalism with phonon operators that do not depend on the sign of the angular momentum projection has proved inadequate. New phonon operators are introduced that depend on the sign of the projection of the angular momentum onto the symmetry axis of the deformed nucleus. It is shown that calculations with the new phonons take into account the Pauli principle correctly in the two-phonon components of the wave functions. There is a difference from calculations with phonons that do not depend on the sign of the angular momentum projection. The new phonons must be used in deformed nuclei if the Pauli principle is to be taken into account properly and in calculations with wave functions of excited states having components with more than one phonon operator. (10 refs.)

99494 Seniority-three yrast states in the N=82 nucleus ^{147}Tb. J.Styczen, M.Piiparinen, Y.Nagai, P.Kleinheinz (Inst. fur Kernphys., KFA Julich, Julich, Germany), D.Bazzacco, J.Eberth, J.Blomqvist.
Z. Phys. A (Germany), vol.312, no.3, p.149-54 (1983).
Firm spin-parity assignments for the high-spin states up to 3.5 MeV in the one-proton nucleus ^{147}Tb were obtained from ^{144}Sm(^{6}Li,3n) in-beam γ-ray and conversion electron measurements. The energies of these two-particle one-hole excitations were calculated from the shell model with empirical nucleon-nucleon interaction energies. The calculated energy splittings agree well with experiment, whereas the theoretical excitation energies disagree by $\gtrsim$1 MeV if recently measured ground state masses are used. (19 refs.)

99495 Rotation aligned bands and configuration dependent interaction in ^{189}Hg. M.Guttormsen, K.P.Blume, Y.K.Agarwal, A.Grumbkow, K.Hardt, H.Hubel, J.Recht, P.Schuler (Inst. fur Strahlen- und Kernphys., Univ. Bonn, Bonn, Germany).
Z. Phys. A (Germany), vol.312, no.3, p.155-62 (1983).
High spin states in ^{189}Hg have been studied using the ^{181}Ta(^{14}N,6n) reaction. The various one- and three-quasiparticle rotational bands were interpreted within the cranked shell model. The band-crossing frequencies are found to depend on the number of spectator particles. The effect can be accounted for by a residual two-body interaction of approximately −0.11 MeV. (20 refs.)

99496 A reconsideration of fission fragment angular distributions from nuclei of high spin. L.C.Vaz, J.M.Alexander (Dept. of Chem., State Univ. of New York, Stony Brook, NY, USA).
Z. Phys. A (Germany), vol.312, no.3, p.163-8 (1983).
It has often been stated that fission fragment angular anisotropy, as predicted by equilibrium statistical theory, should disappear with increasing spin of the composite nucleus. However, several recent experimental studies reveal strong anisotropies for fission fragments from high-spin nuclear systems. The authors discuss this apparent discrepancy and its relationship to the rigid-rotor approximation used in the standard theory. A systematic comparison is given for fission fragment anisotropies from many experiments via the empirical parameters K_0^2 and $\mathcal{J}_{\mathrm{eff}}$. These systematics indicate a strong regularity, provided one allows for the perturbing effects of fission after transfer reactions. Many of the observed anisotropies exceed the predictions of the standard theory, but, as these predictions are based on a rigid rotor model, this does not seem particularly note-worthy. (15 refs.)

99497 Coupling of one and two quasiparticles to a Bohr-Mottelson core in ^{195,196,197,198}Hg. M.Trefz, A.A.Raduta, A.Faessler, Th.J.Koppel (Inst. fur Theoretische Phys., Univ. Tubingen, Tubingen, Germany).
Z. Phys. A (Germany), vol.312, no.3, p.195-207 (1983).
A new model for coupling the motion of particles to that of a quadrupole collective core with rotations and β and γ vibrations is proposed. The Hamiltonian describing the core is obtained by quantising the classical Hamiltonian associated with the quadrupole degrees of freedom. The inertial parameters and the deformation energy surface are determined microscopically. The spherical shell model particles interacting among themselves by pairing are coupled to the core by a λ^2-pole ($\lambda=0, 2, 4$) potential. The theory is applied to $^{195-198}$Hg. The predicted results agree very well the experimental data. A comparison of the present model to the other formalism is also given. (51 refs.)

99498 Coherent quadrupole states of three interacting bands and the solution of a Bohr-Mottelson Hamiltonian. A.A.Raduta, A.Faessler, Th.Koppel, C.Lima (Inst. fur Theoretische Phys., Univ. Tubingen, Tubingen, Germany).
Z. Phys. A (Germany), vol.312, no.3, p.233-45 (1983).
The projected functions of the coherent state model (CSM) describing the ground, gamma and beta bands are studied in the intrinsic frame of reference. Several symmetry relations for the intrinsic functions are obtained. Analytical expressions for the matrix elements of the collective operator $\beta^{m+n}\cos^m\gamma\sin^n\gamma$ are derived. Important selection rules are established for them. The probability distribution for the deformations β and γ are studied and compared to those corresponding to the solution of a microscopically determined Bohr-Mottelson Hamiltonian. (35 refs.)

99499 Observation of the weakly deformed $\nu i_{13/2}{}^2$ band in ^{188}Hg. K.Hardt, Y.K.Agarwal, C.Gunther, M.Guttormsen, R.Kroth, J.Recht (Inst. fur Strahlen- und Kernphys., Univ. Bonn, Bonn, Germany), F.A.Beck, T.Byrski, J.C.Merdinger, A.Nourredine, D.C.Radford, J.P.Vivien, C.Bourgeois.
Z. Phys. A (Germany), vol.312, no.3, p.251-6 (1983).
High-spin states in ^{188}Hg have been investigated using the ^{168}Er(^{24}Mg,4n) reaction. The rotation aligned $\nu i_{13/2}{}^2$ band, which intersects the weakly oblate ground state band at $I \approx 10$, is observed up to $I^{\pi}=20^+$ with an isomeric 12^+ level with $T_{1/2}=134(15)$ ns. The coexisting strongly deformed band, built on the 825 keV 0^+ level, is observed up to the 14^+ state. The systematics of the $\nu i_{13/2}{}^2$ rotation aligned bands is discussed. (12 refs.)

Nuclear data sheets for A=108 .... See Entry 98669

Cylindrical $\bar{s}\bar{p}$-boson model for large deformed nuclei .... See Entry 99513

Levels and transitions in ^{124}Te following thermal-neutron capture by ^{123}Te and the β decay of oriented ^{124}Sb .... See Entry 99533

Quenched magnetic transitions from high spin states in light nuclei .... See Entry 99534

Atomic-charge-state distributions of fusion-evaporation residues and nuclear shape changes at high spin .... See Entry 99537

E_{γ}-E_{γ} correlations from partial fusion reactions .... See Entry 99596

21.10D Binding energy and masses

Crossing of single-particle energy levels resulting from neutron excess in the sd shell .... See Entry 99490

Application of linear response theory to light odd-A nuclei in s-d shell .... See Entry 99526

21.10F Shape, charge, radius and form factors

99500 Measurement of isotropic variations in the charge radii of europium nuclei by the method of three-stepped laser photoionization of atoms. G.D.Alkhazov, A.E.Barzakh, E.I.Berlovich, V.P.Denisov, A.G.Dernyatin, V.S.Ivanov, A.N.Zherikhin, O.N.Kompanets, V.S.Letokhov, V.I.Mishin, V.N.Fedoseev (Inst. of Spectroscopy, Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.5, p.274-8 (5 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.5, p.231-4 (5 March 1983).
The optical isotopic shifts in atomic spectra are measured for the first time using the method of laser multistep photoionization of atoms and the changes in the mean-square charge radii of radioactive nuclei are determined. The measurements were performed for the radioactive isotopes $^{145\text{-}149}$Eu in the transition $4f^7 6s^2\ {}^8S_{7/2}{}^0$-$4f^7 6s\ 6p\,{}^6P_{7/2}$, $\lambda=576.5$ nm. (9 refs.)

99501 Effect of the Coriolis and centrifugal forces for nuclei with a stable octupole deformation. S.G.Rohozinski, W.Greiner (Gesellschaft fur Schwerionenforschung, Darmstadt, Germany).
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.1-4 (18 Aug. 1983).
Effects of the Coriolis and centrifugal forces for nuclei with a stable octupole deformation are examined in the frame of a schematic collective model. It is found that these effects are by no means attenuated with a rise of the octupole deformation. Taking them into account seems to allow for a consistent description of a strong anharmonization and differences in the moments of inertia of the positive- and negative-parity bands. (10 refs.)

99502 Nuclear size and compressibility. N.N.Kolesnikov, M.I.Starosotnikov (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Sov. Phys. J. (USA), vol.25, no.11, p.1049-53 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.84-9 (Nov. 1982).
Data on electron scattering on nuclei and spectra of mesoatoms and atoms are used to construct new expressions for nuclear size, which consider the effects of shells and deformations together with the dependence on A and Z. The compressibility of nuclei is also considered. (16 refs.)

Strong and weak coupling to the octupole-deformed mode in $_{89}{}^{227}$Ac .... See Entry 99491

Phonon operators in deformed nuclei .... See Entry 99493

Meson-exchange corrections to the nuclear weak axial charge density in the hard pion model and $0^+ \rightleftarrows 0^-$ transitions in A=16 nuclei .... See Entry 99505

A possible explanation of the difference between the structure functions of iron and deuterium .... See Entry 99506

Pionic corrections and the EMC enhancement of the sea in iron .... See Entry 99507

Bound-state shell model with full correction for spurious centre-of-mass motion .... See Entry 99511

Cylindrical $\bar{s}\bar{p}$-boson model for large deformed nuclei .... See Entry 99513

Effect of confinement size on nuclear structure functions .... See Entry 99532

Atomic-charge-state distributions of fusion-evaporation residues and nuclear shape changes at high spin .... See Entry 99537

On the non-relativistic approach to elastic ed scattering and the dependence on nucleon form factors .... See Entry 99565

Form factor of the M1 transition to the 10.23 MeV state in ^{48}Ca and the role of the Δ(1232) .... See Entry 99566

Electro-disintegration of ^{2}H with polarised beam and target ... See Entry 99568

Anharmonic vibration-rotation approach to quasimolecular spectra .... See Entry 99587

21.10H Spin, parity, and isobaric spin

Nuclear data sheets for A=108 .... See Entry 98669

Strong and weak coupling to the octupole-deformed mode in $_{89}{}^{227}$Ac .... See Entry 99491

Seniority-three yrast states in the N=82 nucleus ^{147}Tb .... See Entry 99494

Rotation aligned bands and configuration dependent interaction in ^{189}Hg .... See Entry 99495

A reconsideration of fission fragment angular distributions from nuclei of high spin .... See Entry 99496

Observation of the weakly deformed $\nu i_{13/2}{}^2$ band in ^{188}Hg .... See Entry 99499

Levels and transitions in ^{124}Te following thermal-neutron capture by ^{123}Te and the β decay of oriented ^{124}Sb .... See Entry 99533

Quenched magnetic transitions from high spin states in light nuclei .... See Entry 99534

Short range and long range schematic interactions, their implications for giant resonances, polarization charges and other properties of nuclei .... See Entry 99557

21.10K Electromagnetic moments

99503 An improved determination of the quadrupole moment of the first excited state of ^{208}Pb. R.H.Spear, W.J.Vermeer, M.T.Esat, J.A.Kuehner (Dept. of Nuclear Phys., Australian Nat. Univ., Canberra, Australia), A.M.Baxter, S.Hinds.
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.29-32 (18 Aug. 1983).
Coulomb-excitation studies of the 3^- first excited state of ^{208}Pb using ^{12}C and ^{16}O projectiles for a range of angles give -0.34 ± 0.15 e b for the static quadrupole moment ($Q(3^-)$) and 0.611 ± 0.012 e^2 b^3 for B(E3; $0^+ \rightarrow 3^-$). The value obtained for $Q(3^-)$ is substantially more precise and reliable than previous determinations, and is larger in magnitude than theoretical predictions. (26 refs.)

Strong and weak coupling to the octupole-deformed mode in $_{89}{}^{227}$Ac .... See Entry 99491

Nuclear moments and isotope shifts of europium isotopes by hyperfine structure investigations with collinear laser-ion beam spectroscopy .... See Entry 100285

21.10M Level density and structure

99504 Nuclear spectroscopy of ^{90}Y. D.J.Decman, R.K.Sheline (Florida State Univ., Tallahassee, FL, USA), Y.Tanaka, E.T.Jurney.
Z. Phys. A (Germany), vol.312, no.3, p.209-19 (1983).
The level structure of ^{90}Y has been studied using the ^{91}Zr$(t,\alpha)^{90}$Y and ^{89}Y$(n,\gamma)^{90}$Y reactions. The proton pickup reaction was studied with 17 MeV tritons and a Q3D spectrometer. In the thermal ^{89}Y$(n,\gamma)^{90}$Y reaction γ-rays from ~100 to 6857 keV were observed. In addition to previously known states and configurations, the ten states of the $\pi(p^3/_2)^{-1}\ \nu(d^5/_2)^1$ and $\pi(f^5/_2)^{-1}\ \nu(d^5/_2)^1$ configurations are assigned. Also many other new levels are identified from the (n,γ) data. The 0^- state of the $\pi(f^5/_2)^{-1}\ \nu(d^5/_2)^1$ is assigned at 3130 keV. Finite-range shell model calculations suggest that the tensor force is necessary to reproduce the experimentally observed splittings. (26 refs.)

Nuclear data sheets for A=108 .... See Entry 98669

Seniority-three yrast states in the N=82 nucleus ^{147}Tb .... See Entry 99494

An improved determination of the quadrupole moment of the first excited state of ^{208}Pb .... See Entry 99503

The structure of the S and D pairs of the Interacting Boson Model from the Hartree-Fock-Bogolyubov approximation .... See Entry 99515

Does accidental degeneracy imply a symmetry group? .... See Entry 99522

Levels and transitions in ^{124}Te following thermal-neutron capture by ^{123}Te and the β decay of oriented ^{124}Sb .... See Entry 99533

Structure effects in the ^{4}He$(\gamma$,p$)^3$H E2 cross section .... See Entry 99563

Isobaric analogue resonances in the ^{41}K and ^{65}Cu(p,n) reactions .... See Entry 99574

Excitation and decay of $\Delta L=1$ modes in ^{12}N via the ^{12}C(^{3}He,tp) reaction .... See Entry 99583

The measurement of entry states in light nuclei .... See Entry 99590

21.30 NUCLEAR FORCES

(see also 13.75C Nucleon-nucleon interactions)

99505 Meson-exchange corrections to the nuclear weak axial charge density in the hard pion model and $0^+ \rightleftarrows 0^-$ transitions in A=16 nuclei. H.-U.Jager, M.Kirchbach, E.Truhlik (Lab. of Theoretical Phys., Joint Inst. of Nuclear Res., Dubna, USSR).
Nucl. Phys. A (Netherlands), vol.A404, no.3, p.456-66 (15 Aug. 1983).
Starting with the hard-pion model based on a minimal chiral invariant phenomenological lagrangian, the two-body part of the time component of the weak axial-vector current is constructed in the tree approximation. Pion, rho- and A$_1$-meson exchanges are considered. The mesonic exchange operator obtained is applied to describe the purely weak axial $0^+ \rightleftarrows 0^-$, $\Delta T=1$ transition in the nuclear $A=16$ system. In order to treat nuclear structure correlation effects, explicit use of shell-model wave functions with configuration mixing is made. The authors confirm the large enhancement of the nuclear weak axial charge density with respect to impulse approximation. (21 refs.)

99506 A possible explanation of the difference between the structure functions of iron and deuterium. C.H.Llewellyn Smith (Dept. of Theoretical Phys., Univ. of Oxford, Oxford, England).
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.107-11 (18 Aug. 1983).
It is shown that the difference between $F_2{}^{\mathrm{Fe}}$ and $F_2{}^{\mathrm{D}}$ can be accounted for by a simplistic model in which iron contains 6-12 more pions than deuterium and these pions carry ~5% of the momentum. This requires the one-pion exchange contribution to be enhanced in heavy nuclei. A nuclear enhancement with the required characteristics has long been predicted. (17 refs.)

99507 Pionic corrections and the EMC enhancement of the sea in iron. M.Ericson, A.W.Thomas (CERN, Geneva, Switzerland).
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.112-16 (18 Aug. 1983).
It is shown that the European Muon Collaboration (EMC) enhancement in the region $x<0.3$ can be explained by an increase in the pion field in iron if there is an attractive force which mixes nucleon-hole and delta-hole states at momenta of order 300-400 MeV/c. Some experimental consequences of this explanation are discussed. (27 refs.)

99508 Microscopic collective nuclear potentials for vector and tensor forces. V.V.Vanagas (Inst. of Phys., Acad. of Sci., Lithuanian SSR).
Sov. Phys.-Collect. (USA), vol.22, no.2, p.1-8 (1982). Translation of: *Litov. Fiz. Sb. (USSR)*, vol.22, no.2, p.3-12 (1982).
General expressions for the collective terms of the vector and tensor forces are obtained, and explicit expressions for the potentials of these forces in the case of multipole interactions are given. Aspects of the collective potential of vector and tensor forces are discussed. (10 refs.)

Renormalization of the self-consistent summation of exchange diagrams in a relativistic quantum field theory .... See Entry 99286

Thermodynamical theory of pion condensation .... See Entry 99527

A connection between the relativistic mean field approach and effective interactions .... See Entry 99530

Short range and long range schematic interactions, their implications for giant resonances, polarization charges and other properties of nuclei .... See Entry 99557

DWIA calculations of proton momentum distributions in ^{12}C and ^{16}O(e,e′p) reactions .... See Entry 99567

An optical model for kaonic atoms .... See Entry 100605

21.40 FEW-NUCLEON SYSTEMS

99509 Parameters of the six-quark component of the deuteron. V.G.Ableev, G.G.Vorob'ev, L.Vizireva, Kh.Dimitrov, S.A.Zaporozhets, A.P.Kobushkin, D.K.Nikitin, A.A.Nomofilov, N.M.Piskunov, I.M.Sitnik, E.A.Strokovskii, L.N.Strunov, A.Filipkowski, V.I.Sharov (Joint Inst. for Nuclear Res., USSR).
JETP Lett. (USA), vol.37, no.4, p.233-6 (20 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.4, p.196-8 (20 Feb. 1983).
New data are reported on the momentum distribution of the nucleons in the deuteron. The parameters of the six-quark component of the deuteron are determined. The use of this component leads to a good description of accurate data on deuteron stripping by nuclei (from Dubna) and on the electrodisintegration of deuterons (from Stanford). (10 refs.)

Configuration space Faddeev calculations. VI. Triton wave function .... See Entry 99510

Neutron pick-up (n,^{2}n*) reaction .... See Entry 99577

Emission of direct particles in heavy ions collisions .... See Entry 99599

21.60 NUCLEAR-STRUCTURE MODELS AND METHODS

(for hadronic atoms and molecules, see 36.10)

99510 Configuration space Faddeev calculations. VI. Triton wave function. J.L.Friar, B.F.Gibson (Theoretical Div., Los Alamos Nat. Lab., Los Alamos, NM, USA), G.L.Payne.
Z. Phys. A (Germany), vol.312, no.3, p.169-75 (1983).
For pt.V see Phys. Rev. C., vol.24, no.5, p.2279-89 (1981). The triton ground-state wave function calculated using the Reid soft-core potential is displayed in configuration space. Both the S-state and D-state Schrodinger wave function components and the Faddeev amplitudes from which they are constructed are plotted. Specific features resulting from the tensor nature of the two-body force and from the strong short-range repulsion of the potential are discussed. Comparisons with corresponding functions generated by the Malfliet-Tjon s-wave potential model are made. Several intuitive features of the Schrodinger wave function are discussed. (14 refs.)

Comparison of the deep-inelastic structure functions of deuterium and aluminum nuclei .... See Entry 99457

Thermodynamical theory of pion condensation .... See Entry 99527

Double beta decay of ^{128}Te/^{130}Te and the question of a neutrino Majorana mass .... See Entry 99546

The reliability of nuclear model predictions of β-decay properties of nuclei far from stability .... See Entry 99549

Neutron pick-up (n,^{2}n*) reaction .... See Entry 99577

The anthropic principle .... See Entry 105002

21.60C Shell model

99511 Bound-state shell model with full correction for spurious centre-of-mass motion. R.Shyam (Inst. fur Kernphys., Tech. Hochschule Darmstadt, Darmstadt, Germany), M.A.Nagarajan.
J. Phys. G (GB), vol.9, no.8, p.901-12 (Aug. 1983).
A method to take fully into account the spurious CM motion in the shell model wavefunctions for the bound state is presented. This method is based on the earlier method of Philpott (1977) given for the continuum shell model. The exact intrinsic wavefunctions for the bound states obtained by this method have been used to calculate the form factors for the nucleon transfer reactions. These form factors have been compared with the CM-corrected form factors obtained by the approximate method of Pinkston (1976, 1977). It is found that Pinkston's method underestimates the CM corrections to the overlap functions for one-nucleon transfer reactions. (12 refs.)

99512 Particle-number-conserving method for treating the nuclear pairing correlation. J.Y.Zeng (The Niels Bohr Inst., Univ. of Copenhagen, Copenhagen, Denmark), T.S.Cheng.
Nucl. Phys. A (Netherlands), vol.A405, no.1, p.1-28 (22 Aug. 1983).
A particle-number-conserving (PNC) method for treating the nuclear pairing correlation is presented. The difficulties encountered in the BCS method (particle-number nonconservation, spurious states, blocking effect and orthogonality, etc.) disappear in the PNC treatment. A detailed comparison between the BCS and PNC methods is made. It is found that the shape and the state density of the low-lying spectra obtained are quite different from those of the quasiparticle spectra obtained in the BCS method. Large differences between the two methods are found in the occupation probabilities in the excited states, the branching ratios for two-particle transfer reactions, etc. Blocking effects in the energy and the moment of inertia are analyzed. The residual quasiparticle interaction and the relation between the even-odd mass difference and quasiparticle energy are investigated. Pair vibration and pair rotation are investigated in the framework of the PNC formalism. (10 refs.)

Crossing of single-particle energy levels resulting from neutron excess in the sd shell ....See Entry 99490

Seniority-three yrast states in the N=82 nucleus ^{147}Tb ....See Entry 99494

Coupling of one and two quasiparticles to a Bohr-Mottelson core in ^{195,196,197,198}Hg ....See Entry 99497

Nuclear size and compressibility ....See Entry 99502

Nuclear spectroscopy of ^{90}Y ....See Entry 99504

Meson-exchange corrections to the nuclear weak axial charge density in the hard pion model and $0^+ \rightleftarrows 0^-$ transitions in A=16 nuclei ....See Entry 99505

On the effective number of bosons in the interacting boson model ....See Entry 99514

Application of linear response theory to light odd-A nuclei in s-d shell ....See Entry 99526

Core excitations and M1 strengths in the Ca isotopes ....See Entry 99535

Form factor of the M1 transition to the 10.23 MeV state in ^{48}Ca and the role of the Δ(1232) ....See Entry 99566

DWIA calculations of proton momentum distributions in ^{12}C and ^{16}O(e,e′p) reactions ....See Entry 99567

Excitation and decay of $\Delta L=1$ modes in ^{12}N via the ^{12}C(^{3}He,tp) reaction ....See Entry 99583

On the influence of shell structure in dissipative collisions ...... See Entry 99591

Molecular interpretation of the neutron transfer in the reaction ^{13}C(^{13}C,^{12}C)^{14}C within the two-center shell model ....See Entry 99593

21.60E Collective models

99513 Cylindrical $\bar{s}\bar{p}$-boson model for large deformed nuclei. Hsi-Tseng Chen (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan), A.Arima.
Phys. Rev. Lett. (USA), vol.51, no.6, p.447-50 (8 Aug. 1983).
It is proposed that the intrinsic states in a well deformed nucleus may be described as those of a system of nonspherical bosons, each possessing quasispin 1, $\bar{p}$, or quasispin 0, $\bar{s}$. The model is tested by the experimental data with analytical expressions which have been derived for the bandheads and the $E2$ transitions. (7 refs.)

99514 On the effective number of bosons in the interacting boson model. O.Scholten (Dept. of Phys. & Astron., Michigan State Univ., East Lansing, MI, USA).
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.144-6 (28 July 1983).
A procedure for calculating the effective number of bosons in the interacting boson model is proposed. As an example, a calculation is presented for the 50-82 major shell for protons in which there is a subshell closure at $Z=64$. (12 refs.)

99515 The structure of the S and D pairs of the Interacting Boson Model from the Hartree-Fock-Bogolyubov approximation. S.Pittel (Bartol Res. Found., Franklin Inst., Univ. of Delaware, Newark, DE, USA), J.Dukelsky.
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.9-14 (18 Aug. 1983).
The Hartree-Fock-Bogolyubov approximation is used to determine the optimum choice for the S and D pairs of the microscopic Interacting Boson Model. Results are presented for the even Sm isotopes. (19 refs.)

99516 Diagram representation of the single-phonon propagator in the quasiparticle-phonon model of nuclei. G.Kyrchev (Joint Inst. for Nuclear Res., Dubna, USSR).
Theor. & Math. Phys. (USA), vol.53, no.2, p.1113-19 (Nov. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.2, p.260-70 (Nov. 1982).
A diagram technique is proposed for the quasiparticle-phonon model of nuclei. It is shown that restriction to single-phonon and two-phonon components in the wave functions of the excited states of even-even deformed nuclei is equivalent to summation of a definite class of single-loop diagrams. The contribution of a two-loop diagram is calculated. Further, closure of the hierarchy of equations for the Green's functions yields explicit approximations that lead to summation of the considered class of graphs. (16 refs.)

99517 The Interacting Boson Model and its connection with group theory. B.R.Barrett (Dept. of Phys., Univ. of Arizona, Tucson, AZ, USA).
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.407-21
The interacting Boson Model for only one kind of s and d bosons is described, and its connection with the group U(6) of unitary transformations of six dimensions is demonstrated. It is then shown how the subgroup chains of U(6) facilitate the solution of the eigenvalue problem for the s and d bosons in certain limiting cases. (15 refs.)

99518 A hidden symmetry in collective excitations of many-body systems. M.Moshinsky (Inst. de Fisica, Univ. Autonoma de Mexico, Mexico City, Mexico), Q.Castanos, A.Frank.
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.437-43
A collective Hamiltonian derived from an A-nucleon system is analyzed in the large A-limit and its hidden symmetry group identified. (15 refs.)

99519 The U(6) symmetry in the microscopic collective model. J.Deenen, C.Quesne (Univ. Libre de Bruxelles, Brussels, Belgium).
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.444-7
For any number of particles, the collective part of the harmonic oscillator Hamiltonian is shown to reduce to a six-dimensional harmonic oscillator. There is therefore a hidden U(6) symmetry in the microscopic collective model. (6 refs.)

99520 A formalism for the microscopic Interacting Boson Model with non-degenerate orbits. A.Frank, P.Van Isacker (Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.450-1
The authors discuss a formalism for the microscopic theory of the interacting boson model with non-degenerate shell model orbits, which is concise and simple for numerical calculations. They briefly indicate two of the possible applications of this formalism. (1 ref.)

Algebraic methods for a direct calculus of observables in the theory of nuclear band structure ....See Entry 99492

Rotation aligned bands and configuration dependent interaction in ^{189}Hg ....See Entry 99495

A reconsideration of fission fragment angular distributions from nuclei of high spin ....See Entry 99496

Coupling of one and two quasiparticles to a Bohr-Mottelson core in ^{195,196,197,198}Hg ....See Entry 99497

Coherent quadrupole states of three interacting bands and the solution of a Bohr-Mottelson Hamiltonian ....See Entry 99498

Observation of the weakly deformed $\nu i_{13/2}{}^2$ band in ^{188}Hg ....See Entry 99499

Effect of the Coriolis and centrifugal forces for nuclei with a stable octupole deformation ....See Entry 99501

Microscopic collective nuclear potentials for vector and tensor forces ....See Entry 99508

Levels and transitions in ^{124}Te following thermal-neutron capture by ^{123}Te and the β decay of oriented ^{124}Sb ....See Entry 99533

Systematics of the effective ratio $\langle\Gamma_n/\Gamma_f\rangle$ of neutron emission and fission partial widths for transcurium nuclei ....See Entry 99559

Anharmonic vibration-rotation approach to quasimolecular spectra ....See Entry 99587

21.60F Models based on group theory

99521 Boson mappings in nuclear physics. A brief and prejudiced survey. A.Klein (Dept. of Phys., Univ. of Pennsylvania, Philadelphia, PA, USA).
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.422-35
The physical problems which stimulated the study of boson mappings are reviewed. The various mathematical techniques available for this problem are outlined. It is emphasized that the first mapping technique found in the literature, that of Holstein-Primakoff (HP), has been insufficiently exploited. A modified HP technique is illustrated. The unresolved problems in connection with the derivation of the interacting boson model are illustrated by means of a simplified model, and a proposal for a solution is made. (28 refs.)

99522 Does accidental degeneracy imply a symmetry group?. M.Moshinsky (Inst. de Fisica, Univ. Nacional Autonoma de Mexico, Mexico City, Mexico), C.Quesne.
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.436
Summary form only given. The object of this paper is to probe the relation, which is usually taken for granted, between the appearance of accidental degeneracy in the energy levels of a given Hamiltonian and its symmetry group. This is done by analyzing the very simple problem of an oscillator to which a particular spin-orbit and centrifugal force are added. The authors find the operators that connect all the states of given energy as well as their corresponding observables in the classical limit. The Poisson bracket relations between these observables leads to a Lie Algebra U(3)×SU(2), but it does not translate into a Lie Algebra for the commutators of the corresponding operators, as some matrix elements of commutators, corresponding to Poisson brackets that are zero, do not vanish. Thus while accidental degeneracy in the quantum problem may lead to a larger group in the classical limit, it is not always given by the dimensions of the irreducible representations of this group. (no refs.)

99523 SO(2n+1) in an $[SU(2)]^n$ basis: symmetric representations. H.De Meyer, G.Vanden Berghe, P.De Wilde (Rijks Univ. Gent, Gent, Belgium).
Group Theoretical Methods in Physics. Proceedings of the XI International Colloquium, Istanbul, Turkey, 23-28 Aug. 1982 (Berlin, Germany: Springer-Verlag 1983), p.448-9
The number of internal labels of symmetric irreducible representations (SIRs) of SO(2n+1) equals 2n−1, as can be verified from a simple counting rule of Seligman and Sharp. One possible way to define such labels is to reduce the SIRs of SO(2n+1) into IRs of its maximal sub-algebra SO(2n−3)⊗Su(2)⊗SU(2) and to verify that no degeneracies are left. In order to derive the branching rule (restricted to SIRs) various methods are at one's disposal. Recently, the authors obtained the expression $SO(2n+1)\rightarrow SU(2)\otimes SU(2)\otimes SO(2n-3)$: $[v,0,\ldots,0]\rightarrow\Sigma_{\mu=0}{}^{v}\Sigma_{\lambda=0}{}^{[v-\mu/2]}(\mu/2,\mu/2,[v-\mu-2\lambda,0,\ldots,0])$, with n−1 zeros on the left hand side and n−3 zeros on the right hand side. The authors are concerned with the application of this expression for the case n=3. The main reason is that the reduction of SIRs of SO(7), which are closely related to the nuclear octupole phonon states, is a relevant step for solving the octupole phonon state labelling problem. (5 refs.)

On the effective number of bosons in the interacting boson model .... See Entry 99514

The structure of the S and D pairs of the Interacting Boson Model from the Hartree-Fock-Bogolyubov approximation .... See Entry 99515

The Interacting Boson Model and its connection with group theory .... See Entry 99517

A hidden symmetry in collective excitations of many-body systems .... See Entry 99518

The U(6) symmetry in the microscopic collective model .... See Entry 99519

A formalism for the microscopic Interacting Boson Model with non-degenerate orbits .... See Entry 99520

Levels and transitions in ^{124}Te following thermal-neutron capture by ^{123}Te and the β decay of oriented ^{124}Sb .... See Entry 99533

Anharmonic vibration-rotation approach to quasimolecular spectra .... See Entry 99587

21.60G Cluster models

99524 Resonating group kernels for complex cluster systems. Y.Suzuki (Phys. Dept., Niigata Univ., Niigata, Japan).
Nucl. Phys. A (Netherlands), vol.A405, no.1, p.40-54 (22 Aug. 1983).
The Bargmann transform technique has been generalized to evaluate the resonating group kernels needed for the microscopic cluster model in which constituent fragments are described by harmonic oscillator functions with unequal width parameters. All the techniques developed for the case of equal width parameters are applicable without any change except for a slight modification of the transformation to the Bargmann space cluster-internal and cluster-relative motion vectors. The inversion of the Bargmann transformation has been carried out for those Bargmann transforms which appear in the cluster model, making it possible to gain the kernels in a closed algebraic form. The kernels for the α+d and 9-quark 3-nucleon systems have been evaluated to illustrate the technique. (12 refs.)

21.60J Hartree-Fock and random-phase approximations

99525 On the general theory of nuclear non-equilibrium systems (statistical equations and 'nuclear hydrodynamics'). M.K.Weigel, J.Winter (Sektion Phys., Ludwig-Maximilians-Univ. Munchen, Garching, Germany).
J. Phys. G (GB), vol.9, no.8, p.913-29 (Aug. 1983).
The Green function method is used as the basic theory for the purpose of investigating the general structure of nuclear non-equilibrium systems. Firstly, the equations for the Green functions for Fermi systems in the real time domain are derived by application of Schwinger's variational principle for causal processes. In the second step the statistical equations (Boltzmann equation) are obtained from the first energy moments of the Green functions. By assuming a weak energy dependence of the mass operator it is then possible to generalise the time-dependent Hartree-Fock approach. The third step deals with the statistical approach to (nuclear) hydrodynamics by integrating the weighted Wigner transforms. As an example, the microscopic structure of the forces for the centre-of-mass motion of two colliding nuclei is investigated. It turns out that the 'optical' potential determines the behaviour of the systems. (33 refs.)

99526 Application of linear response theory to light odd-A nuclei in s-d shell. S.Sengupta (Phys. Dept., Burdwan Univ., Burdwan, India), T.K.Das.
Rev. Bras. Fis. (Brazil), vol.12, no.3, p.541-9 (Sept. 1982).
Microscopic calculations have been performed for light s-d shell nuclei using the linear response theory (LRT), in which the odd-A nuclear wave function is built on the even even (A-l) Hartree-Fock-Bogoliubov solution. The variational parameters are obtained by solving the linearized equations. The pairing plus quadrupole force has been used as residual interaction. Calculated BE, Q_J and $B(E2)$ values agree fairly well with available experimental data. (16 refs.)

Algebraic methods for a direct calculus of observables in the theory of nuclear band structure .... See Entry 99492

The structure of the S and D pairs of the Interacting Boson Model from the Hartree-Fock-Bogolyubov approximation .... See Entry 99515

Theory of model-space single-particle potential and its application to nuclear matter calculations .... See Entry 99529

A connection between the relativistic mean field approach and effective interactions .... See Entry 99530

Short range and long range schematic interactions, their implications for giant resonances, polarization charges and other properties of nuclei .... See Entry 99557

DWIA calculations of proton momentum distributions in ^{12}C and ^{16}O(e,e'p) reactions .... See Entry 99567

21.65 NUCLEAR MATTER

99527 Thermodynamical theory of pion condensation. G.G.Bunatian (JINR, Dubna, USSR), I.N.Mishustin.
Nucl. Phys. A (Netherlands), vol.A404, no.3, p.525-50 (15 Aug. 1983).
A thermodynamical approach to the description of the pion field and π-condensation in nuclear matter of high density and nonzero temperature is developed. It has been shown that the quantum and thermal fluctuations of pion fields play a decisive role near the critical point; they are the reason why the equation $D^{-1}(\omega,k,\rho,T)=0$ has no solutions $\omega^2(k)<0$ at any density ρ and temperature T, i.e. the criterion earlier used for the formation of the π-condensate is not satisfied. In order that the π-condensate may arise in the system with given ρ, T the thermodynamical potential should decrease when the π-condensate field is switched on: $\Delta\Omega(\phi)\leq 0$. The character as well as the critical parameters of the phase transition are strongly dependent on the effective $\pi\pi$ interaction. In the framework of the $\Lambda\phi^4$ model, the critical density and the jumps of the condensate field amplitude, along with the renormalized gap of the pion excitation spectrum and of the thermodynamical quantities, are estimated. The area of applicability of the authors' approach as well as possible consequences of the theory are discussed. (25 refs.)

99528 Kinetic theory for plasmas with non-Abelian interactions. U.Heinz (Inst. for Theoretische Phys. Johann Wolfgang Geothe-Univ., Frankfrut-am-Main, Germany).
Phys. Rev. Lett. (USA), vol.51, no.5, p.351-4 (1 Aug. 1983).
The derivation of kinetic equations for the classical and quantum (Wigner) distribution functions for a plasma with non-Abelian interactions is outlined. Particular emphasis is put on the relation between the color structures in the classical and the quantum theories. (16 refs.)

99529 Theory of model-space single-particle potential and its application to nuclear matter calculations. Z.Y.Ma, T.T.S.Kuo (Dept. of Phys., State Univ. of New York, Stony Brook, NY, USA).
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.137-43 (28 July 1983).
A theory of the model-space nuclear single-particle potential U is proposed, where the condition for determining U is that the one-body part of the resulting model-space effective interaction vanishes. Preliminary application to nuclear matter calculations has been made. It has led to a continuous self-consistent single-particle spectrum $\epsilon_k{}^M$ up to k_M, the momentum space boundary of the chosen model space, such as 3 fm^{-1}. Comparing with the usual BHF nuclear matter calculations using a discontinuous single-particle spectrum, the use of $\epsilon_k{}^M$ has increased in low-order calculations the nuclear matter binding energy by about 3 MeV, coming predominantly from the $^3S_1$-$^3D_1$ channel. (18 refs.)

99530 A connection between the relativistic mean field approach and effective interactions. A.Bouyssy, S.Marcos (Div. de Phys. Theorique, Inst. de Phys. Nucleaire, Orsay, France).
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.157-61 (28 July 1983).
Starting first from the relativistic mean field approach of finite nuclei, the Dirac equation is reduced to a Schrodinger equation which resembles very much the Hartree-Fock-Skyrme equation. As an alternative, a low density expansion of the energy in nuclear matter is performed and both approaches are compared. The connection with effective hamiltonians is discussed, as well as the possible relation between realistic parameters and effective ones. (15 refs.)

99531 Abnormal nuclei. J.Boguta (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.19-23 (18 Aug. 1983).
The Lee-Wick idea of abnormal nuclei is realized in a saturating chiral field theory of nuclear matter. It describes normal nuclear matter reasonably well. The properties of abnormal nuclei are investigated by solving the non-linear field equations numerically. Abnormal nuclei are shell like, having most of their mass concentrated on the surface. Implications of chiral symmetry, such as the existence of topological quantum number, is also discussed. (10 refs.)

99532 Effect of confinement size on nuclear structure functions. F.E.Close, R.G.Roberts, G.G.Ross.
Report RL-83-051, Rutherford Appleton Lab., Chilton, Oxon., England (June 1983), 12 pp.
The authors consider the differences in the structure function of a heavy nucleus such as iron, compared to a light nucleus. They investigate, in the context of QCD, a suggestion that these differences arise as a result of differences in the scale of confinement of the nuclear constituents. This results in a simple relationship between heavy and light nucleus structure functions which is in reasonable agreement with experiment if the confinement size in iron is around 10-20% greater than in a free nucleon. (11 refs.)

Universal signals of a quark-gluon plasma .... See Entry 99411

^{25}Mg(α,n)^{28}Si and ^{26}Mg(α,n)^{29}Si as neutron sources in explosive neon burning .... See Entry 104728

Quark-abnormal neutron stars .... See Entry 104904

21.80 HYPERNUCLEI

A separable potential and off-shell scattering amplitude for an α-Λ interaction .... See Entry 99584

23.00 RADIOACTIVITY AND ELECTROMAGNETIC TRANSITIONS

(see also 82.55 Radiochemistry)

23.20 ELECTROMAGNETIC TRANSITIONS

99533 Levels and transitions in ^{124}Te following thermal-neutron capture by ^{123}Te and the β decay of oriented ^{124}Sb. S.J.Robinson, W.D.Hamilton (Phys. Div., Univ. of Sussex, Brighton, England), D.M.Snelling.
J. Phys. G (GB), vol.9, no.8, p.961-84 (Aug. 1983).
Levels and γ-ray transitions in ^{124}Te have been studied using the techniques of directional correlation and nuclear orientation. Directional correlation measurements were performed on the γ-rays observed following thermal-neutron capture by ^{123}Te and the selection of several coincidence gates has allowed a comprehensive level scheme to be produced. The spins of 15 levels have been proposed from the directional correlation results and multiple mixing ratios have been extracted for 8 of the most intense transitions. Directional distribution measurements have been performed on the γ radiation observed following the β decay of oriented ^{124}Sb. The orientation was obtained by diffusing the antimony into iron and cooling to 6.5 mK. The observed anisotropies in the γ-radiation patterns have allowed 3 spin assignments to be made and 14 multipole mixing ratios to be extracted. The levels in ^{124}Te are discussed in terms of the simple vibrational phonon and interacting boson models. It is shown that ^{124}Te is a new example of O(6) nuclear symmetry within the boson model. (49 refs.)

99534 Quenched magnetic transitions from high spin states in light nuclei. P.Blunden, B.Castel (Oak Ridge Nat. Lab., Oak Ridge, TN, USA), H.Toki.
Z. Phys. A (Germany), vol.312, no.3, p.247-9 (1983).
Recent investigations of stretched $M6$ transitions in the s-d shell have uncovered the unexpected systematic trend that isoscalar $M6$ transitions are two to three times more retarded than the isovector ones. The authors present the result of a microscopic calculation analyzing the different mechanisms usually invoked in the formation of the quenching and suggest that an additional argument based on the difference in structure between isoscalar and isovector transition densities may be playing a predominant role in explaining the data. (17 refs.)

Nuclear data sheets for A=108 .... See Entry 98669

Cylindrical $\bar{s}\bar{p}$-boson model for large deformed nuclei .... See Entry 99513

Core excitations and M1 strengths in the Ca isotopes .... See Entry 99535

Weak gamma transition of 0.89 MeV of ^{207}Pb .... See Entry 99536

Atomic-charge-state distributions of fusion-evaporation residues and nuclear shape changes at high spin .... See Entry 99537

23.20C Lifetimes and transition probabilities

99535 Core excitations and M1 strengths in the Ca isotopes. B.A.Brown, D.J.Horen, B.Castel, H.Toki (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.151-4 (28 July 1983).
The existence of strong M1 transitions from $T=1$ and $T=2$ states in ^{40}Ca provides an interesting challenge to nuclear structure models. The authors show that the recent M1 data can be reconciled with a shell model study of ^{40}Ca and that the fragmentation and disappearance of strengths in ^{42}Ca and ^{44}Ca is consistent with a weak coupling extension of the ^{40}Ca system in which the M1 strength is divided among T_z and T_{z+1} components. (20 refs.)

Application of linear response theory to light odd-A nuclei in s-d shell .... See Entry 99526

Form factor of the M1 transition to the 10.23 MeV state in ^{48}Ca and the role of the Δ(1232) .... See Entry 99566

A gas cell for Doppler-shift attenuation measurements up to 10^7 Pa .... See Entry 100208

23.20N Internal conversion and extranuclear effects

99536 Weak gamma transition of 0.89 MeV of ^{207}Pb. R.K.Mishra (Dept. of Phys., Al-Fateh Univ., Tripoli, Libya).
Curr. Sci. (India), vol.52, no.11, p.544 (5 June 1983).
The author describes the attempts to detect the weak gammas by analysing the single conversion electron spectrum with a surface barrier Si-detector. (4 refs.)

99537 Atomic-charge-state distributions of fusion-evaporation residues and nuclear shape changes at high spin. T.M.Cormier, P.M.Cormier, M.Herman, N.G.Nicolis, P.M.Stwertka (Dept. of Phys. & Astron., Univ. of Rochester, Rochester, NY, USA).
Phys. Rev. Lett. (USA), vol.51, no.7, p.542-5 (15 Aug. 1983).
The average internal-conversion probabilities as a function of spin for continuum γ transitions are deduced from the energy dependence of the evaporation-residue atomic-charge-state distributions. Strongly enhanced internal-conversion probabilities are observed at high spin. The implications of these results for nuclear shapes at high spin are considered. (14 refs.)

23.40 BETA DECAY; ELECTRON AND MUON CAPTURE

99538 Recent theoretical progress on the $\beta\beta$ decay. E.Takasugi (Inst. of Phys., Osaka Univ., Osaka, Japan).
AIP Conf. Proc. (USA), no.99, p.207-17 (1983). (Neutrino Mass and Gauge Structure of Weak Interactions, Cable, WI, USA, Sept. 1982).
The general feature of the $\beta\beta$ decay is reviewed and the recent theoretical progress is discussed. (18 refs.)

99539 Geochemical double beta decay experiments. T.Kirsten (Max-Planck-Inst. fur Kernphys., Heidelberg, Germany).
AIP Conf. Proc. (USA), no.99, p.218 (1983). (Neutrino Mass and Gauge Structure of Weak Interactions, Cable, WI, USA, Sept. 1982).
Double beta decay provides a very sensitive test of lepton-quark symmetry; unfortunately, however, decay rates are so small that it has not yet been possible to unequivocally detect a double beta decay event directly. More important therefore is the data obtained by the 'geochemical' method where one detects the double beta decay products which have accumulated in natural minerals during long geological time periods. The author discusses the principles of the geometrical method, its strength and its limitations, the available data, new results on the ^{128}Te-^{130}Te system; theoretical implications of the data concerning the electron neutrino restmass and lepton-number conservation. A limit of $m_\nu \leq 5.6$ eV (95% confidence) has been obtained from the recent ^{128}Te-^{130}Te-measurements. (no refs.)

99540 Recent results obtained in experiments on double beta decay of ^{76}Ge and other nuclides. E.Bellotti, E.Fiorini, C.Liguori, A.Pullia, A.Sarracino, L.Zanotti (Dipartimento di Fisica, Univ. di Milano, Milano, Italy).
AIP Conf. Proc. (USA), no.99, p.219-24 (1983). (Neutrino Mass and Gauge Structure of Weak Interactions, Cable, WI, USA, Sept. 1982).
Results are reported of an experimental search for lepton number violation in ^{76}Ge, ^{150}Nd, ^{148}Nd, ^{100}Mo, ^{58}Ni, and ^{92}Mo decays. The experimental set up has been running under M. Blanc ($\sim$5000 m w.e. depth). No evidence has been found so far for any type of neutrinoless process. Limits of 10^{22} years for ^{76}Ge transitions are reported. (13 refs.)

99541 Neutrinoless $\beta\beta$-decay in gauge theories. J.D.Vergados (Dept. of Phys., Univ. of Ioannina, Ioannina, Greece).
AIP Conf. Proc. (USA), no.99, p.225-43 (1983). (Neutrino Mass and Gauge Structure of Weak Interactions, Cable, WI, USA, Sept. 1982).
The lepton violating neutrinoless $\beta\beta$-decay is investigated in the context of fashionable gauge theories. Various mechanisms are examined, e.g. light or heavy neutrinos, with or without right-handed currents, intermediate doubly charged Higgs particles, majoron emission, etc. Numerical results have been obtained for the transitions $^{48}\mathrm{Ca} \rightarrow {}^{48}\mathrm{Ti}$ ($\beta^-\beta^-$) and $^{58}\mathrm{Ni} \rightarrow {}^{58}\mathrm{Fe}$ ($\beta^+\beta^+$, electron capture, double electron capture) employing realistic nuclear models. (35 refs.)

99542 Future double beta decay experiments. D.O.Caldwell (Univ. of California, Santa Barbara, CA, USA).
AIP Conf. Proc. (USA), no.99, p.244-9 (1983). (Neutrino Mass and Gauge Structure of Weak Interactions, Cable, WI, USA, Sept. 1982).
Double beta decay laboratory experiments in progress or planned are surveyed. Particularly searches for neutrinoless double beta decay are emphasized and present limits on lifetimes and corresponding neutrino masses given. Especially discussed is a UCSB-LBL ^{76}Ge experiment which may reach limits $\sim 10^{24}$ years or $\sim$1 eV for m_ν. (6 refs.)

99543 Resonant neutrino activation and neutrino oscillations. W.P.Kells (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
AIP Conf. Proc. (USA), no.99, p.272-81 (1983). (Neutrino Mass and Gauge Structure of Weak Interactions, Cable, WI, USA, Sept. 1982).
Low Q value weak nuclear decays are considered which have two body final states (electron captures and bound state beta decays, BSD). This permits an analogy with the Mossbauer effect, where the emitted (anti)neutrinos will resonantly activate daughter nuclei in a suitable absorber. Candidates for such a process are examined and the relevant solid state host problems are discussed. The author points out that resonant line widths as large as the narrowest observed in Mossbauer spectroscopy suffice to greatly extend the sensitivity of ν (disappearance) oscillation experiments. (16 refs.)

99544 Relativistic Hartree-Fock calculations of K-shell ionization probabilities in beta decay. T.Mukoyama (Inst. for Chem. Res., Kyoto Univ., Kyoto, Japan), T.Kagawa.
Bull. Inst. Chem. Res. Kyoto Univ. (Japan), vol.61, no.1, p.36-44 (March 1983).
The *K*-shell ionization probabilities in β^- decay have been calculated for ^{185}W and ^{203}Hg using the relativistic Hartree-Fock wave functions. The effect of the indistinguishability of two electrons in the final state is taken into consideration. The calculated results are compared with the experimental data and other theoretical predictions. (27 refs.)

99545 Electron capture to positron branching ratios in the decay of ^{22}Na and ^{44}Sc. A.P.Baerg (Phys. Div., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
Can. J. Phys. (Canada), vol.61, no.8, p.1222-6 (Aug. 1983).
The electron capture to positron branching ratios, e/β^+, in the decay of ^{22}Na and ^{44}Sc have been re-measured by a new anticoincidence counting method. The results confirm the earlier values obtained by coincidence counting, but with a significantly reduced uncertainty. The new values are: 0.1079 ± 0.0003 for decay of ^{22}Na to the 1.27 MeV level in ^{22}Ne and 0.0499 ± 0.0005 for decay of ^{44}Sc to the 1.16 MeV level in ^{44}Ca. (8 refs.)

99546 Double beta decay of ^{128}Te/^{130}Te and the question of a neutrino Majorana mass. K.Grotz, H.V.Klapdor, J.Metzinger (Max-Planck-Inst. fur Kernphys., Heidelberg, Germany).
J. Phys. G (GB), vol.9, no.8, p.L169-73 (Aug. 1983).
The 2ν double beta ($\beta\beta$) decay of ^{30}Te and ^{128}Te is calculated in the PBCS pairing model. A correct treatment of the phase-space integral shows that the Pontecorvo (1968) argument leads to an incorrect half-life ratio. This has severe impact on the discussion of neutrinoless β decay and a possible neutrino mass. (27 refs.)

99547 The half-lives of ^{26m}Al, ^{34}Cl, ^{38m}K: precision measurements with isotope-separated samples. V.T.Koslowsky, E.Hagberg, J.C.Hardy (Phys. Dept., Univ. of Toronto, Toronto, Ontario, Canada), R.E.Azuma, E.T.H.Clifford, H.C.Evans, H.Schmeing, U.J.Schrewe, K.S.Sharma.
Nucl. Phys. A (Netherlands), vol.A405, no.1, p.29-39 (22 Aug. 1983).
The half-lives of ^{26m}Al, ^{34}Cl and ^{38m}K have been measured with isotopically pure samples prepared with an on-line isotope separator. Emitted β^+ particles were observed with a large-solid-angle, high-efficiency, low-background gas proportional counter, from which signals were multiscaled. The counting electronics had a well-defined non-extendable dead time. Each sample decay curve was individually corrected for dead time before being summed with other accumulated data, no pile-up corrections being necessary. The analyis procedure was tested on hypothetical data. The effect of contaminant isobars on the resultant half-lives has been investigated. Half-life results are ^{26m}Al: 6346.2 ± 2.6 ms, ^{34}Cl: 1527.7 ± 2.2 ms and ^{38m}K: 924.2 ± 0.3 ms. The quoted uncertainties include—for the first time—explicit provision for all possible contaminants. (28 refs.)

99548 The shape of the beta strength function and consequences for nuclear physics and astrophysics. H.V.Klapdor (Max-Planck-Inst. fur Kernphys., Heidelberg, Germany).
Prog. Part. & Nucl. Phys. (GB), vol.10, p.131-225 (1983).
Discusses the structure of the beta strength function and how it affects nuclear physics and astrophysics. Topics covered include beta decay of nuclei far from stability, beta delayed fission, transuranic element production, double beta decay, reactor physics, the r-process, stars and galactic and solar neutrinos. (462 refs.)

99549 The reliability of nuclear model predictions of β-decay properties of nuclei far from stability. K.-L.Kratz (Inst. fur Kernchem., Univ. Mainz, Mainz, Germany).
Z. Phys. A (Germany), vol.312, no.3, p.263-4 (1983).
Reliable predictions of β-decay properties of nuclei far from stability require the knowledge of the detailed β-strength function, $S_\beta(E)$. This latter quantity corresponds to the energy distribution of the reciprocal ft-value and is usually defined in terms of the reduced Gamow-Teller (GT) transition probability $B'(GT)=6260\ (g_V/g_A)^2/ft$. The author reviews various nuclear model and compares them with experiment. (13 refs.)

99550 New beta-delayed proton emitters in the lanthanide region. J.M.Nitschke, M.D.Cable (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA), W.-D.Zeitz.
Z. Phys. A (Germany), vol.312, no.3, p.265-6 (1983).
Several new beta-delayed proton emitters have been observed at the on-line mass separator OASIS. They were previously identified as: ^{125}Ce ($8.9+0.7$ s), ^{126}Pr (3.2 ± 0.6 s), ^{127}Nd (1.9 ± 0.4 s), ^{128}Nd (4 ± 2 s), ^{137}Gd (7 ± 3 s), ^{139}Gd (4.9 ± 1 s), and ^{143}Dy (4.1 ± 0.3 s). (6 refs.)

Meson-exchange corrections to the nuclear weak axial charge density in the hard pion model and $0^+ \rightleftarrows 0^-$ transitions in A=16 nuclei .... See Entry 99505

Levels and transitions in ^{124}Te following thermal-neutron capture by ^{123}Te and the β decay of oriented ^{124}Sb .... See Entry 99533

Semiconductor telescope spectrometer for beta-ray spectra ... See Entry 100171

Upper limit of peak area .... See Entry 100212

Nuclei with an extra quark, stellar burning, and the solar neutrino problem .... See Entry 104730

Nuclear β-decays of highly ionized heavy atoms in stellar interiors .... See Entry 104852

Electron capture rates during collapse of the supernova core .... See Entry 104897

23.60 ALPHA DECAY

99551 Existence of an α-decaying state of ^{12}C at $E_{exc}=30.3$ MeV. D.Miljanic ('Ruder Boskovic' Inst., Zagreb, Yugoslavia), E.Kossionides, G.Vourvopoulos, P.Assimakopoulos.
Z. Phys. A (Germany), vol.312, no.3, p.267-8 (1983).
New results together with previous evidence are presented supporting the existence of a narrow state of ^{12}C at $E_{exc}=30.3$ MeV. (11 refs.)

23.90 OTHER TOPICS IN NUCLEAR DECAY AND RADIOACTIVITY

New beta-delayed proton emitters in the lanthanide region ..... See Entry 99550

24.00 NUCLEAR REACTIONS AND SCATTERING: GENERAL

24.10 NUCLEAR REACTION AND SCATTERING MODELS AND METHODS

99552 The $^4He(\pi^-,n)^3H$ reaction in a Δ-hole model. M.Hirata (Dept. of Phys., Hiroshima Univ., Hiroshima, Japan), K.Masutani, A.Matsuyama, K.Yazaki.
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.15-18 (18 Aug. 1983).
The $^4He(\pi^-,n)^3H$ reaction in the resonance region is studied within the framework of the Δ-hole model. The basic mechanism of the pion absorption is assumed to be the $\Delta N \rightarrow NN$ transition and the interaction parameters for this transition are determined through the analysis of the $d(\pi^+,p)p$ reaction. The present model is found to describe the main features of the observed cross sections for the $^4He(\pi^-,n)^3H$ reaction, although it fails to explain the details of the angular distribution. (9 refs.)

99553 A possible modification of the Koonin formula of two-proton interferometry including an effect of two-proton clusters with a short range correlation. M.Biyajima (Dept. of Phys., Faculty of Liberal Arts, Shinshu Univ., Matsumoto, Japan).
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.24-8 (18 Aug. 1983).
By taking the two-proton (pp) clusters with a short range correlation (δ_c=0.6-0.7 fm) into account, which is useful in explaining the cumulative effects of backward pions and backward protons produced in hadron-nucleus collisions, Koonin's original (1977) pp interferometry formula can be modified. A comparison of the data in a ^{12}C collision at 40 GeV/c and an Ar+KCl collision at 1.8 GeV/c with the new modified Koonin formula is made. A small interaction size obtained in a previous analysis for the latter collision changes. (19 refs.)

99554 A note on some problems in transfer calculations. J.Bang (Niels Bohr Inst., Univ. of Copenhagen, Copenhagen, Denmark), A.M.Popova.
Z. Phys. A (Germany), vol.312, no.3, p.185-94 (1983).
Some principal questions of the theory of multiparticle transfer reactions are studied in the framework of Fredholm type equations. Expressions are compared to those of the distorted wave Born or coupled reaction channel approximations. (10 refs.)

99555 Quasi-elastic reaction cross sections. W.Westmeier, U.Brosa (Philipps-Univ., Marburg, Germany).
Z. Phys. A (Germany), vol.312, no.3, p.261-2 (1983).
Starting from the idea that a critical phenomenon separates deep-inelastic from quasi-elastic reactions, the authors introduce a simple procedure to calculate quasi-elastic cross sections. The results are compared with experimental data. (14 refs.)

Bound-state shell model with full correction for spurious centre-of-mass motion .... See Entry 99511

Statistical simulation of complete events in energetic nuclear collisions .... See Entry 99560

Measure of absorption in multistep compound processes .... See Entry 99561

Removal of interference effect in the calculation of photonuclear cross-sections .... See Entry 99562

Structure effects in the $^4He(\gamma,p)^3H$ E2 cross section .... See Entry 99563

On the non-relativistic approach to elastic ed scattering and the dependence on nucleon form factors .... See Entry 99565

DWIA calculations of proton momentum distributions in ^{12}C and $^{16}O(e,e'p)$ reactions .... See Entry 99567

Electro-disintegration of ^2H with polarised beam and target .... See Entry 99568

High energy proton interactions with Sr and Cs: a contribution to the waste transmutation study .... See Entry 99569

Neutron pick-up $(n,^2n^*)$ reaction .... See Entry 99577

Tensor analysing power of $(d,^3He)$ and (d,t) reactions and the D-state of the tri-nucleon system .... See Entry 99579

A study of the ^6Be system by use of the reaction $^3\vec{H}e(^3He,p)\,^5Li(g.s.)$ between 17 and 30 MeV with a polarized target .... See Entry 99581

Time-dependent variational description of $\alpha\alpha$ scattering .... See Entry 99582

Excitation and decay of $\Delta L=1$ modes in ^{12}N via the $^{12}C(^3He,tp)$ reaction .... See Entry 99583

$^{58}Ni(^{16}O,^{12}C)^{62}Zn$ reaction at an incident energy 80 MeV .... See Entry 99585

Gauge invariance in heavy-ion collisions .... See Entry 99586

Anharmonic vibration-rotation approach to quasimolecular spectra .... See Entry 99587

Molecular interpretation of the neutron transfer in the reaction $^{13}C(^{13}C,^{12}C)^{14}C$ within the two-center shell model .... See Entry 99593

General characteristics of the forward glory energy oscillations in heavy ion scattering .... See Entry 99594

A possible explanation for the evidence of anomalously short mean free paths of projectile fragments from heavy-ion collisions .... See Entry 99597

A study of charge symmetry breaking effects in elastic $\pi^{\pm}d$ scattering .... See Entry 99601

Inclusive reaction of nuclei induced by pions at intermediate energies .... See Entry 99602

24.10H Optical and diffraction models

99556 High energy hadron-nucleus diffraction scattering and nuclear structure. K.Takabayashi, M.Yonezawa (Dept. of Phys., Hiroshima Univ., Hiroshima, Japan).
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.169-71 (28 July 1983).
Two possible effects are suggested at high energy hadron-nucleus diffraction scattering if the nucleus behaves as a composite system of continuous (big-drop) or discrete non-nucleonic constituents. One is the appearance of the secondary dip in hadron-deuteron elastic differential cross sections and another is a small shadowing (eclipse) effect in the total cross section or even an antishadowing effect in light nuclei. (11 refs.)

On the general theory of nuclear non-equilibrium systems (statistical equations and 'nuclear hydrodynamics') .... See Entry 99525

DWIA calculations of proton momentum distributions in ^{12}C and $^{16}O(e,e'p)$ reactions .... See Entry 99567

Antiproton nuclear scattering in a microscopic potential model .... See Entry 99572

$^{58}Ni(^{16}O,^{12}C)^{62}Zn$ reaction at an incident energy 80 MeV .... See Entry 99585

Galileo-invariant theory of low energy pion-nucleus scattering. III. The π^--^4He reaction and light π-mesoatoms .... See Entry 99600

An optical model for kaonic atoms .... See Entry 100605

24.30 RESONANCE REACTIONS AND SCATTERING

99557 Short range and long range schematic interactions, their implications for giant resonances, polarization charges and other properties of nuclei. A.Mekjian, L.Zamick (Dept. of Phys. & Astron., Rutgers Univ., Piscataway, NJ, USA).
Phys. Rep. (Netherlands), vol.95, no.6, p.321-95 (May 1983).
Various schematic interactions, both short and long range, are employed in conjunction with sum rules to help form a link between microscopic and macroscopic aspects of nuclear structure. Topics included are giant resonances and polarization charges. (89 refs.)

On the distribution of the fluctuating reaction cross section .... See Entry 99558

Removal of interference effect in the calculation of photonuclear cross-sections .... See Entry 99562

Isobaric analogue resonances in the ^{41}K and $^{65}Cu(p,n)$ reactions .... See Entry 99574

Resonant charged particle emission from $^{11}B+p$ and ^{12}C states at E_x=20-23 MeV .... See Entry 99575

Anharmonic vibration-rotation approach to quasimolecular spectra .... See Entry 99587

Search for a three-particle component of the E_{CM}=11.1 MeV 5^- resonance in the $^{12}C+^{16}O$ reaction .... See Entry 99589

24.50 DIRECT REACTIONS

Neutron pick-up $(n,^2n^*)$ reaction .... See Entry 99577

Scattering and break-up of deuterons on α-particles in a realistic three-body model .... See Entry 99580

Anharmonic vibration-rotation approach to quasimolecular spectra .... See Entry 99587

24.60 STATISTICAL THEORY AND FLUCTUATIONS

99558 On the distribution of the fluctuating reaction cross section. H.Witala, L.Jarczyk, A.Strzalkowski (Inst. of Phys., Jagellonian Univ., Cracow, Poland), J.Lang, R.Muller.
Acta Phys. Pol. B (Poland), vol.B14, no.7, p.555-60 (July 1983).
Exact formula for the statistical distribution function of the fluctuating cross section is presented. Comparison with the results obtained from the approximate formula shows that such a formula can be used for calculation of the cumulative distribution function in the range of its values from 0.01 to 0.99. (7 refs.)

99559 Systematics of the effective ratio $\langle\Gamma_n/\Gamma_f\rangle$ of neutron emission and fission partial widths for transcurium nuclei. E.A.Cherepanov (JINR, Dubna, USSR), A.S.Iljinov, M.V.Mebel.
J. Phys. G (GB), vol.9, no.8, p.931-8 (Aug. 1983).
The ratios of neutron emission to fission partial widths averaged over the evaporation cascade, $\langle\Gamma_n/\Gamma_f\rangle$, are obtained from an analysis of the experimental cross sections of (HI, xn) reactions. The dependences of $\langle\Gamma_n/\Gamma_f\rangle$ on the excitation energy, E^*, angular momentum, I, and the number of neutrons emitted, x, are determined in the framework of the statistical model of the decay of excited nuclei. Using these dependences, the experimental data are analysed and the semi-empirical systematics of $\langle\Gamma_n/\Gamma_f\rangle$ are obtained. The dependence of the ratio $\langle\Gamma_n/\Gamma_f\rangle$ on the nucleon composition of the nucleus is considered in the framework of the liquid-drop model. (18 refs.)

99560 Statistical simulation of complete events in energetic nuclear collisions. G.Fai, J.Randrup (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Nucl. Phys. A (Netherlands), vol.A404, no.3, p.551-77 (15 Aug. 1983).
A statistical model is developed for the generation of complete multifragment events in medium-energy nuclear collision. Based on simple geometrical considerations, the collision system is divided into a few (participant/spectator) sources that disassemble independently. The sufficiently excited sources quickly explode into pions, nucleons, and composite, possibly particle unstable, nuclei. The different final states compete according to their microcanonical weight. The less excited sources, and the unstable explosion products, deexcite by sequential light-particle emission. The model has been implemented as a Monte Carlo computer code that is sufficiently efficient to permit generation of large event samples. The analysis of such multifragment events is addressed and some illustrative aplications are discussed. (18 refs.)

99561 Measure of absorption in multistep compound processes. B.V.Carlson, M.S.Hussein (Inst. de Fisica, Univ. de Sao Paulo, Sao Paulo, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.4, p.627-38 (Dec. 1982).
The Moldauer-Simonius theorem (1975) that relates the modulus of the determinant of the average, optical, S-matrix to the average width and spacing of the compound nucleus resonances is generalized to the multiclass resonances situation encountered in preequilibrium reactions. Corrections to the generalized M/S theorem are seen to be connected primarily to the width distribution of the widest doorway class. (14 refs.)

Wounded nucleons in α-α collisions at high energies .... See Entry 99475

On the general theory of nuclear non-equilibrium systems (statistical equations and 'nuclear hydrodynamics') .... See Entry 99525

On the mechanism of inclusive particle emission in proton-nucleus collisions at 0.5 GeV .... See Entry 99578

The measurement of entry states in light nuclei .... See Entry 99590

Measurements of nuclear deexcitation times down to 10^{-19} sec using crystal blocking of ^{16}O on diamond .... See Entry 99607

24.70 POLARIZATION IN REACTIONS AND SCATTERING

Short range and long range schematic interactions, their implications for giant resonances, polarization charges and other properties of nuclei .... See Entry 99557

On the non-relativistic approach to elastic ed scattering and the dependence on nucleon form factors .... See Entry 99565

Form factor of the M1 transition to the 10.23 MeV state in ^{48}Ca and the role of the Δ(1232) .... See Entry 99566

Electro-disintegration of ^{2}H with polarised beam and target ... See Entry 99568

Systematic study on the elastic scattering of 65 MeV polarized protons .... See Entry 99571

Tensor analysing power of (d,^{3}He) and (d,t) reactions and the D-state of the tri-nucleon system .... See Entry 99579

A study of the ^{6}Be system by use of the reaction $^{3}\vec{\mathrm{H}}$e(^{3}He,p) ^{5}Li(g.s.) between 17 and 30 MeV with a polarized target .... See Entry 99581

24.75 GENERAL PROPERTIES OF FISSION

A reconsideration of fission fragment angular distributions from nuclei of high spin .... See Entry 99496

The shape of the beta strength function and consequences for nuclear physics and astrophysics .... See Entry 99548

25.00 NUCLEAR REACTIONS AND SCATTERING: SPECIFIC REACTIONS

25.10 NUCLEAR REACTIONS AND SCATTERING INVOLVING FEW-NUCLEON SYSTEMS

Wounded nucleons in α-α collisions at high energies .... See Entry 99475

Large p_T hadron production in nucleus-nucleus collisions .... See Entry 99482

Scattering and break-up of deuterons on α-particles in a realistic three-body model .... See Entry 99580

A study of the ^{6}Be system by use of the reaction $^{3}\vec{\mathrm{H}}$e(^{3}He,p) ^{5}Li(g.s.) between 17 and 30 MeV with a polarized target .... See Entry 99581

Time-dependent variational description of $\alpha\alpha$ scattering .... See Entry 99582

The spontaneous fission of ^{8}Be and the fusion at sub-Coloumb barrier energies in the time-dependent cluster theory .... See Entry 99604

25.20 PHOTONUCLEAR REACTIONS AND PHOTON SCATTERING

99562 Removal of interference effect in the calculation of photonuclear cross-sections. M.H.Ahsan, N.Dytlewski, S.A.Siddiqui, H.H.Thies (Univ. of Western Australia, Nedlands, Australia).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.333-5 (1 July 1983).
The unmodified calculation of high resolution photonuclear cross-sections obtained with quasi-monochromatic photons, using bremsstrahlung, can result in an apparent 'interference effect' in narrow resonances. A simple method is described which eliminates this effect. (8 refs.)

99563 Structure effects in the ^{4}He(γ,p)^{3}H E2 cross section. J.J.Bevelacqua (US Dept. of Energy, Oak Ridge, TN, USA).
J. Phys. G (GB), vol.9, no.8, p.895-9 (Aug. 1983).
The ^{4}He(γ,p)^{3}H E2 cross section is calculated for $E_p{}^{CM} \leq 34$ MeV within the framework of the generalised R-matrix methodology of Lane and Robson (1966, 1969). The model suggests that three cross section peaks occur within this energy range. The first two peaks, at $E_p{}^{CM}=13.6$ and 22.5 MeV, correspond roughly to the 2^+ levels of Fairman and Meyerhof (1973) and McBroom et al. (1980). However, the third peak, at $E_p{}^{CM}=30.5$ MeV, does not correspond with any known 2^+ level. The existing data show considerable scatter and are not sufficiently detailed to confirm the predictions of the model. (28 refs.)

Photoneutrons from thick D_2O, Be and Pb converters at $E_{max}=15$ MeV .... See Entry 99606

25.30 LEPTON-INDUCED REACTIONS AND SCATTERING

99564 Pion electroproduction from $_1{}^1$H and $_1{}^2$H near threshold. E.T.Dressler (Dept. of Phys., Pennsylvania State Univ., Abington, PA, USA).
Can. J. Phys. (Canada), vol.61, no.8, p.1227-30 (Aug. 1983).
The differential cross sections for $_1{}^1$H(e,π^+)e′,n and $_1{}^2$H(e,π^+)e′,2n are calculated and compared with some recent data (Caplan and Sealock, manuscript in preparation). The theoretical model in this calculation uses essentially the same approximations as were used by Dressler et al. (1979) for the $_1{}^2$H(γ,π^+)2n total threshold cross section. The results of this new calculation are in good agreement with the $_1{}^1$H(e,π^+)e′,n data. However, comparing the author's results to the $_1{}^1$H/$_1{}^2$H data at an incident electron energy of 200 MeV and a pion energy of 15 MeV seems to indicate that the $_1{}^2$H(eπ^+)e′,2n calculation somewhat overestimates this cross section. (8 refs.)

99565 On the non-relativistic approach to elastic ed scattering and the dependence on nucleon form factors. I.I.Belyantsev, V.K.Mitrjushkin, P.K.Rashidov, S.V.Trubnikov (Lab. of Theoretical Phys., JINR, Moscow, USSR).
J. Phys. G (GB), vol.9, no.8, p.871-83 (Aug. 1983).
The predictions of non-relativistic theory for elastic ed scattering with a recent version of the Paris potential and using the modified dispersion approach for the deuteron electromagnetic form factors, polarisation vector and tensor are studied. The dependence of all the quantities mentioned above on the choice of the nucleon form factor, in particular of the least known neutron electric form factor, is analysed. It is shown that a good description of the experimental data on elastic deuteron form factors up to $Q^2 \leq 8$ $(\mathrm{GeV}/c)^2$ may be obtained within the framework of a purely non-relativistic approach. Moreover, the values $G_{En}(Q^2)$ extracted from the data on elastic ed scattering at small Q^2 lead to good agreement between theory and experiment for the magnitude of the slope at zero $G_{En}'(0)$. The importance of polarisation experiments in elucidating the role of relativistic effects, the contribution of 6q states, etc., are discussed. (54 refs.)

99566 Form factor of the M1 transition to the 10.23 MeV state in ^{48}Ca and the role of the Δ(1232). W.Steffen, H.-D.Graf, A.Richter (Inst. fur Kernphys., Tech. Hochschule Darmstadt, Darmstadt, Germany), A.Harting, W.Weise, U.Deutschmann, G.Lahm, R.Neuhausen.
Nucl. Phys. A (Netherlands), vol.A404, no.3, p.413-27 (15 Aug. 1983).
The form factor of the 10.23 MeV 1^+ state in ^{48}Ca has been measured by inelastic electron scattering up to a momentum transfer of 1.4 fm^{-1}. The state is known to have a relatively simple shell-model structure. The shell-model calculation is, however, in severe disagreement with the data. The authors have attempted to analyse this discrepency in terms of non-nucleonic degrees of freedom. The mechanism of a Δ-hole polarization is important for the reduction of the form factor at low q if the Δ-hole interaction is sufficiently strong. The remaining quenching may be attributed to nucleonic core polarization while corrections from meson-exchange currents turn out to be small. (31 refs.)

99567 DWIA calculations of proton momentum distributions in ^{12}C and ^{16}O(e,e′p) reactions. V.P.Berezovoj, Yu.P.Mel'nik, A.V.Shebeko (Inst. of Phys. & Technol., Ukrainian Acad. of Sci., Kharkov, Ukrainian SSR).
Nucl. Phys. A (Netherlands), vol.A404, no.3, p.443-55 (15 Aug. 1983).
The DWIA analysis of the quasi-free (e,e′p) process on ^{12}C and ^{16}O has been performed within the framework of the single-particle shell model. The spherical Hartree-Fock wave functions for the effective Skyrme forces are used in describing the ground-state properties of these nuclei. The competition between the structure effects and the final proton-nucleus interaction in forming the momentum distributions of outgoing protons is studied in a wide range of recoil momenta (up to 3 fm^{-1}). The distorting optical potential has been calculated on the basis of the Watson multiple scattering theory. The results of the analysis are compared with the new data obtained at Saclay. (51 refs.)

99568 Electro-disintegration of ^{2}H with polarised beam and target. C.Y.Cheung, R.M.Woloshyn (TRIUMF, Vancouver, BC, Canada).
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.147-50 (28 July 1983).
The asymmetry with respect to change in sign of the electron longitudinal polarization is calculated for the exclusive ^{2}H(e,e′n)p and inclusive ^{2}H(e,e′)X reactions on a polarised deuteron target. The sensitivity to the neutron electric form factor is discussed. (8 refs.)

Comparison of the deep-inelastic structure functions of deuterium and aluminum nuclei .... See Entry 99457

Parameters of the six-quark component of the deuteron .... See Entry 99509

25.40 NUCLEON-INDUCED REACTIONS AND SCATTERING

(see also 28.20 Neutron physics)

99569 High energy proton interactions with Sr and Cs: a contribution to the waste transmutation study. P.De Felice, R.Ocone, A.Rindi (Lab. Nazionali di Frascati, NFN, Frascati, Italy), J.Tuyn, R.Deltenre, G.Roubaud.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.359-65 (1 July 1983).
The authors studied the production of stable and radioactive isotopes by irradiation of ^{90}Sr and ^{137}Cs in high energy particle beams. A fast computer program has been written which follows the yield of the various nuclides through successive transmutation and decay processes. The cross sections for the high energy reactions were calculated using semiempirical equations. Samples of Sr and Cs have been exposed to a 600 MeV proton beam. The comparison of experimental and theoretical results confirms the validity of the semiempirical formulas as well as of the transmutation code. This work is a contribution to the study of the scientific feasibility of using charged particle beams for transmutation to reduce the radioactivity of high level nuclear waste materials. (7 refs.)

99570 Disintegration of carbon-12 with 7.1-20.1 MeV neutrons in dielectrics. A.Aframian (Atomic Energy Organization of Iran, NRC, Tehran, Iran).
J. Phys. G (GB), vol.9, no.8, p.985-94 (Aug. 1983).
The intrinsic scattering of neutrons by carbon and its disintegration modes resulting in single and multiple ^{4}He emissions have been studied using discrete neutron energies in the dielectric nuclear track detector (DNTD), CA80-15, $(C_6H_8O_9N_2)_n$. Ranges and space angles of the triply formed α particles have been measured yielding energy-dependent cross sections. Alternatively, the detector can also be used as a high-energy neutron dosimeter and spectrometer. (20 refs.)

99571 Systematic study on the elastic scattering of 65 MeV polarized protons. H.Sakaguchi (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
Mem. Fac. Sci. Kyoto Univ. Ser. Phys. Astrophys. Geophys. Chem. (Japan), vol.36, no.2, p.305-41 (March 1983). In Japanese.
Elastic scattering of 65 MeV polarized protons from 25 nuclei (^{16}O-^{209}Bi) has been measured. Systematics of the optical potential, which reproduces both the analyzing power and the differential cross section data remarkably, was persued. The volume integral of the real central part of the optical potential (J_R) shows a behavior similar to the binding energy curve for the target mass number. The mean square radius of the real central part of the optical potential is found to obey the relation $\langle r^2\rangle_{pot}=(0.937\pm0.012)A^{2/3}+(6.42\pm0.21)$ fm^2. By comparing with the systematics of the charge distributions obtained from electron scattering data, it is found that the effective two-body interaction range between an incident proton and a nucleon in the target has a target mass number dependence given by $\langle r^2\rangle_{int}=(0.132\pm0.013)A^{2/3}+(4.24\pm0.24)$ fm^2. Assuming this relation, root mean square radii of the point nucleon distributions are obtained. (48 refs.)

99572 Antiproton nuclear scattering in a microscopic potential model. J.A.Niskanen, A.M.Green (Res. Inst. for Theoretical Phys., Univ. of Helsinki, Helsinki, Finland).
Nucl. Phys. A (Netherlands), vol.A404, no.3, p.495-508 (15 Aug. 1983).
The authors derive an energy-dependent optical potential for $\bar{p}$ scattering on ^{12}C, ^{16}O, ^{32}S and ^{40}Ca. Using this they calculate the elastic scattering differential cross section and the absorption cross section at the laboratory energies 35 MeV, 75 MeV and 130 MeV (and for ^{40}Ca also at 200 MeV). Even though the model dependence of the elastic cross sections is non-negligible, the absorption cross sections are, in fact, practically independent on the model. A comparison is made with the rather meagre experimental data at 118 MeV and 174 MeV. (20 refs.)

99573 Multiparticle production in pTa interactions at 8 GeV/*c*. N.Fujiwara, S.Noguchi, M.Kohriki, S.Yamashita (Dept. of Phys., Nara Women's Univ., Nara, Japan).
Nucl. Phys. A (Netherlands), vol.A404, no.3, p.509-24 (15 Aug. 1983).
pTa interactions have been studied. The total inelastic cross section, multiplicities, net charge distributions and inclusive momentum and rapidity spectra for produced particles are reported. The correlations between fast and slow particles are presented and the reaction mechanisms for multiparticle production in pTa interactions are discussed. (16 refs.)

99574 Isobaric analogue resonances in the ^{41}K and ^{65}Cu(p,n) reactions. S.Saini, G.Singh, A.Chatterjee, S.Kailas, D.D.Karnik, N.Veerabahu, M.K.Mehta (Nuclear Phys. Div., Bhabha Atomic Res. Centre, Bombay, India).
Nucl. Phys. A (Netherlands), vol.A405, no.1, p.55-68 (22 Aug. 1983).
The total (p,n) reaction cross sections for ^{41}K and ^{65}Cu have been measured as a function of proton energy in the energy ranges 1.46-4.10 and 2.25-4.20 MeV, respectively. Several prominent isobaric analogue resonances have been identified. A detailed shape analysis of these isobaric analogue resonances has been performed to determine the proton width Γ_p, the spreading width W and the spectroscopic factor S_n for the various resonances. (27 refs.)

99575 Resonant charged particle emission from ^{11}B+p and ^{12}C states at E$_x$=20-23 MeV. F.Borchers, H.de Jong, J.Krug, E.Kuhlmann (Inst. fur Experimentalphys. I, Ruhr-Univ. Bochum, Bochum, Germany).
Nucl. Phys. A (Netherlands), vol.A405, no.1, p.141-58 (22 Aug. 1983).
Absolute differential cross sections of the reactions ^{11}B(p,p$_i$)^{11}B(i), i=0-3, and ^{11}B(p,α_0)^{8}Be have been measured at about 20 angles for up to 37 bombarding energies E_p=4.5-7.5 MeV corresponding to excitation energies E$_x$(^{12}C)=20.1-22.8 MeV. Several compound resonances are observed for which from their angular distributions the following spin and parity assignments were derived: E_x=20.25 MeV ($J^\pi=1^+$), 20.63 (3^-), 21.52 (3^-), 21.99 (1^-), and 22.47 (3^-). The positions and widths of the resonances were determined by R-matrix formulae. In all cases the sum of the proton partial widths virtually exhausts the total width indicating dominant 1p1h configurations. The resonances at 20.25, 20.63 and, tentatively, 21.99 MeV are identified to be the $T_z=0$ analog states of low-lying $T=1$ multiplets. A strong $J^\pi=2^+$ background was found throughout the whole energy range which was taken to be the low-energy tail of the isoscalar giant quadrupole resonance. (37 refs.)

99576 Improved experimental test of detailed balance and time reversibility in the reactions ^{27}Al+$p\rightleftharpoons^{24}$Mg+α. E.Blanke, H.Driller, W.Glockle (Abteilung fur Phys. und Aastron., Ruhr Univ. Bochum, Bochum, Germany), H.Genz, A.Richter, G.Schrieder.
Phys. Rev. Lett. (USA), vol.51, no.5, p.355-8 (1 Aug. 1983).
A new test of the principle of detailed balance in the nuclear reactions ^{27}Al(p,α_0)^{24}Mg and ^{24}Mg(α,p_0)^{27}Al at bombarding energies 7.3 MeV$\leq E_p\leq$7.7 MeV and 10.1 MeV$\leq E_\alpha\leq$10.5 MeV, respectively, is reported. Measured relative differential cross sections agree within the experimental uncertainty $\Delta=\pm0.51\%$ and hence are consistent with time-reversal invariance. From this result an upper limit $\xi\leq5\times10^{-4}$ (80% confidence) is derived for a possible time-reversal-noninvariant amplitude in the reaction. (17 refs.)

99577 Neutron pick-up (n,^{2}n*) reaction. M.Zadro, D.Miljanic (Ruder Boskovic Inst., Zagreb, Yugoslavia).
Z. Phys. A (Germany), vol.312, no.3, p.257-8 (1983).
Direct ^{2}n* contributions (^{2}n*-singlet n-n final state interaction) to the (n,2n) reaction cross sections are estimated. (11 refs.)

99578 On the mechanism of inclusive particle emission in proton-nucleus collisions at 0.5 GeV. S.G.Mashnik (Inst. of Appl. Phys., Acad. of Sci., Kishinev, USSR), S.Tesch.
Z. Phys. A (Germany), vol.312, no.3, p.259-60 (1983).
A cascade-exciton model is used to describe the backward particle emission from proton-nucleus collisions at medium energies. A good agreement with data at 0.5 GeV is obtained. (5 refs.)

Nuclear spectroscopy of ^{90}Y .... See Entry 99504

A possible modification of the Koonin formula of two-proton interferometry including an effect of two-proton clusters with a short range correlation .... See Entry 99553

High energy hadron-nucleus diffraction scattering and nuclear structure .... See Entry 99556

Analysis and estimate of neutron cross sections of curium isotopes .... See Entry 99605

25.50 ^{2}H- AND ^{3}H-INDUCED REACTIONS AND SCATTERING

99579 Tensor analysing power of (d,^{3}He) and (d,t) reactions and the D-state of the tri-nucleon system. F.Entezami, J.D.Brown, J.M.Barnwell, K.S.Dhuga, O.Karban, J.M.Nelson, S.Roman (Dept. of Phys., Univ. of Birmingham, Birmingham, England).
Nucl. Phys. A (Netherlands), vol.A405, no.1, p.69-87 (22 Aug. 1983).
Tensor analysing powers of the (d,^{3}He) reaction on ^{19}F, ^{45}Sc, ^{63}Cu, ^{64}Zn and (d,t) reaction on ^{63}Cu and ^{64}Zn have been measured at 12.4 MeV incident deuteron energy. The results were compared with the DWBA theory including the D-state term in the tri-nucleon wave function expressed by the D_2 parameter. The χ^2 criterion was applied to determine the value of the D_2 parameter. The effect of the tensor spin-orbit term T_R in the deuteron optical potential was investigated. The inclusion of the T_R term lowers the magnitude of the 'best fit' D_2 value in all cases and the results for (d,t) and (d,^{3}He) are very similar and in accordance with recent theoretical estimates. (39 refs.)

99580 Scattering and break-up of deuterons on α-particles in a realistic three-body model. J.Bang (The Niels Bohr Inst., Univ. of Copenhagen, Copenhagen, Denmark), J.-J.Benayoun, C.Gignoux, I.J.Thompson.
Nucl. Phys. A (Netherlands), vol.A405, no.1, p.126-40 (22 Aug. 1983).
Deuteron-α scattering with n,p break-up is calculated in a three-body model with local interactions. The exclusion principle is taken into account in an approximate way. (14 refs.)

99581 A study of the ^{6}Be system by use of the reaction $^3\vec{\text{H}}$e(^{3}He,p)^{5}Li(g.s.) between 17 and 30 MeV with a polarized target. U.Kirchner, R.Beckmann, U.Holm, H.-G.Korber (Inst. fur Experimentalphys., Univ. Hamburg, Hamburg, Germany).
Nucl. Phys. A (Netherlands), vol.A405, no.1, p.159-69 (22 Aug. 1983).
The differential cross section of the reaction ^{3}He(^{3}He,p)^{5}Li(g.s) has been measured at 26 MeV and the analyzing power A_y in the energy range 17-30 MeV with the use of a polarized ^{3}He target. The data are compared with existing microscopic multi-channel calculations to the ^{6}Be system. The influence of the $J^\pi=4^+$ channels turned out to be too strong. The deviations from the antisymmetry to 90° c.m. of the analyzing power angular distribution $A_y(\theta)$ are discussed with respect to the purely direct transfer model for identical particles in the entrance channel. (22 refs.)

Nuclear spectroscopy of ^{90}Y .... See Entry 99504

25.60 ^{3}HE- AND ^{4}HE-INDUCED REACTIONS AND SCATTERING

99582 Time-dependent variational description of $\alpha\alpha$ scattering. M.Saraceno (Dept. de Fisica, CNEA, Buenos Aires, Argentina), P.Kramer, F.Fernandez.
Nucl. Phys. A (Netherlands), vol.A405, no.1, p.88-108 (22 Aug. 1983).
The time-dependent variational principle is applied to the simple but quite realistic situation of $\alpha\alpha$ scattering. The effects of antisymmetrization are included and the authors show that they lead to a change in the structure of the phase space of relative motion. The main new feature is the appearance of forbidden regions in the phase space which have, in the quantum treatment, a close connection with states excluded by the Pauli principle. The elastic phase shifts are evaluated semiclassically in the distorted phase space and compared to a quantum calculation by the resonating group method. (33 refs.)

99583 Excitation and decay of $\Delta L=1$ modes in ^{12}N via the ^{12}C(^{3}He,tp) reaction. W.A.Sterrenburg, M.N.Harakeh, S.Y.Van der Werf, A.Van der Woude (Kernfysisch Versneller Instituut, Groningen, Netherlands).
Nucl. Phys. A (Netherlands), vol.A405, no.1, p.109-25 (22 Aug. 1983).
A study of the nucleus ^{12}N has been performed using the ^{12}C(^{3}He,t) reaction at bombarding energies of 75 and 81 MeV. Differential cross sections were measured and interpreted using an effective projectile-nucleon interaction and microscopic wave functions. Proton decay to final states in ^{11}C was measured by recording coincidences tritons emitted at 0° and protons detected at several backward angles. From the triton angular distributions and the triton-proton angular correlations strong suggestions can be made about the location of $J^\pi=2^-$, 1^- and 0^- strengths in ^{12}N. The $\Delta L=1$ strength distributions are compared with the results of shell-model calculations. (25 refs.)

99584 A separable potential and off-shell scattering amplitude for an α-Λ interaction. S.Oryu, R.Kircher (Dept of Phys., Sci. Univ. of Tokyo, Noda, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1673-6 (May 1983).
A separable potential of low rank is derived from a local α-Λ potential for the $S_{1/2}$-wave. This separable potential reproduces the bound state and the scattering wave functions of a given nonseparable α-Λ interaction with high accuracy. In addition, the off-shell T-matrix and the off-shell scattering amplitude have been calculated on the basis of the form factors of the separable potential. (14 refs.)

Wounded nucleons in α-α collisions at high energies .... See Entry 99475

Large p_T hadron production in nucleus-nucleus collisions .... See Entry 99482

Improved experimental test of detailed balance and time reversibility in the reactions ^{27}Al+$p\rightleftharpoons^{24}$Mg+α .... See Entry 99576

The spontaneous fission of ^{8}Be and the fusion at sub-Coloumb barrier energies in the time-dependent cluster theory .... See Entry 99604

^{25}Mg(α,n)^{28}Si and ^{26}Mg(α,n)^{29}Si as neutron sources in explosive neon burning .... See Entry 104728

25.70 HEAVY ION INDUCED REACTIONS AND SCATTERING

99585 ^{58}Ni(^{16}O,^{12}C)^{62}Zn reaction at an incident energy 80 MeV. Y.Okuma (Res. Center for Nuclear Phys., Osaka Univ., Osaka, Japan), T.Motobayashi, K.Takimoto, S.Shimoura, K.Ogino, M.Fukada, T.Suehiro, S.Matsuki, T.Yanabu.
Bull. Inst. Chem. Res. Kyoto Univ. (Japan), vol.61, no.1, p.12-29 (March 1983).
Cross section angular distributions for the ^{16}O+^{58}Ni elastic scattering and the ^{58}Ni(^{16}O,^{12}C)^{62}Zn-3.8416 MeV reaction leading to the discrete and continuum states at an incident energy E$_{lab}$(^{16}O)=80 MeV have been measured. The eight low-lying single and double energy levels were observed in the energy spectra of the ^{58}Ni(^{16}O,^{12}C)^{62}Zn reaction. Populations of these levels have the cross sections of 1-200 μb/sr. The total yield of the (^{16}O,^{12}C) reaction was enhanced in the particle-identification spectra of the ^{16}O induced reactions on ^{58}Ni. This is because the Q value of this reaction is negative but small. The g'nd state cross section was proved to change with the incident energy by comparing the present data with the other 46 and 60 MeV data. The cross section angular distribution for the g'nd state transition changes also with the incident energy. Optical model parameters were deduced from the best fit to the measurements of the ^{16}O+^{58}Ni elastic scattering. The EFR-DWBA calculations of the (^{16}O,^{12}C) results were performed with reasonable fits for the cross section angular distributions of observed energy levels. (45 refs.)

99586 Gauge invariance in heavy-ion collisions. D.H.Kobe, P.K.Kennedy (Dept. of Phys., North Texas State Univ., Denton, TX, USA).
J. Phys. B (GB), vol.16, no.15, p.L443-7 (14 Aug. 1983).
A manifestly gauge-invariant formulation of the Dirac equation for an electron in the electromagnetic field generated by two heavy ions is given, which used the eigenstates and eigenvalues of the gauge-invariant energy operator. Transitions between the energy eigenstates are induced by the power operator, not the vector potential. (16 refs.)

99587 Anharmonic vibration-rotation approach to quasimolecular spectra. N.Cindro (Rudjer Boskovic Inst., Zagreb, Yugoslavia), W.Greiner.
J. Phys. G (GB), vol.9, no.8, p.L175-9 (Aug. 1983).
A closed-form expression for the energies of known ^{12}C+^{12}C and positive-parity ^{12}C+^{16}O resonances was obtained assuming an anharmonic quadrupole vibration-rotation model for the colliding nuclei. The expression has a form identical to that obtained by Iachello (1981) on the basis of dipole vibrations; this result shows that the nature of the degrees of freedom dominating nuclear quasimolecules can also be well accounted for by quadrupole motion. The model describes the sequential deformation of the nuclear system before it breaks up into clusters; the strongly deformed nuclear shapes can be associated with nuclear isomerism. (7 refs.)

99588 Target dependence of ^{16}O-induced reactions at 20 MeV/A. A.Menchaca-Rocha (Inst. des Sci. Nucleaires, Grenoble, France), M.E.Brandan, R.Legrain, A.Dacal, A.Galindo.
J. Phys. G (GB), vol.9, no.8, p.L181-5 (Aug. 1983).
Projectile-like particle yields from ^{16}O-induced reactions at E_i=315 MeV have been measured for ^{12}C and ^{60}Ni targets and compared with those for

^{208}Pb. Factorisation for the relative yields is found to extend down to light targets. (13 refs.)

99589 **Search for a three-particle component of the $E_{CM}=11.1$ MeV 5^- resonance in the $^{12}C+^{16}O$ reaction.** H.U.Gersch, H.Schobbert, D.Wohlfarth (Zentralinst. fur Kernforschung, Rossendorf, Dresden, Germany).
J. Phys. G (GB), vol.9, no.8, p.939-46 (Aug. 1983).
The 11.1 MeV 5^- resonance in the $^{12}C+^{16}O$ reaction is remeasured and the position of the resonance is determined to be $E_x(^{28}Si)=(27.881\pm0.022)$ MeV. A kinematically complete study of the $^{12}C(^{16}O,\alpha^{12}C)^{12}C$ reaction into this resonance is carried out. Particle identification is based on the reaction kinematics. No evidence for a ^{12}C-α-^{12}C component of this resonance is found. (13 refs.)

99590 **The measurement of entry states in light nuclei.** R.Daniel, J.D.Burrows, P.A.Butler, J.R.Cresswell, A.D.Irving, D.J.G.Love, T.P.Morrison, P.J.Nolan, J.F.Sharpey-Schafer (Oliver Lodge Lab., Univ. of Liverpool, Liverpool, England).
J. Phys. G (GB), vol.9, no.8, p.947-60 (Aug. 1983).
Gamma-ray and charged-particle emission have been studied following the bombardment of ^{28}Si and ^{32}S with 40 MeV ^{16}O ions and of ^{58}Ni with 55 MeV ^{16}O ions. The locus of states populated by particle evaporation and depopulated by γ emission (entry line) has been studied in the 2p channel for each of these reactions by measuring the mean γ-ray multiplicity and total proton kinetic energy. The moments of inertia for ^{46}Ti and ^{72}Se are deduced from the slope of the entry line. The data are compared with statistical-model calculations and show good agreement. (15 refs.)

99591 **On the influence of shell structure in dissipative collisions.** K.D.Hildenbrand, H.Freiesleben, A.Gobbi, U.Lynen, A.Olmi, H.Sann, E.C.Wu (Gesellschaft fur Schwerionenforschung, Darmstadt, Germany).
Nucl. Phys. A (Netherlands), vol.A405, no.1, p.179-204 (22 Aug. 1983).
A kinematically complete study of the symmetric systems $^{144}Sm+^{144}Sm$ and $^{154}Sm+^{154}Sm$ has been performed at energies 30% in excess of the interaction barrier. They have been chosen because of their different internal structure: ^{144}Sm has a closed $N=82$ neutron shell and a spherical ground-state configuration; ^{154}Sm with ten neutrons outside this shell is strongly deformed. The observed gross features of both reactions like energy, angular and total mass or element distributions are very similar; the ratio of the mass variances as function of the total kinetic energy loss indicates the number of exchanged nucleons to be comparable in all stages of the reactions. At small energy losses, however, the element distributions of the $^{144}Sm+^{144}Sm$ reaction are considerably broader, pointing at an enhanced proton transfer at the cost of the number of exchanged neutrons in this system. This observation is attributed to the influence of the closed shell which seems to block the transfer of neutrons at low excitation energies. These results can be explained quantitatively by the different gradients of the shell-corrected potential energy surfaces of the two systems. (43 refs.)

99592 **Search for short-lived anomalons in projectile fragmentation.** H.A.Gustafsson, H.H.Gutbrod, B.Kolb, B.Ludewigt, A.M.Poskanzer, T.Renner, H.Riedesel, H.G.Ritter, A.I.Warwick, H.H.Wieman (Gesellschaft fur Schwerionenforschung, Darmstadt, Germany).
Phys. Rev. Lett. (USA), vol.51, no.5, p.363-5 (1 Aug. 1983).
An anomalous short mean free path for projectile fragments has been observed in emulsions. The effect disappears in the first few centimeters and it has been suggested that the disappearance is due to a lifetime effect. The projectile fragmentation yields from a solid and a dilute Cu target bombarded by 1.7-Gev/u ^{56}Fe have been measured and it is concluded that the disappearance of the effect is not due to decay. (5 refs.)

99593 **Molecular interpretation of the neutron transfer in the reaction $^{13}C(^{13}C,^{12}C)^{14}C$ within the two-center shell model.** R.Konnecke, W.Greiner (Inst. fur Theoretische Phys., Johann-Wolfgang-Goethe-Univ., Frankfurt-am-Main, Germany), W.Scheid.
Phys. Rev. Lett. (USA), vol.51, no.5, p.366-9 (1 Aug. 1983).
On the basis of the two-center shell model a molecular reaction theory is applied to the reaction $^{13}C(^{13}C,^{12}C)^{14}C$. Prominent structures in the measured differential cross sections can be reproduced by this theory. (13 refs.)

99594 **General characteristics of the forward glory energy oscillations in heavy ion scattering.** M.S.Hussein (Dept. of Phys., MIT, Cambridge, MA, USA).
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.165-8 (28 July 1983).
Analytic expressions are derived for the period and amplitude of the energy oscillations associated with nuclear forward glory scattering. It is found that the amplitude increases with energy as $E^{1/4}$ whereas the period behaves approximately as $E^{3/2}/\ln E$. Several numerical examples are worked out. (11 refs.)

99595 **Complete fusion in peripheral collisions observed in the reaction ^{16}O on ^{146}Nd at 10 MeV/u.** H.Oeschler, M.Kollatz (Tech. Hochschule Darmstadt, Darmstadt, Germany), W.Bohne, K.Grabisch, H.Lehr, H.Freiesleben, K.D.Hildenbrand.
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.177-80 (28 July 1983).
It is experimentally well established that the nucleus ^{162}Er is stable against fission for spins below 65 ħ. The observation of fission in the reaction ^{16}O on ^{146}Nd proves therefore that compound nuclei have been formed with spins beyond this value via complete fusion as in the competing process of incomplete fusion with ^{12}C originating from ^{16}O break-up states with spins below 55 ħ in ^{158}Dy are populated which are stable against fission. Complete fusion is found to occur for partial waves well above the critical l value. For these peripheral collisions complete and incomplete fusion seem to coexist. (11 refs.)

99596 **E_γ-E_γ correlations from partial fusion reactions.** H.Yamada, A.Ahmed, H.Banda, J.H.Hamilton, C.F.Maguire, R.B.Piercey, A.V.Ramayya (Dept. of Phys. & Astron., Vanderbilt Univ., Nashville, TN, USA), S.A.Hjorth, D.C.Hensley, J.D.Cole, G.A.Leander.
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.33-6 (18 Aug. 1983).
A partial fusion reaction, $^{154}Sm(^{14}N,(p,d,t)xn)^{157-159}Er$, is shown to be a viable alternative to heavier-ion complete fusion reactions for E_γ-E_γ correlation studies at very high spin. The valley observed in the present correlation plot, obtained with NaI detectors, indicates rotational band structure up to $E_\gamma\approx1.46$ MeV and a corresponding estimated spin of $I=48$. A numerical simulation of the experimental data to check the method shows the significance of this result. (16 refs.)

99597 **A possible explanation for the evidence of anomalously short mean free paths of projectile fragments from heavy-ion collisions.** E.S.Pshenin, V.G.Voinov (High Energy Phys. Inst., Kazakh Acad. of Sci., Alma-Ata, USSR).
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.133-6 (18 Aug. 1983).
In the last years many experiments with heavy-ion accelerator beams have been performed. Some of these experiments give evidence for anomalously short mean free paths (MFP's) of projectile fragments for the first few centimeters after the point of emission. The authors give the possible explanation of this effect based on the statistical bias of the estimate for the MFP used by experimenters. The unbiased estimate for the reciprocal of the MFP is presented. (9 refs.)

99598 **Heavy fragment energies and angular distributions in the reaction of 86 MeV/nucleon ^{12}C with medium-A targets.** A.Lleres, J.Blachot, J.Crancon, A.Gizon, H.Nifenecker (Dept. de Recherche Fondamentale, CENG, Grenoble, France).
Z. Phys. A (Germany), vol.312, no.3, p.177-84 (1983).
Using the thin target-thin catchers techniques, masses, mean recoil energies and angular distributions of target residues have been measured for 86 MeV/nucleon ^{12}C induced reactions. Several different nuclear reaction processes, from peripheral to central collisions have been observed. Experimental results are partly reproduced by intranuclear cascade+evaporation calculations. Up to now, the production of the lightest masses $(44<A<71)$ recoiling with high kinetic energies is not correctly understood by theoretical models. More exclusive experiments are needful to check if the formation of a highly excited quasi-compound nucleus could be a possible explanation of the phenomena. (19 refs.)

99599 **Emission of direct particles in heavy ions collisions.** H.Tricoire (Inst. de Phys. Nucleaire, Orsay, France).
Z. Phys. A (Germany), vol.312, no.3, p.221-32 (1983).
The author presents a theoretical model for the emission of fast light particles derived from the PEP (Promptly Emitted Particles) model. This model is extended to the emission of fast alpha particles. With some restrictions, analytical formulae are derived for the production rate and the mean angular momentum associated with fast particles. Most of the qualitative features predicted by the analytical formulae are confirmed by the numerical results obtained from a more realistic calculation where the trajectories of the particles are followed during the whole collision. It is argued that PEP alpha particles emitted preferentially in low angular momentum collisions, could represent the major part of the fast alpha particles observed in incomplete fusion reactions. (24 refs.)

Seniority-three yrast states in the N=82 nucleus ^{147}Tb ....See Entry 99494

Rotation aligned bands and configuration dependent interaction in ^{189}Hg ....See Entry 99495

Observation of the weakly deformed $vi_{13/2}{}^2$ band in ^{188}Hg ....See Entry 99499

An improved determination of the quadrupole moment of the first excited state of ^{208}Pb ....See Entry 99503

Kinetic theory for plasmas with non-Abelian interactions ....See Entry 99528

On the distribution of the fluctuating reaction cross section ....See Entry 99558

Systematics of the effective ratio $\langle\Gamma_n/\Gamma_f\rangle$ of neutron emission and fission partial widths for transcurium nuclei ....See Entry 99559

Measure of absorption in multistep compound processes ....See Entry 99561

Angular momentum partition as a function of the mass asymmetry in heavy-ion induced fission ....See Entry 99603

Measurements of nuclear deexcitation times down to 10^{-19} sec using crystal blocking of ^{16}O on diamond ....See Entry 99607

A new system for astrophysical nuclear reaction studies with radioactive ion beams ....See Entry 99920

25.80 MESON- AND HYPERON-INDUCED REACTIONS AND SCATTERING

99600 **Galileo-invariant theory of low energy pion-nucleus scattering. III. The π^--^4He reaction and light π-mesoatoms.** R.Mach (Inst. of Nuclear Phys., Czechoslovak Acad. Sci., Rez, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.7, p.772-86 (1983).
For pt.II, see ibid., vol.B33, no.6, p.616 (1983). Using two versions of the Galileo-invariant optical model, π^--^4He elastic scattering cross sections were calculated in the energy interval 50-260 MeV. Level shifts and widths of several light π-mesoatoms were estimated in the Born approximation. Whereas the $(A+1)$-body model appears to be more suitable in the resonance region the two-body model yields surprisingly good results for both the low-energy scattering and the characteristics of π-mesoatoms. (24 refs.)

99601 **A study of charge symmetry breaking effects in elastic $\pi^\pm d$ scattering.** A.S.Rinat, Y.Alexander (Weizmann Inst. of Sci., Rehovot, Israel).
Nucl. Phys. A (Netherlands), vol.A404, no.3, p.467-81 (15 Aug. 1983).
The authors computed external and internal Coulomb distortions as well as strong charge symmetry breaking (CSB) effects in $\pi^\pm d\rightarrow\pi^\pm d$. Available data for $T_\pi=143$ MeV indicate the presence of CSB on the level of observed and deduced parameters for different Δ-isobars and the pn mass difference. Data for $T_\pi\gtrsim180$ MeV are predicted to better suit the extraction of a measure of charge symmetry breaking. This note also contains a critical analysis of a previous study of CSB effects on $\sigma_{\pi d}{}^{tot}$. (19 refs.)

99602 **Inclusive reaction of nuclei induced by pions at intermediate energies.** J.Suzumura (Dept. of Phys., Sci. Univ. of Tokyo, Noda, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1669-72 (May 1983).
The dynamics of the two-nucleon absorption of pion in the reaction $\pi^\pm+A\rightarrow p+$anything at intermediate energies is investigated in the correlated pair model. The process is dominated by pion and ρ-meson exchange following Δ_{33} excitation. The role of the ρ-meson is shown to be crucial in reducing the contribution of pion exchange. (12 refs.)

The $^4He(\pi^-,n)^3H$ reaction in a Δ-hole model ....See Entry 99552

A possible modification of the Koonin formula of two-proton interferometry including an effect of two-proton clusters with a short range correlation ....See Entry 99553

High energy hadron-nucleus diffraction scattering and nuclear structure ....See Entry 99556

25.85 FISSION REACTIONS

99603 **Angular momentum partition as a function of the mass asymmetry in heavy-ion induced fission.** F.A.Dilmanian, L.Grodzins, J.W.Ball, M.Beckerman, R.Boisseau, S.Gazes, R.Ledoux, A.Sperduto (Lab. for Nuclear Sci., MIT, Cambridge, MA, USA).
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.172-6 (28 July 1983).
Gamma ray multiplicities and angular distributions have been measured as functions of the mass asymmetry of the fission fragments for the reactions of 150-210 MeV ^{37}Cl beams with ^{107}Ag, and 150-210 MeV ^{32}S beams with ^{112}Cd. In all reactions, as the mass asymmetry increases the mean total gamma ray multiplicities decreases, the relative width of the multiplicity increases and the gamma ray anisotropy decreases. Thus the more asymmetric the mass splitting the smaller is the total spin of the fission fragments, and, probably, the total angular momentum of the compound system. (18 refs.)

99604 The spontaneous fission of ^{8}Be and the fusion at sub-Coloumb barrier energies in the time-dependent cluster theory. S.Drozdz (Inst. of Nuclear Phys., Cracow, Poland), J.Okolowicz, M.Ploszajczak.
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.5-8 (18 Aug. 1983).
The time-dependent cluster theory is applied for a description of the spontaneous fission of ^{8}Be and for a calculation of the α-α fusion cross section at sub-Coulomb barrier energies. The calculated spontaneous fission decay width $\Gamma^{(cal)} \simeq 7.5$ eV reproduces the experimental value $\Gamma^{(ex)} = 6.8 \pm 1.7$ eV. (12 refs.)

99605 Analysis and estimate of neutron cross sections of curium isotopes. T.S.Belanova.
Sov. At. Energy (USA), vol.53, no.6, p.841-8 (Dec. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.6, p.386-91 (Dec. 1982).
The presence of curium isotopes in power-reactor fuel creates many problems in reactor operation and design, in repeated fuel reprocessing and actinide waste disposal, and also in the production of transuranium elements. A quantitative estimate of the rate of buildup and decay of Cm nuclei requires data on the neutron capture and fission cross sections in both the resonance and thermal energy regions. The author attemps to systematize the published experimental data on neutron cross sections for Cm isotopes, and to estimate values at thermal and resonance energies. (37 refs.)

99606 Photoneutrons from thick D_2O, Be and Pb converters at $E_{max} = 15$ MeV. A.V.Drobinin, M.Leonard, Yu.M.Tsipenyuk.
Sov. At. Energy (USA), vol.53, no.6, p.858-61 (Dec. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.6, p.398-9 (Dec. 1982).
Neutron escape is one of the basic channels of an excited nucleus. Neutrons may be emitted at various stages in a nuclear reaction. The energy spectrum of the decay products from an intermediate or heavy nuclide is due, in the main, to the decay of the compound nucleus, but it also contains a high-energy component corresponding to the decay of the ingoing state into the continuum; part of the spectrum is due to the preequilibrium decay from more complicated configurations. The authors study the photoneutron spectra from D_2O, Be and Pb convertors at 15 MeV. (11 refs.)

The shape of the beta strength function and consequences for nuclear physics and astrophysics .... See Entry 99548

Systematics of the effective ratio $\langle \Gamma_n/\Gamma_f \rangle$ of neutron emission and fission partial widths for transcurium nuclei .... See Entry 99559

25.88 FUSION REACTIONS

99607 Measurements of nuclear deexcitation times down to 10^{-19} sec using crystal blocking of ^{16}O on diamond. J.Gomez del Campo, D.Shapira, J.A.Biggerstaff, C.D.Moak, P.D.Miller, N.Neskovic (Oak Ridge Nat. Lab., Oak Ridge, TN, USA), R.W.Fearick, J.P.F.Sellschop.
Phys. Rev. Lett. (USA), vol.51, no.6, p.451-4 (8 Aug. 1983).
The crystal-blocking technique was used to measure the deexcitation times of the evaporation residues of 120-MeV ^{16}O on ^{12}C, emerging along the $\langle 110 \rangle$ axis of a 12-μm-thick diamond crystal. The extracted times ranged from 4×10^{-19} sec for Mg to 4×10^{-18} sec for N, and they are consistent with statistical-model predictions. (12 refs.)

Complete fusion in peripheral collisions observed in the reaction ^{16}O on ^{146}Nd at 10 MeV/u .... See Entry 99595

E_γ-E_γ correlations from partial fusion reactions .... See Entry 99596

The spontaneous fission of ^{8}Be and the fusion at sub-Coloumb barrier energies in the time-dependent cluster theory .... See Entry 99604

27.00 PROPERTIES OF SPECIFIC NUCLEI LISTED BY MASS RANGES

27.10 A ≤ 5

Comparison of the deep-inelastic structure functions of deuterium and aluminum nuclei .... See Entry 99457

Wounded nucleons in α-α collisions at high energies .... See Entry 99475

Large p_T hadron production in nucleus-nucleus collisions .... See Entry 99482

A possible explanation of the difference between the structure functions of iron and deuterium .... See Entry 99506

Parameters of the six-quark component of the deuteron .... See Entry 99509

Configuration space Faddeev calculations. VI. Triton wave function .... See Entry 99510

The ^{4}He(π^-,n)^{3}H reaction in a Δ-hole model .... See Entry 99552

Structure effects in the ^{4}He(γ,p)^{3}H E2 cross section .... See Entry 99563

Pion electroproduction from $_1{}^{1}$H and $_1{}^{2}$H near threshold .... See Entry 99564

On the non-relativistic approach to elastic ed scattering and the dependence on nucleon form factors .... See Entry 99565

Electro-disintegration of ^{2}H with polarised beam and target .... See Entry 99568

Scattering and break-up of deuterons on α-particles in a realistic three-body model .... See Entry 99580

A study of the ^{6}Be system by use of the reaction $^{3}\vec{\mathrm{H}}$e(^{3}He,p) ^{5}Li(g.s.) between 17 and 30 MeV with a polarized target .... See Entry 99581

Time-dependent variational description of $\alpha\alpha$ scattering .... See Entry 99582

Galileo-invariant theory of low energy pion-nucleus scattering. III. The π^--^{4}He reaction and light π-mesoatoms .... See Entry 99600

A study of charge symmetry breaking effects in elastic $\pi^{\pm}$d scattering .... See Entry 99601

The spontaneous fission of ^{8}Be and the fusion at sub-Coloumb barrier energies in the time-dependent cluster theory .... See Entry 99604

Photoneutrons from thick D_2O, Be and Pb converters at $E_{max} = 15$ MeV .... See Entry 99606

27.20 6 ≤ A ≤ 19

Meson-exchange corrections to the nuclear weak axial charge density in the hard pion model and $0^+ \rightleftarrows 0^-$ transitions in A=16 nuclei .... See Entry 99505

Existence of an α-decaying state of ^{12}C at $E_{exc} = 30.3$ MeV .. See Entry 99551

DWIA calculations of proton momentum distributions in ^{12}C and ^{16}O(e,e′p) reactions .... See Entry 99567

Disintegration of carbon-12 with 7.1-20.1 MeV neutrons in dielectrics .... See Entry 99570

Antiproton nuclear scattering in a microscopic potential model .... See Entry 99572

Resonant charged particle emission from ^{11}B+p and ^{12}C states at $E_x = 20$-23 MeV .... See Entry 99575

Tensor analysing power of (d,^{3}He) and (d,t) reactions and the D-state of the tri-nucleon system .... See Entry 99579

Excitation and decay of $\Delta L = 1$ modes in ^{12}N via the ^{12}C(^{3}He,tp) reaction .... See Entry 99583

Target dependence of ^{16}O-induced reactions at 20 MeV/A .... See Entry 99588

Search for a three-particle component of the $E_{CM} = 11.1$ MeV 5^- resonance in the ^{12}C+^{16}O reaction .... See Entry 99589

Molecular interpretation of the neutron transfer in the reaction ^{13}C(^{13}C,^{12}C)^{14}C within the two-center shell model .... See Entry 99593

Heavy fragment energies and angular distributions in the reaction of 86 MeV/nucleon ^{12}C with medium-A targets .... See Entry 99598

The spontaneous fission of ^{8}Be and the fusion at sub-Coloumb barrier energies in the time-dependent cluster theory .... See Entry 99604

Photoneutrons from thick D_2O, Be and Pb converters at $E_{max} = 15$ MeV .... See Entry 99606

Measurements of nuclear deexcitation times down to 10^{-19} sec using crystal blocking of ^{16}O on diamond .... See Entry 99607

External tandem target system for efficient production of short-lived positron emitting radionuclides .... See Entry 104052

27.30 20 ≤ A ≤ 38

Comparison of the deep-inelastic structure functions of deuterium and aluminum nuclei .... See Entry 99457

Crossing of single-particle energy levels resulting from neutron excess in the sd shell .... See Entry 99490

Electron capture to positron branching ratios in the decay of ^{22}Na and ^{44}Sc .... See Entry 99545

The half-lives of ^{26m}Al, ^{34}Cl, ^{38m}K: precision measurements with isotope-separated samples .... See Entry 99547

Antiproton nuclear scattering in a microscopic potential model .... See Entry 99572

Improved experimental test of detailed balance and time reversibility in the reactions $^{27}\mathrm{Al} + p \rightleftharpoons {}^{24}\mathrm{Mg} + \alpha$ .... See Entry 99576

The measurement of entry states in light nuclei .... See Entry 99590

^{25}Mg(α,n)^{28}Si and ^{26}Mg(α,n)^{29}Si as neutron sources in explosive neon burning .... See Entry 104728

27.40 39 ≤ A ≤ 58

A possible explanation of the difference between the structure functions of iron and deuterium .... See Entry 99506

Pionic corrections and the EMC enhancement of the sea in iron .... See Entry 99507

Core excitations and M1 strengths in the Ca isotopes .... See Entry 99535

Recent results obtained in experiments on double beta decay of ^{76}Ge and other nuclides .... See Entry 99540

Neutrinoless $\beta\beta$-decay in gauge theories .... See Entry 99541

Electron capture to positron branching ratios in the decay of ^{22}Na and ^{44}Sc .... See Entry 99545

Form factor of the M1 transition to the 10.23 MeV state in ^{48}Ca and the role of the Δ(1232) .... See Entry 99566

Antiproton nuclear scattering in a microscopic potential model .... See Entry 99572

Isobaric analogue resonances in the ^{41}K and ^{65}Cu(p,n) reactions .... See Entry 99574

Tensor analysing power of (d,^{3}He) and (d,t) reactions and the D-state of the tri-nucleon system .... See Entry 99579

^{58}Ni(^{16}O,^{12}C)^{62}Zn reaction at an incident energy 80 MeV .... See Entry 99585

The measurement of entry states in light nuclei .... See Entry 99590

A gas cell for Doppler-shift attenuation measurements up to 10^{7} Pa .... See Entry 100208

27.50 59 ≤ A ≤ 89

Nuclear spectroscopy of ^{90}Y .... See Entry 99504

Recent results obtained in experiments on double beta decay of ^{76}Ge and other nuclides .... See Entry 99540

Future double beta decay experiments .... See Entry 99542

Isobaric analogue resonances in the ^{41}K and ^{65}Cu(p,n) reactions .... See Entry 99574

Tensor analysing power of (d,^{3}He) and (d,t) reactions and the D-state of the tri-nucleon system .... See Entry 99579

Target dependence of ^{16}O-induced reactions at 20 MeV/A .... See Entry 99588

Search for short-lived anomalons in projectile fragmentation .. See Entry 99592

A gas cell for Doppler-shift attenuation measurements up to 10^{7} Pa .... See Entry 100208

27.60 90 ≤ A ≤ 149

Seniority-three yrast states in the N=82 nucleus ^{147}Tb .... See Entry 99494

Measurement of isotropic variations in the charge radii of europium nuclei by the method of three-stepped laser photoionization of atoms .... See Entry 99500

Nuclear spectroscopy of ^{90}Y .... See Entry 99504

Levels and transitions in ^{124}Te following thermal-neutron capture by ^{123}Te and the β decay of oriented ^{124}Sb .... See Entry 99533

Geochemical double beta decay experiments .... See Entry 99539

Recent results obtained in experiments on double beta decay of ^{76}Ge and other nuclides .... See Entry 99540

Double beta decay of ^{128}Te/^{130}Te and the question of a neutrino Majorana mass .... See Entry 99546

New beta-delayed proton emitters in the lanthanide region ..... See Entry 99550

High energy proton interactions with Sr and Cs: a contribution to the waste transmutation study .... See Entry 99569

On the influence of shell structure in dissipative collisions ...... See Entry 99591

Complete fusion in peripheral collisions observed in the reaction ^{16}O on ^{146}Nd at 10 MeV/u .... See Entry 99595

Angular momentum partition as a function of the mass asymmetry in heavy-ion induced fission .... See Entry 99603

Semiconductor telescope spectrometer for beta-ray spectra ... See Entry 100171

Upper limit of peak area .... See Entry 100212

27.70 150 ≤ A ≤ 189

Rotation aligned bands and configuration dependent interaction in ^{189}Hg .... See Entry 99495

Observation of the weakly deformed $vi_{13/2}{}^2$ band in ^{188}Hg .... See Entry 99499

The structure of the S and D pairs of the Interacting Boson Model from the Hartree-Fock-Bogolyubov approximation .... See Entry 99515

Atomic-charge-state distributions of fusion-evaporation residues and nuclear shape changes at high spin .... See Entry 99537

Recent results obtained in experiments on double beta decay of ^{76}Ge and other nuclides .... See Entry 99540

Relativistic Hartree-Fock calculations of K-shell ionization probabilities in beta decay .... See Entry 99544

Multiparticle production in pTa interactions at 8 GeV/c .... See Entry 99573

On the influence of shell structure in dissipative collisions ...... See Entry 99591

E_γ-E_γ correlations from partial fusion reactions .... See Entry 99596

27.80 190 ≤ A ≤ 219

Coupling of one and two quasiparticles to a Bohr-Mottelson core in ^{195,196,197,198}Hg .... See Entry 99497

An improved determination of the quadrupole moment of the first excited state of ^{208}Pb .... See Entry 99503

Weak gamma transition of 0.89 MeV of ^{207}Pb .... See Entry 99536

Relativistic Hartree-Fock calculations of K-shell ionization probabilities in beta decay .... See Entry 99544

Target dependence of ^{16}O-induced reactions at 20 MeV/A ..... See Entry 99588

Photoneutrons from thick D_2O, Be and Pb converters at $E_{max}=15$ MeV .... See Entry 99606

27.90 220 ≤ A

Strong and weak coupling to the octupole-deformed mode in $_{89}{}^{227}$Ac .... See Entry 99491

Analysis and estimate of neutron cross sections of curium isotopes .... See Entry 99605

A pilot scale, alpha disassembly and decontamination facility at the Savannah River Laboratory .... See Entry 99682

Fission neutron radiography with etch-track detectors .... See Entry 100199

A search for superheavy nuclei tracks in extraterrestrial olivine crystals .... See Entry 104694

28.00 NUCLEAR ENGINEERING AND NUCLEAR POWER STUDIES

(see also 86.10 Energy resources and their utilisation)

28.20 NEUTRON PHYSICS

(see also 25.40 Nucleon-induced reactions and scattering)

99608 Multiple scattering from an infinite plane slab. A.K.Soper (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.337-47 (1 July 1983).
A straightforward iterative procedure is used to calculate multiple scattering from an infinite slab over a wide range of slab thicknesses. For thin slabs, the calculations agree well with earlier work. In particular, the author finds that the ratio of total scattered to primary scattered neutron currents for a thin slab is represented by the function $1/(1-\delta)$, where δ is the ratio of secondary to primary currents. For thick slabs, the results are compared with Monte Carlo simulations of polyethylene and iron. The agreement is generally good, but the method exaggerates the ability of polyethylene to attenuate 10 MeV neutrons. A model of two parallel slabs is used to discuss the reflectivity of the walls of a neutron collimator. (13 refs.)

99609 Slowing down of neutrons from a pulsed, point, monoenergetic source in a hydrogenous medium. R.Golub (Tech. Univ., Munchen, Garching, Germany), A.D.Taylor.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.349-57 (1 July 1983).
The authors present an approximate analytic solution for the distribution of neutrons from a pulsed, point source in an infinite hydrogenous medium. The solution is obtained in the diffusion approximation with the energy loss due to collisions with the hydrogen nuclei treated exactly. Their result is very close to the Age-Diffusion theory result. They then extend the method to apply to a point source surrounded by a bare spherical moderator and compare the results with those obtained from Monte Carlo (TIMOC) calculations and a steady state transport code (ANISN). (18 refs.)

99610 Spin-dependent scattering and absorption of thermal neutrons on dynamically polarized nuclei. H.Glattli, J.Coustham (IRF, CEN, Gif-sur-Yvette, France).
J. Phys. (France), vol.44, no.8, p.957-65 (Aug. 1983).
Dynamic nuclear polarization and the spin-temperature concept of nuclear Zeeman reservoirs are systematically used to obtain spin-dependent scattering lengths b_N of separate isotopes in the same target. A simple generalization shows the way to measure B_N for nuclei invisible by nuclear magnetic resonance. It shown also how to obtain precise ratios of b_N for different isotopes or of spin-dependent absorption and scattering of the same isotope. Values of b_N are given for ^{13}C, ^{35}Cl, ^{79}Br, ^{81}Br as well as upper limits for ^{31}P, ^{37}Cl and ^{41}K. (8 refs.)

99611 A solution of the neutron transport equation using spherical harmonics. J.K.Fletcher (UKAEA, Warrington, England).
J. Phys. A (GB), vol.16, no.12, p.2827-35 (21 Aug. 1983).
A solution of the neutron transport equation is obtained by expanding the flux $\Phi(r\Omega)$ at position r in direction Ω as a series of the form: $\Phi(r,\Omega)=\Sigma_{l=0}{}^N(2l+1)\Sigma_{m=0}{}^l P_l{}^m(\cos\theta)[\psi_{lm}\ (r)\cos(m\phi)+\gamma_{lm}(r)\sin(m\phi)]$ where $P_l{}^m(\cos\theta)$ is the associated Legendre polynomial of order l, m with θ and ϕ the axial and azimuthal angles, respectively, of Ω. $\psi_{lm}(r)$ and $\gamma_{lm}(r)$ satisfy first-order differential equations and are determined by eliminating terms with odd l and then using finite-difference or finite-element techniques on the resulting second-order system. Complicated algebra is involved in deriving this latter set of relations and FORTRAN subroutines have been written to calculate the necessary coefficients and specify the relevant differentials. (12 refs.)

99612 Neutron-transmission function for the region of unresolved resonances. A.V.Komarov, A.A.Luk'yanov.
Sov. At. Energy (USA), vol.53, no.6, p.849-53 (Dec. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.6, p.392-5 (Dec. 1982).
An important part in the urgent problem of increasing the accuracy of reactor-physics calculations is played by investigations of the resonant self-screening in the retardation, absorption, and diffusion of decelerating neutrons in reactor media. The most complete information of the peculiarities of this structure and its importance for the estimation of self-screening effects is given by experimental data on neutron transmission as a function of the sample thickness. The authors calculate the transmission function in the region of unresolved resonances using a model cross section corresponding to the case of identical equidistant resonances with mean resonant parameters. (24 refs.)

Physical characteristics of an RBMK reactor in the transitional period .... See Entry 99614

Enhanced intensity of 7.6 MeV gamma rays from an ^{241}Am/Be source in a multilayered CH_2-Fe shield .... See Entry 99735

28.41 FISSION REACTOR THEORY AND DESIGN

99613 Verification and validation as an integral part of the development of digital systems for nuclear applications. E.A.Straker, N.C.Thomas.
Nucl. Saf. (USA), vol.24, no.3, p.338-51 (May-June 1983).
The nuclear industry's current attitude toward verification and validation (V&V) is realized through the experiences gained to date. On the basis of these experiences, V&V can effectively be applied as an integral part of digital system development for nuclear electric power applications. An overview of a typical approach for integrating V&V with system development is presented. This approach represents a balance between V&V as applied in the aerospace industry and the standard practice commonly applied within the nuclear industry today. (27 refs.)

99614 Physical characteristics of an RBMK reactor in the transitional period. V.S.Romanenko, A.V.Krayushkin.
Sov. At. Energy (USA), vol.53, no.6, p.816-24 (Dec. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.6, p.367-73 (Dec. 1982).
The authors present a rational method of neutron-physics calculation of transitional-period characteristics for an RBMK is described, the basic physical processes occurring in the reactor in this period are analyzed, and certain reserves of the fuel cycle are pointed out. (5 refs.)

99615 Reactor tests of two thermoemission electric power generating elements in a single loop channel. V.P.Baril'chenko, V.P.Berzhatyi, A.S.Karnaukhov, V.P.Kirienko, V.A.Maevskii, V.K.Morozov, A.V.Nikonov, N.N.Parkhomenko, V.S.Pastukhov, V.V.Sinyavskii, Yu.A.Sobolev.
Sov. At. Energy (USA), vol.53, no.6, p.866-8 (Dec. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.6, p.402-4 (Dec. 1982).
An important stage for the technical achievement of thermoemissive energy conversion is the complex reactor investigations of the thermoemission electric power generating elements (EPGE) and multielement assemblies. One of the problems of these tests is the verification of the reproducibility and stability of the power generating characteristics of EPGE of the same kind. Comparison of the results of EPGE tests or tests of EPGE assemblies, conducted nonsimultaneously, is not always correct, in view of the different test conditions. It is difficult to ensure identical working parameters in different tests, e.g., heat release, temperature of individual components of the channel, pressure of the working substance, etc. Therefore, in order to eliminate this indeterminacy it is desirable to test the individual EPGE or their assemblies simultaneously and in one loop channel. For this purpose, a loop channel was developed and tested, with two independent identical EPGE. (4 refs.)

The shape of the beta strength function and consequences for nuclear physics and astrophysics .... See Entry 99548

Neutron-transmission function for the region of unresolved resonances .... See Entry 99612

Chemical equilibria for accident analysis in pressurised water nuclear reactor systems .... See Entry 99703

Numerical simulation of thermal-hydraulic transients in LMFBR piping systems .... See Entry 99707

NEA Library Programs on LWR Safety ANS 1982 Annual Meeting .... See Entry 99708

NORCOOL-I, a best-estimate model for BWR emergency cooling during reflood. I .... See Entry 99709

NORCOOL-I, a best-estimate model for BWR emergency cooling during reflood. II .... See Entry 99710

SSYST—a code system to analyze LWR fuel rod behavior under accident conditions .... See Entry 99711

DRUFAN, an advanced best-estimate code for LWR blowdown analysis .... See Entry 99712

Radiation environment during the commissioning and power runup in the fifth unit at the Novyiu Voronezh nuclear power station .... See Entry 99739

28.42 FISSION REACTOR MATERIALS

99616 **Characterization and storage of high-level waste.** C.Bauer, G.Ondracek (Univ. Karlsruhe, Karlsruhe, Germany).
Atomwirtsch.-Atomtech. (Germany), vol.28, no.7-8, p.393-9 (July-Aug. 1983). In German.
Presents a summary review dealing with the characterization and storage of high-level radioactive waste, the design and structure of waste packages (product and enclosure), and the technology of waste packages (also storage forms) and their interrelations. The discussion of the possibilities for long-term isolation of high level waste from the biosphere indicates continental geological formations as suitable repository sites. For the Federal Republic of Germany, these are rock salt formations whose states and the modification resulting from the storage of high-level waste determine the minimum criteria to be met by the designs of storage forms fit for ultimate repository storage. (58 refs.)

99617 **Analysis of the hexcan of a fast breeder reactor with a through crack.** F.Cesari (Dipartimento Reattori Veloci, ENEA, Bologna, Italy).
Comput. & Struct. (GB), vol.17, no.5-6, p.643-7 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
Application of the finite element method to the problem involving a superficial crack in a hexcan of a fast breeder reactor is discussed. The aim is to calculate the stress intensity factor of the hexcan with a through crack in the static and dynamic case, loaded with the internal pressure. In the dynamic fracture the crack is considered both fixed and propagating. The structure is discretized with shell elements of 6 and 8 nodes available in the ADINA code. (8 refs.)

99618 **Experiences in nonlinear shell analysis using ADINA.** P.Hypponen, H.Raiko (Nuclear Engng. Lab., Tech. Res. Centre of Finland, Helsinki, Finland).
Comput. & Struct. (GB), vol.17, no.5-6, p.649-52 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
The calculation of a steel pipe collapse loading test using ADINA is presented. In the test a simply supported pipe was loaded in the middle by a 50 mm broad loading head and the force-displacement ratio was measured. The test pipe was modelled by using thin shell elements and the contact problem on loading surface was described by stiffening truss elements. The load itself was given as a prescribed displacement to the truss elements. The calculation was static, geometrically and materially nonlinear including instability and contact problem. The calculations were made on both CDC CYBER 173 and CRAY 1 computers whose running times were compared too. (2 refs.)

99619 **Near-field thermomechanical response of a waste vault.** R.S.C.Wai, K.K.Tsui (Dept. of Geotech. Engng., Ontario Hydro, Toronto, Ontario, Canada).
Comput. & Struct. (GB), vol.17, no.5-6, p.677-87 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
The near-field thermomechanical response of an immobilised waste disposal vault in crystalline hard rock was studied numerically taking into account the nonlinear behaviour of the host rock. The results indicate that the temperature dependence of rock properties has relatively little effect on the transient temperature distributions but may increase the thermal stresses and displacements substantially. However no deep-seated, major overstressed zones are expected. (17 refs.)

99620 **Thermomechanical calculations related to thermally induced rock loosening in an underground cavity.** L.Liedtke, J.Kopietz (Federal Inst. for Geosci. & Natural Resources, Hannover, Germany).
Comput. & Struct. (GB), vol.17, no.5-6, p.891-902 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
Zones of loosening, together with failure probability and safety factors, can be used to characterize the stability of underground caverns. The effect of a cylindrical heat source on the surrounding rock salt has been investigated in an in situ test carried out in a rock salt mass at a depth of about 750 m. The results of the calculations were confirmed by comparison with the temperatures and displacements measured during the in situ experiment. This research has implications for radioactive waste disposal. (10 refs.)

99621 **Chemical thermodynamics of iodine species in the HTGR fuel particle.** T.B.Lindemer (Chem. Technol. Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
CALPHAD: Comput. Coupling Phase Diagrams & Thermochem. (GB), vol.7, no.2, p.87-102 (April-June 1983).
The iodine-containing species in an intact fuel particle in the high-temperature gas-cooled reactor (HTGR) have been calculated. Assumptions include: (i) attainment of chemical thermodynamic equilibrium among all species in the open porosity of the particle, primarily in the buffer layer; and (ii) fission-product concentrations in proportion to their yields. The primary gaseous species is calculated to be cesium iodide; in carbide-containing fuels, gaseous barium iodide may exhibit equivalent pressures. The condensed iodine-containing phase is usually cesium iodide, but in carbide-containing fuels, barium iodide may be stable instead. Adsorption of elemental iodine on the carbon in the particle appears to be $\leq 10^{-4}$ μg I/g C. The fission-product-spectra excess of cesium over iodine would generally be adsorbed on the carbon, but may form Cs_2MoO_4 under some circumstances. Equilibria exterior to the fuel particle have not been analyzed, and may be considerably different from those given above. (19 refs.)

99622 **International measures of nuclear materials control.** M.Canty, E.Munch, G.Stein (Kernforschungsanlage Julich, Germany).
Energiewirtsch. Tagesfragen (Germany), vol.33, no.6, p.361-8 (June 1983). In German.
With the increasing use of nuclear energy worldwide, fears that the availability of nuclear weapons materials will inevitably follow seem not without foundation. The authors review the international efforts to limit the proliferation of nuclear materials, considering the technical aspects of their effective control and monitoring. (8 refs.) *S.R.*

99623 **Subjective evaluation using expert judgment: an application.** F.P.Sioshansi (Decision Analysis Group, Woodward-Clyde Consultants, San Francisco, CA, USA).
IEEE Trans. Syst., Man & Cybern. (USA), vol.SMC-13, no.3, p.391-7 (May-June 1983).
Objective evaluations based on analytical techniques are of limited value in the absence of specific information about some of the key parameters. A quantitative evaluation procedure is developed based on the subjective judgement of a group of experts. The methodology is used to identify plug designs with a high likelihood of satisfactory performance for a nuclear waste repository. (26 refs.)

99624 **Sodium, a domesticated metal.** G.Lucenet (Electricite de France, Paris, France).
Rev. Fr. Electr. (France), vol.55, no.279, p.8-10 (Dec. 1982). In French.
Figures are given for the growth in annual production of sodium, and the development of electrochemical methods since 1807 is reviewed, with a description of a modern electrolytic cell. Industrial applications of sodium are listed by way of introduction to the main theme which is the use of molten sodium as a heat-transfer fluid in fast nuclear reactors. The behaviour of sodium fires (without flame) is described, with notes on fire-extinguishing agents and safety measures in fast-neutron reactor design. The sodium-water reaction is discussed. The author concludes that, where due precautions are taken, sodium is neither more nor less dangerous than other liquid or solid metals in use, even in the LMFBR. (no refs.) *M.B.D.*

99625 **Radiological bases of the long term management of radioactive wastes.** H.Jammet, M.Dousset.
Tech. Mod. (France), vol.75, no.3-4, p.14-20 (March-April 1983). In French.
Ecologists are particularly concerned about the environment. This includes the effects of industrial residues and, in particular, wastes from the nuclear industries. The paper gives some information as to what constitutes radioactive wastes, risks arising from them, the methods of protecting human beings and the necessary conditions for their long term management. Radioactive wastes are first classified, being largely split into long and short periods of decay. Sections then follow on risks and principles of protection and the limitation of individual doses. The last section covers the actual methods of stocking these wastes and methods of protecting mankind in general. Various criteria which govern these matters are given. (no refs.) *G.V.D.*

99626 **Atomic displacement rates of light ions in cubic metals.** P.Jung.
Report JUL-1823, Kernforschungsanlage, Julich, Germany (Jan. 1983), 51 pp.
Atomic displacement rates of light ions in cubic metals (Al, V, Fe, Cu, Nb, Mo, Ag, Pt and Au) are calculated. The parameters used are chosen such that the calculations fit all available data of electron, ion and fast neutron irradiations as closely as possible. This procedure allows a more reliable extension of the calculations to energies beyond the range of existing data. Interpolation of the parameters of different materials enables the calculation of displacement rates for metals where no light ion data are available, (Ni, Pd, Ta, W and stainless steel). Further on helium-to-dpa ratios are calculated for those metals, which are of interest for fusion reactor applications. (67 refs.)

99627 **Guide to the Canadian nuclear fuel waste management program. Second edition.**
Report AECL-7790, Atomic Energy Canada Ltd., Chalk River, Ont. (Feb. 1983), 60 pp.
This document describes the administrative structure and major research and development components of the Canadian Nuclear Fuel Waste Management Program. It outlines the participating organizations, summarizes the program statistics, and describes the international cooperation and external review aspects of the Program. It is the second edition of the Guide, which was first issued under the same title in December 1981. (101 refs.)

99628 **Neutron radiography in Grenoble. I. A complementary means for inspecting nuclear fuels during irradiation.** F.Michel (CENG-CEA, Grenoble, France).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.241-9
Among the many facilities developed in Grenoble to carry out a great variety of experimental irradiations, neutron radiography affords an important specific contribution: inspection of the assembly of the irradiation rigs, evolution of the physical state of the fuel pins, dimensional measurements. The technique is contrived to interrupt the irradiation process for as short a time as possible. Its results constitute a valuable complement to those of other in-pile methods of analysis, to furnish data permitting a high level interpretation of the on-going irradiation experiment. (7 refs.)

99629 **TREAT neutron radiography facility.** L.J.Harrison (Argonne Nat. Lab., Idaho Falls, ID, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.251-5
The TREAT reactor was built as a transient irradiation test reactor. By taking advantage of built-in system features, it was possible to add a neutron radiography facility. This facility has been used over the years to radiograph a wide variety and large number of preirradiated fuel pins in many different configurations. Eight different specimen handling casks weighing up to 54.4 t (60 T) can be accommodated. Thermal, epithermal and track-etch radiographs have been taken. Neutron radiography service can be provided for specimens from other reactor facilities, and the capacity for storing preirradiated specimens also exists. (3 refs.)

99630 **Hot Fuel Examination Facility neutron radiography reactor design.** W.J.Richards, G.C.McClellan (Argonne Nat. Lab., Idaho Falls, ID, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.257-62
The high demand for neutron radiography of both irradiated and non-irradiated reactor structural and fuel specimens resulted in the decision to install a neutron radiography facility in the Hot Fuel Examination Facility/North at Argonne National Laboratory's Idaho Site. The neutron radiography facility was designed for both in-cell and out-of-cell radiography with high throughput. The facility uses state-of-the-art radiography techniques with maximum flexibility for incorporating radiography techniques to be developed in the future. (4 refs.)

99631 **Operation and modification of the HEDL Neutron Radiography Facility (NRF).** R.L.Tomlinson, J.F.Perfect (Westinghouse Hanford Co., Richland, WA, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.263-70
The Neutron Radiography Facility (NRF) at the Hanford Engineering Development Laboratory (HEDL) was originally built to perform neutron radiography of unirradiated fuel pins for the fast flux test facility (FFTF). Modifications have been completed recently on the NRF which now enable neutron radiography of irradiated fuel pins to be accomplished. In addition, modifications were made to the existing facility to improve handling capabilities and enable precise alignment of unirradiated fuel assemblies which contain 217 fuel pins. The equipment design had to provide for safe handling of the irradiated components to prevent excessive radiation exposure to personnel. Procedures were developed and interlocks installed to supplement the design and provide an additional margin of safety for the facility components and cask handling equipment. While the facility was shut down for modifications, certain other changes were made to the existing facility to improve the beam intensity and quality. (2 refs.)

99632 Design of the Fuels and Materials Examination Facility (FMEF) neutron radiography facility for irradiated fuel. R.L.Tomlinson, J.B.Henshall (Westinghouse Hanford Co., Richland, WA, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.271-7
The Fuels and Materials Examination Facility (FMEF) is a breeder reactor program facility currently under construction at the Hanford Reservation. Major activities carried out in the FMEF are post-irradiation examination of breeder reactor subassemblies, fuel and control pins, and materials; test pin fabrication for use in the Fast Flux Test Facility (FFTF); and Secure Automated Fabrication (SAF) of FFTF and Clinch River Breeder Reactor fuel. An important feature of the FMEF is the neutron radiography examination facility which will examine full or partial fuel assemblies at short decay times following long-term reactor irradiation. The neutron source is a one-megawatt TRIGA reactor which supplies intense neutron beams to the two neutron radiography exposure facilities. These two exposure facilities operate simultaneously and independently so that both full fuel assemblies and individual fuel pins can be neutron radiographed in the separate exposure facilities at the same time using collimation systems that are continuously and remotely variable over a wide range of resolutions. (3 refs.)

99633 Examination of fuel rods by means of neutron radiography. U.Bergenlid, I.Gustafsson (Studsvik Energiteknik AB, Nykoping, Sweden).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.349-53
Examinations by means of neutron radiography have been performed at the Studsvik R2 and R2-0 reactors for a number of years. The work is mainly related to investigations of the behaviour of nuclear fuel rods. The radiography facility at the R2 reactor is described. This is followed by examples of radiographs of fuel rods illustrating various kinds of information which can be obtained. Measurements of fuel pellet dimensions require a high precision. A microdensitometric method has been used for this purpose and is described. (1 ref.)

99634 Neutron and gamma radiography of UO_2 and TRIGA fuel elements. A.H.Robinson, Y.C.Gao, A.G.Johnson, J.C.Ringle (Oregon State Univ., Corvallis, OR, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.355-63
The Oregon State TRIGA reactor neutron radiography facility has been used to produce both neutron and gamma radiographs of reactor fuel. In this paper a comparison of the applicability of neutron and gamma radiography to both UO_2 fuel pins and TRIGA fuel elements is made. (no refs.)

99635 Inspection of Pu particle in UO_2-PuO_2 pellet by neutron radiography. A.Tsuruno (JAERI, Tokai, Japan).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.365-8
For the quality control of UO_2-PuO_2 pellet the inspection of Pu particle has been done by neutron radiography at JRR-4 NRG facility. Four Pu particles have been found out successfully. For the image analysis the enhancement of the contrast has been carried out by the filter tailoring beam method, and the result of calculation and experiment are presented. (2 refs.)

99636 The application of neutron radiography for the testing and investigation of nuclear fuel elements. V.T.Korneev, K.P.Dubrovin, E.G.Ivanov (I.V. Kurchatov Inst. of Atomic Energy, Moscow, USSR).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.375-82
The experience of using the neutron radiography method for the nondestructive testing and investigation of fuel elements of nuclear reactors is reported. The neutron radiography facility constructed on the basis of the vertical channel of the MR-type reactor is described. Practical results of using the neutron radiography for analysis of irradiated and nonirradiated fuel elements are presented. (7 refs.)

99637 Neutron radiography applications. H.P.Leeflang, H.Kwast (Netherlands Energy Res. Found., Petten, Netherlands).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.383-9
Neutron radiography is proposed to be applied as a non-destructive inspection method for the examination of irradiated fuel as well as for other material irradiation experiments. In the irradiation programme being carried out in the High Flux Reactor (HFR) several fuel irradiations are foreseen. These irradiations are meant to investigate the behaviour of fuel and cladding under a variety of conditions. (6 refs.)

99638 Application of epithermal neutron radiography to performance tests on advanced LMFBR fuel. J.Bordo, F.Mason, P.Zeisser (Joint Res. Centre, Comm. of the European Communities, Petten Establ., Petten, Netherlands).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.391-4
Neutron radiography is a current means for non-destructive examination of nuclear fuel, in particular on irradiated, highly radioactive specimens, to detect fuel cracking, fuel location, central void formation, gas closure and related phenomena. LMFBR fuel holds a large fraction of fissile nuclei by virtue of which it becomes less transparent to thermal neutrons. The application of epithermal neutrons, however, yields satisfactory penetration. This paper presents some results of the epithermal neutron radiography examination of a high enriched 8 mm mixed carbide fuel pin after different stages of in-pile operation. The paper highlights in particular the early occurrence of cracks and the gradual process of healing. (3 refs.)

99639 Neutron radiography of subassemblies or pins in a hot laboratory. P.Boyer, E.Le Boulbin, P.Millet.
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.395-401
Neutron radiography is a nondestructive process used for examination of spent fast breeder reactor fuel. Two facilities are available: the Fuel Subassembly Dismantling Laboratory (LDAC) for the RAPSODIE reactor, and the Spent Element Cell (CEI) for the PHENIX plant. Both comprise a reactor designed to provide neutron radiographs of spent fuel pins or subassemblies by the image transfer method. This paper describes the reactors, reviews their operational history and presents some significant results obtained. (no refs.)

99640 Feasibility of EPI-thermal neutron radiography of fast reactor fuel assemblies. C.T.Oien (Sandia Nat. Labs., Livermore, CA, USA), J.P.Barton, C.F.Barton.
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.403-10
Penetration of the quantities of enriched fuel contained in typical fast reactor fuel bundles cannot be achieved using standard thermal neutron radiography techniques. This study was therefore undertaken to demonstrate the potential of epithermal neutron techniques. A combination of calculations and experiments using simulated fuel showed that: (1) intensities of epithermal neutrons from a 1 MW Triga reactor are sufficient to penetrate a 217-pin bundle of typical LMFBR fuel and provide sensitivity to pellet-size discontinuities; (2) neutrons from fissions generated in the fuel should not cause prohibitive background 'noise'; (3) for basically symmetrical bundles, the ability to detect discontinuities depends greatly on the precise angles at which the bundle is radiographed; (4) multi-angle radiography combined with computerized axial tomography can provide powerful analysis of selected cross sections. (7 refs.)

99641 Ex-core neutron radiography of large fuel bundles. E.A.Rhodes (Reactor Analysis & Safety Div., Argonne Nat. Lab., Argonne, IL, USA), J.P.Barton, C.F.Barton, G.A.Schlapper, R.M.Brugger, A.DeVolpi, C.E.Dickerman, D.Rose.
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.411-18
At the Transient Reactor Test (TREAT) Facility, reactor transients induce destructive fuel motion in test capsules to study the effects of simulated LMFBR hypothetical core disruptive accidents. In TREAT Upgrade (TU), capsule size will increase to 37 or more fuel pins with steel casings up to 7.2 cm thick. Neutron radiography is used in determining final material disposition and sectioning planes for post-mortems. For TU, objectives are to provide mass and 3D spatial resolution of displaced fuel and to identify steel and sodium. A number of penetrating radiographic techniques were investigated for large fuel bundles, including the use of cold, epithermal, 24-keV, and 14-MeV neutrons. It is found that through a combination of techniques, TU radiography needs can likely be met, if sources of sufficient intensity and detection methods of adequate sensitivity are made available. (7 refs.)

99642 Recent developments and capabilities in neutron radiography at HEDL. J.E.Tobin, R.A.Karnesky (Westinghouse Hanford Co., Richland, WA, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.419-23
Radiographic imaging of irradiated fuels has routinely been qualitative in nature, providing information on the general condition of internal components of a fuel pin. Conventional X-ray and neutron radiographic techniques, applicable to irradiated fuels, have not been of high enough resolution to be useful for quantitative image analysis. Recently, however, high resolution neutron radiographic techniques and image analysis, using precision microdensitometry, have been developed at HEDL. The versatility of these radiographic techniques and associated image analysis is such that precision measurements of highly radioactive components can be performed with minimal modification. The use of high resolution neutron radiography and associated image analysis techniques can significantly reduce the cost of fuel pin performance evaluation by decreasing the number of destructive examinations required. This paper describes the development of a high resolution neutron radiographic imaging method, and the modification of a previously developed system to obtain quantitative measurements from neutron radiographs. (6 refs.)

99643 Postirradiation examination using neutron tomography. D.M.Tow (EG&G Idaho Inc., Idaho Falls, ID, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.425-35
Reconstructive tomography using multiple neutron radiographs, or neutron tomography, is being developed at the Idaho National Engineering Laboratory (INEL) for the examination of nuclear fuel bundles which have been irradiated in test situations. A study has been in progress for about a year to define suitable data collection and processing requirements and to estimate achievable image quality. An iterative maximum entropy reconstruction algorithm, MENT, was judged appropriate for this application and used to generate all reconstructions for the study. Cross-sectional images of a 91-pin fast breeder reactor fuel bundle were obtained from 36 penetrating neutron radiographs of the bundle. The fuel pins and most of the spacer wires can be distinguished in these reconstructed images. Computer simulations were also conducted. Results show that reconstructions of nearly symmetrical arrays of fuel elements can be misleading. A reconstruction which appears robust and plausible may inaccurately show only the symmetrical features. Important irregularities such as mispositioned spacer wires may not appear if an insufficient number of radiographic views is used. (2 refs.)

99644 Neutron radiography applications and techniques at the Hot Fuel Examination Facility. G.C.McClellan, W.J.Richards (Argonne Nat. Lab., Idaho Falls, ID, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.437-43
Neutron radiography has been used extensively to the Hot Fuel Examination Facility (HFEF) to evaluate the performance of irradiated nuclear fuels and materials. This nondestructive technique has proved extremely valuable in determining the internal condition of fuel pins during various stages of their burnup lifetime. Such features as pellet separation, voids, bond-sodium level, fuel cracking, and fissile density variations are easily detected by means of neutron radiography. Neutron radiography is also performed on large specialized assemblies. These include complete fuel-bundle assemblies, safety-test loops, and test sections from very large-scale safety-test loops following severe in-reactor tests. The HFEF neutron radiography facility is being expanded to provide more versatility and to allow further development of advanced neutron radiography techniques. (8 refs.)

99645 In pool neutron radiography of a BWR control blade. W.J.Oosterkamp, F.J.v.d. Kaa (KEMA, Arnhem, Netherlands).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.447-52
The control blades of boiling water nuclear power reactors (BWR) are an important part of their safety system. The blades are formed on an array of stainless steel tubes filled with boron carbide as a neutron absorber. In 1978 it became obvious that these blades could lose effectiveness before the end of their mechanical design life. Stress corrosion cracking will occur at a certain exposure and tritium and boron carbide can be lost to the coolant. The latter will reduce effectivity of the control blades. A nondestructive method to detect significant borium losses would be of help to assess the quality of the blades. The standard method is to measure the reactivity effect of a high exposure blade as compared to a low exposure blade. This is time consuming and effects the critical path of the refueling operation. The method gives furthermore no details. Neutron radiography has been used by Spalthoff et al. on a similar blade from the power station at Gundremmingen with a Sb-Be source. The authors had a small 0.5×10^8 n/s source available from an experimental reactor. Its strength was a factor 1000 lower than commonly used. (2 refs.)

99646 Inspection of reactor fuel- and absorber-elements by means of neutron radiography with a small size antimony-beryllium neutron source. L.Greim, W.Spalthoff (GKSS-Res. Center Geesthacht, Geesthacht, Germany).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.453-9
For applications of neutron radiography in hot cells a small size antimony-beryllium neutron source has been designed and constructed. It has cylindrical shape with a diameter and a length of about 20 cm. The measured thermal neutron flux is 1.1×10^{-8} n/cm^2 s per kCi ^{124}Sb. The results of an inspection of a spent BWR absorber element are shown. The neutron radiographs done with the dysprosium transfer method revealed defects in the absorber tubes and loss of absorber material. The track etch foil imaging technique was used at the examination of a fuel element dummy of the ship NS Otto Hahn as test for a method for the detection of defective fuel pins. (8 refs.)

99647 Neutron radiography feasibility studies for steel examination for the liquid metal fast breeder reactor program. K.G.Golliher (US DOE, Albuquerque, NM, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.461-8
Neutron radiographs of specimens, representing Liquid Metal Fast Breeder Reactor components, were made at the Shield Test and Irradiation Reactor. The specimens were radiographed through the neutron-perturbing environments of sodium, piping insulation material, and additional steel in an attempt to mock up the LMFBR primary containment vessel and the main coolant header. Calculations and measurements of the neutron energy distribution used for the tests were made and compared to that in a Liquid Metal Fast Breeder Reactor. The radiographs produced are an evaluation of the feasibility of using neutron radiography to perform, in situ, vessel and piping examination. (3 refs.)

99648 Creep strain measurements on irradiated stainless steel samples by means of neutron radiography. H.Hausen, R.Lolgen (Joint Res. Centre, Petten Establ., Petten, Netherlands).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.469-80
Precise measurements of creep strains are essential for the successful operation of in-pile creep experiments. In the present case a large nunber of steel alloy samples are irradiated in a special reactor creep facility under the influence of uniaxial tensile load and temperature. Creep strain measurements are to be performed intermittently during reactor shutdown periods. To facilitate the periodic dimensional checks, measurement by means of a neutron radiograph image was introduced as an alternative to the conventional techniques requiring difficult unload-reload procedures of the irradiated samples and transport to hot cell facilities. The paper details the special design features of the in-pile steel creep rig and explains the layout principles of a dummy sample column which was measured by a 'marker' technique, whereby the change in specimen gauge length is followed by measuring shoulders which are marked by thin segments of dysprosium. (no refs.)

99649 Reactor in-situ test-fuel neutron radiography. A.DeVolpi, E.A.Rhodes (Reactor Analysis & Safety Div., Argonne Nat. Lab., Argonne, IL, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.481-6
The hodoscope at TREAT has been adapted to provide time-integrated radiographic images of fuel distribution. The reactor operating at a low steady-state power induces fission neutrons in the test fuel monitored by the hodoscope. The fast neutrons are detected in two arrays of recoil-proton detectors. A fast-neutron radiograph can be reconstructed from the digital data. Four key benefits are: the radiographs have good sample density contrast, the data may be obtained soon after a preceding destructive experiment, it is not necessary to disturb the test sample, and the digital data format is directly compatible with quantitative analysis. (no refs.)

99650 Image restoration to increase resolution of the fast-neutron hodoscope. E.A.Rhodes, A.DeVolpi (Reactor Analysis & Safety Div., Argonne Nat. Lab., Argonne, IL, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.487-94
The fast-neutron hodoscope is a cineradiographic device that monitors fuel motion within thick opaque test capsules during power transients at the Transient Reactor Test Facility reactor which simulate LMFBR accident conditions. By means of a collimator and a detector array, emissive neutron radiographic digital data are collected in time-resolved and time-integrated (scan) modes. The data are digitally reconstructed into radiographic images and used directly for quantitative analysis. Spatial resolution is adequate in most cases (due in part to fuel-motion correlation), but is marginal for a few experiments. To enhance the resolution of existing collimators, hardware and software techniques are being applied, including collimator repositioning, decreasing scan increments, noise reduction, and fitting procedures involving fuel-motion models and deconvolution. Significant improvements in spatial resolution have been obtained. (8 refs.)

99651 Neutron resonance transmission analysis of reactor spent fuel assemblies. C.D.Bowman, R.A.Schrack, J.W.Behrens, R.G.Johnson (NBS, Washington, DC, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.503-11
A method called neutron resonance transmission analysis (NRTA) is under study which would use a pulsed neutron beam for nondestructive isotopic assay of a complete spent fuel assembly. Neutrons removed from the collimated beam by absorption or scattering in the resonances of the various isotopes in the spent fuel appear as dips in the neutron transmission. The method is completely insensitive to matrix materials such as oxide, fuel cladding, and other structural members. Measurements on spent fuel buttons using the NBS linac as a pulsed neutron source demonstrate a high accuracy capability for the isotopes ^{234,235,236,238}U, ^{239,240,241,242}Pu, ^{241}Am, ^{243}Am, and several fission products. The NRTA method offers high speed and modest operational cost, and it can be implemented with commercially available medical or radiographic γ-ray generators adapted for neutron production. (3 refs.)

99652 Resonance neutron radiography. Y.T.Cheng, D.A.Garrett (NBS, Washington, DC, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.513-17
A resonance neutron tomography project was carried out at the National Bureau of Standards which included (1) the construction of the reactor-based resonance neutron safeguards experimental system and the making of provisions for its use, and (2) the initial tomographic construction of a nuclear waste container. (no refs.)

99653 Use of cellulose nitrate for neutron radiographic testing of burned fuel elements. R.Barbalat (Services des Piles de Saclay, CENS, Gif-sur-Yvette, France).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.747-53
Nitrocellulose film, which is insensitive to gamma rays and visible light, is ideal for neutron radiography, especially for the inspection of radioactive materials. The low contrast, allows maximum information recording in a single irradiation, by multi-stage development of the latent picture, securing successively all the details from the lowest to the highest absorption cross section. Similarly, interesting results can be obtained by selecting the right fluence for the test material. Unlike silver halide film, prolonged irradiation and/or development time does not affect the picture substantially. The fineness obtained is equivalent to that procured by the slowest radiographic films. The low contrast is compensated by copying the film at every stage of the development on high contrast silver film. Owing to the good transparency, direct examinations and optical measurements are possible by means of optical instruments or perhaps of polarization filters, directly on the negative nitrocellulose film. (no refs.)

99654 Track-etch radiography using ^{10}B$_4$C convertor. G.Matsumoto, N.Murata, M.Matsumoto, S.Suzuki (Nagoya Univ., Nagoya, Japan).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.767-74
To take a neutron radiographic image of irradiated reactor fuel with portable neutron source, the authors should improve the efficiency of (n,α) convertors. In the case of natural BN convertors, image intensifying techniques should be applied. When the enriched B$_4$C convertor was used, printing nega track-etch film to printing papers by a commercial machine became possible. (no refs.)

99655 Development of an enriched elemental boron-10 conversion screen for improved 'track-etch' image recording. K.D.Meares (Eagle-Picher Industries, Miami, OK, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.775-83
A free standing reusable boron-10 screen has been developed for routine use in the NR of irradiated fuel elements using the 'track-etch' technique. The finished part consists of a boron-10 coating on a substrate (usually aluminum) to produce a screen with the desired geometry and properties. Coatings from 1 to 40 mils have been produced and large substrates can be coated to meet production NR requirements. Various alternate concepts were explored with the ultimate selection of a coating technique which performs in NR nearly like a monolithic B-10 sheet. Performance was found to greatly depend on the particle-size distribution of the powder which was eventually tailored to produce optimum packing and minimize pore size in the coating. Surface finishing techniques were examined and tested. (9 refs.)

99656 Development of enriched boron track-etch convertor screens for neutron radiographic applications. R.L.Tomlinson, J.E.Tobin (Westinghouse Hanford Co., Richland, WA, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.785-92
The Neutron Radiography Facility (NRF) located at the US Department of Energy (DOE) Hanford site near Richland, Washington was used to evaluate a series of natural and enriched boron compounds for potential use as track-etch neutron radiographic convertor screens. Materials were evaluated for various parameters; e.g. resolution, uniformity, exposure time, radiation damage (gamma radiation) and physical durability. The boron screens are to be used with commercially-available cellulose nitrate sheets to produce high-resolution track-etch neutron radiographs of irradiated fast reactor fuel. Since the gamma-ray exposure from the irradiated fuel is high during neutron radiography, radiation damage tests were performed on the screens using the cobalt-60 irradiation facility operated by the Hanford Engineering Development Laboratory (HEDL) to evaluate the screen durability. Interest centered upon the highly-enriched boron compounds so that the required exposure time for the neutron radiographs could be minimized. (7 refs.)

99657 On the underlying causes for the shape of the density trace of a round object. R.Matfield (Joint Res. Center, Ispra, Italy).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.817-23
The inherent unsharpness of a density trace produced by a converter foil and a film are considered to be represented by a pure scatterer introduced into the radiation beam. Furthermore, at the background/image interface some of the scattered radiation will be lost from the background region on the film and will instead arrive at the edge of the image. The combination of the geometric and inherent effects produce the rounding of the corners of a density trace of a square object, the effects on a cylindrical object are also considered. Applying these arguments to the geometry of a fuel pellet within a cladding tube it is concluded that the peaks on a density trace which represent the position of the edge of the pellet and the inside of the cladding tube will not be significantly changed in the horizontal dimension by the effects of unsharpness, but the vertical positions will vary with different film and foil combinations. (3 refs.)

99658 Neutron radiography in Grenoble. II. Its application in routine dimensional measurements on irradiated experimental fuel pins. A.Jegat (CENG-CEA, Grenoble, France).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.825-32
For pt.I see F. Michel, ibid., p.241-249. The author describes the equipment and method used by the Grenoble Reactor Department to perform systematic dimensional measurements on neutron radiographs carried out at different stages in the evolution of an experimental fuel during irradiation. The precision of these measurements on the profiles and diameter of the fuel and cladding is better than ±50 μm. Examples of results and the correlations obtained through partial automation of the method are presented. (3 refs.)

99659 Application of neutron radiography in light water reactor fuel pin testing programs at the high flux reactor Petten. J.Bordo, J.Bakker, J.F.W.Markgraf (Joint Res. Centre, Commission of the European Communities, Petten Establ., Petten, Netherlands), I.Ruyter, R.Schumann.
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.833-42
Neutron radiography is a major non-destructive test method used for investigations of LWR fuel rods at HFR Petten. More than 150 fuel rods have been neutron radiographed at various stages of irradiation testing. A review of equipment methods and results is presented. Interpretation of neutron radiographs as to dimensional changes, fuel stack condition, fuel rod condition and condition of instrumented fuel rods and irradiation devices is discussed. Based upon selected examples, the importance of neutron radiography is demonstrated. (9 refs.)

99660 On the problems relating to the accuracy of the measurement of fuel pin diameters by neutron radiography. R.Matfield (Joint Res. Center, Ispra, Italy).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.843-9

The author identifies the sources of error in the neutron radiographic system and attempts to estimate some of these errors. The sources of error are in the fuel pin materials, the radiographic set-up, the radiographic equipment, image formation, the microdensitometer, the edge criteria and the dimensional measurement from the microdensitometer trace. However, the critical problem area is that of determining a representative edge criteria and upon this will depend the ability of the method to achieve the required measurement accuracy. (6 refs.)

99661 Measuring signal-to-noise ratio of typical neutron radiographs. P.Gade-Nielsen, J.Olsen (Riso Nat. Lab., Roskilde, Denmark).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.851-8

To improve dimensional measurements of nuclear fuel rods by neutron radiography, the authors have found it useful to measure the signal-to-noise ratio of the radiographs. The signal and the noise are measured by a digital image processing system. By further evaluation of the method it is hoped to be able to estimate the influence of noise on dimensional measurements. They present a simple signal-transfer model for the neutron radiography process adopted from X-ray radiography. They also present preliminary measurements of the signal-to-noise ratio on different films. (5 refs.)

99662 Dimensional measurements of the Petten calibration pin. I.Ruyter (KFA Julich GmbH, Julich, Germany), H.Leeflang.

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.867-83

One of the tasks chosen by the Euratom Neutron Radiography Working Group is to determine the dimensional measurement accuracy obtainable with the neutron cameras and scanning equipment at their disposal. As a starting point for this task, a simple calibration pin with accurately known axial dimensions was made. This calibration pin, Petten calibration pin (PCP), was radiographed at the facility employing track-etch film, copies of the original film made, each copy separately measured in Petten and then sent to the members of the working group for dimensional evaluations using their respective measuring equipment. The authors describe the procedures used and summarize the results arrived at. (14 refs.)

99663 Search for adequate quality standards for neutron radiography of nuclear fuel. J.C.Domanus (Nuclear Dept., Elsinore Shipbuilding & Engng. Co. Ltd., Helsinger, Denmark).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.1017-24

In 1979 a Euratom Neutron Radiography Working Group was constituted, which initiated standardization work in the field of neutron radiography of nuclear fuel. As standards for the image quality of neutron radiographs and checking the accuracy of dimension measurements from them, beam purity and sensitivity indicators have been developed. Preliminary investigations have shown that the measurement accuracy problem can be solved by the use of calibration fuel pins, simulating the true nuclear fuel pins and containing such calibrated items as fuel-to-clad gaps, pellet-to-pellet gaps, central voids, and dishings. (3 refs.)

99664 Euratom test program for image quality and accuracy of dimensions. J.C.Domanus (Nuclear Dept., Elsinore Shipbuilding & Engng. Co. Ltd., Helsinger, Denmark).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.1025-33

The Neutron Radiography Working Group (NRWG) constituted within Euratom in 1979 has developed a test program for checking the image quality and accuracy of dimensions measured from neutron radiographs of nuclear fuel pins, using calibration fuel pin with beam purity and sensitivity indicators. Silver halide X-ray films are to be exposed with Gd and Dy converters by the direct and transfer neutron radiography methods. Nitrocellulose film coated on both sides with a converter and without coating, but between two converter screens will also be used. The results will be compared and conclusions drawn about the suitability of the test items for the purpose of assessing the neutron beam constituents, the image quality and the accuracy of dimension measurements. (3 refs.)

99665 On the development of a combined beam, sensitivity and measurement quality indicator for the neutron radiography of fuel pins. R.Matfield (Joint Res. Center, Ispra, Italy).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.1035-41

A radiographic quality indicator for nuclear fuel has been designed that combines the features of a beam purity indicator, a sensitivity indicator and a measurement indicator. This combined quality indicator fuel consists of six-10 mm diameter by 4 mm long fuel pellets contained in a zirconium tube; the gaps between the pellet diameters and the zirconium tube are controlled by aluminium shims. (no refs.)

99666 Recommended practice for the neutron radiography of nuclear fuels. R.S.Matfield (Joint Res. Centre, Ispra, Italy).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.1043-6

The author presents part of a Neutron Radiography Handbook being prepared by a neutron radiography working party of the European Community. It commences with a description of the information that should be provided by a user of neutron radiography services and then gives recommendations on the equipment to be used. This is followed by two sections on the techniques to be used for detecting discontinuities and the making of measurements on nuclear fuel. This is then followed by recommended safety practices and then sections on film handling, film processing, viewing of radiographs, references, radiographs, storage and records. Recommendations on training and certification are being prepared. Technical justification of the practices which are recommended are not included. (1 ref.)

99667 The DOE's nuclear waste management and fuel cycle programs. F.E.Coffman (USDOE, Washington, DC, USA).

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.3-6

The nuclear waste management and fuel cycle programs of the US Department of Energy are discussed including the West Valley demonstration project and the commitment of DOE to remedial actions. (no refs.)

99668 General perspectives in radioactive waste management in Belgium. P.Dejonghe, L.Baetsle, I.Claes, R.DeBatist, R.Heremans, N.Van de Voorde (CEN/SCK, Mol, Belgium).

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.7-13

The authors consider the general radioactive waste management policy in Belgium and focuses on R&D and D&D activities as well as on operational and institutional organization. The main ongoing R&D and D&D programs are briefly reviewed, covering treatment and conditioning processes, characterization of final products and geological disposal. Most of these programs are carried out under contract with the Commission of the European Community. The creation of a public organization NIRAS/ONDRAF is reported and its major attributions with respect to institutional, managerial and technical aspects are given. (13 refs.)

99669 The European Communities' R & D activities on treatment and handling of radioactive waste. S.Orlowski, R.Simon (Commission of the European Communities, Brussels, Belgium).

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.14-18

Since 1973 the Commission of the European Communities has been conducting research and development on the management and disposal of radioactive waste. The activities on treatment and handling presently concentrate on the processing and conditioning of hulls, ILLW, TRU waste and certain gaseous wastes. The important aspects of characterization and evaluation of final waste forms is being investigated under two separate parts of the CEC programme. (6 refs.)

99670 German waste management policy: the back-end of the fuel cycle situation in the Federal Republic of Germany. R.P.Randl, K.H.Hubenthal (Bundesministerium fur Forschung und Technol., Federal Min. for Res. & Technol., Germany).

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.19-21

The development of nuclear energy and the application of radioisotopes in industry and research in the Federal Republic of Germany have been closely linked to the development of the appropriate requirements with regard to conditioning and disposal of radioactive wastes generated. The authors discuss this parallel development, with reference to the political aspects. (no refs.)

99671 National and cooperative program for waste management in France. Y.Sousselier (Inst. de Protection et Surete Nucleaire, CEA, Paris, France).

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.22-6

The radioactive waste management policy in France is to reprocess the spent fuel and store only the resultant wastes rather than storing the spent fuel itself. The processes used for conditioning the different categories of wastes are presented, and the waste management policy discussed. (no refs.)

99672 Status of high level and alpha bearing waste management in PNC. K.Uematsu (Power Reactor & Nuclear Fuel Dev. Corp., Tokyo, Japan).

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.27-33

The Power Reactor and Nuclear Fuel Development Corporation (PNC) of Japan has a major role in promoting the management of high level and alpha bearing waste, which is indispensible in completing the fuel cycle. The fuel element reprocessing, vitrification, and geological disposal of these wastes in discussed. (no refs.)

99673 A review of radioactive waste management programmes in the United Kingdom. N.J.Keen (UKAEA, Harwell, England), A.G.Duncan.

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.34-9

The authors report progress by the Department of the Environment and the nuclear industry in developing and implementing a strategy for the management of radioactive waste in the UK. It outlines the range of possible disposal facilities required to deal with all classes of waste arising from nuclear power generation. The present practices for waste management and the main lines of development by the main waste producers of the plant needed in future are outlined, together with a summary of some of the generic R&D devoted to treatment, packaging and transport of wastes. (3 refs.)

99674 High-level waste immobilization. J.L.Crandall (E.I. du Pont de Nemours & Co., Savannah River Lab., Aiken, SC, USA).

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.43-9

Analysis of risks, environmental effects, process feasibility, and costs for disposal of immobilized high-level wastes in geologic repositories indicates that the disposal system safety has a low sensitivity to the choice of the waste disposal form. (11 refs.)

99675 The status of French high-level radioactive wastes solidification. C.Sombret (CEA, Paris, France).

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.50-3

Research and development carried out in France over a long period of time about solidification of high-level radioactive wastes have been mainly directed towards vitrification. Investigations into borosilicates resulted in the choice of glass as a final form for the fission products solutions stored in reprocessing plants. AVM, the Marcoule vitrification plant, has been running since 1978. Further, vitrification plants related to the La Hague reprocessing plant are under design. In Marcoule the radioactive glasses coming from AVM have been stored for decades in an interim storage facility located in the same building. Several storage and disposal routes are being considered for the glass containers from LWR reprocessing that will be issued from La Hague (AVH). (2 refs.)

99676 Treatment and solidification of high active fission product solutions. K.D.Kuhn, W.Bahr (Wiederaufarbeitungsanlage Karlsruhe Betriebsgesellschaft mbH., Eggenstein, Germany).

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.54-8

On reprocessing spent fuel elements, >97% of the fission products are found in the high active waste (HAW) solution. In order to avoid large amounts of sludge formation arising from phosphates produced by TBP degradation during evaporation and storage of these high level wastes, the suspended and dissolved TBP must be removed immediately from the HAW. It is proposed to separate the TBP by steam-stripping. Then the HAW will be concentrated in an evaporator, the concentration factor depending on the amount of sludge formation and the heat content of the concentrate. These concentrates may be stored for short periods in stainless steel tanks. Acid concentration and waste volume may be further reduced by in-tank denitration and evaporation. (7 refs.)

99677 The selection and application of a processing system for the treatment of high level liquid waste in the UK. D.W.Clelland, A.D.W.Corbet (British Nuclear Fuels Ltd., Warrington, England).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.59-63
The historical background and the present status of technology in high level liquid waste treatment are reviewed and progress following the decision to implement vitrification at Windscale is reported. The choice of glass as a matrix is discussed. The process which has been selected for industrial scale operation and the characteristics of the vitrified waste are described. The design and handling of containers are indicated. Some of the principles relating to the storage of vitrified high level waste are discussed related to the method of storage to be employed in the UK. The rate of high level waste arisings in the UK together with present inventories and future conditioning rates are presented and the impact of vitrification on the future role of tank storage is discussed. (5 refs.)

99678 Development of high-level liquid waste solidification in PNC. H.Okamoto, M.Yamamoto, H.Nagai, N.Ohnishi (Power Reactor & Nuclear Fuel Dev. Corp., Tokyo, Japan).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.64-71
R&D activities on the solidification of HLLW and related technologies are being performed with the aim of designing and constructing the HLLW Solidification Pilot Plant at Tokai which is planned to start operations in 1987. Solidified waste forms and compositions have been studied with the aid of characterizing solidified products and evaluating solidification technologies, and two typical series of borosilicate glass products have been found to be feasible for the solidification of HLLW generated by the Tokai Reprocessing Plant. The HLLW Engineering Test Facility (ETF) with denitration and concentration equipment, two different types of Joule-heated ceramic melters, off-gas treatment equipment and a canister handling system, has been in operation since February 1980 in order to obtain various kinds of enginering data and perspectives. Air-cooling tests are also in progress to characterize natural or forced convection heat transfer in the storage of the HLLW solidified waste. (5 refs.)

99679 Industrial operating experience at the Marcoule vitrification facility. M.M.Chotin, P.Hugony, A.Pieraggi (COGEMA, Marcoule, France).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.72-5
The vitrification facility (AVM) located at Marcoule is designed to vitrify fission product solutions from the Marcoule fuel reprocessing plant and has been in operation on an industrial basis since June 28, 1978. Extensive design precautions and sophisticated technological solutions have resulted in simplified operation. The facility has operated with a good duty factor. Nevertheless, the unit is an industrial prototype facility in which a number of problems have been encountered. The review of operating and problems encountered are discussed. (5 refs.)

99680 Reprocessing, decontamination and decommissioning waste management at Eurochemic; current and planned activities. E.Detilleux, W.Hild, J.van Geel (Eurochemic, Mol, Belgium).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.76-83
Since the shutdown of its reprocessing activities, Eurochemic has undertaken the decontamination of the reprocessing plant and the management of the generated wastes. The decontamination has been satisfactorily completed, allowing access to all the process cells. The waste management programme, still going on, includes intermediate and high-level liquid waste treatment by bituminization and vitrification, respectively. Other activities involved spent solvent destruction, the digestion into acids of alpha-bearing solid wastes, etc. The authors outline the main features of the programme. (7 refs.)

99681 Los Alamos transuranic waste size reduction facility. A.Briesmeister, J.Harper, B.Reich, J.L.Warren (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.87-92
A transuranic (TRU) waste size reduction facility (SRF) was designed and constructed at the Los Alamos National Laboratory during the period of 1977-81. The authors summarize the engineering development, installation, and early test operations of the SRF. The facility incorporates a large stainless steel enclosure fitted with remote handling and cutting equipment to obtain an estimated 4:1 volume reduction of gloveboxes and other bulky metallic wastes. (no refs.)

99682 A pilot scale, alpha disassembly and decontamination facility at the Savannah River Laboratory. J.R.Cadieux, G.W.Becker,Jr., A.L.Coogler, G.W.Richardson (E.I. du Pont de Nemours & Co., Savannah River Lab., Aiken, SC, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.93-7
An alpha contained pilot facility is being built at the Savannah River Laboratory (SRL) for research into the disassembly and decontamination of noncombustible, transuranic (TRU) waste. The design and program objectives for the facility are presented along with the initial test results from laboratory scale decontamination experiments with ^{238}Pu and ^{244}Cm. (2 refs.)

99683 An integrated decontamination system for surface-contaminated TRU waste. R.P.Allen, L.K.Fetrow, M.W.McCoy (Pacific Northwest Lab., Richland, WA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.98-102
Substantial progress has been made in developing an effective, integrated decontamination system capable of removing plutonium and other transuranic contaminants from the surface of metallic and selected nonmetallic waste. Using this system, a reduction of more than 95% in the volume of TRU waste requiring interim storage and eventual geologic disposal has been achieved for typical plutonium-contaminated glove boxes. The authors describe the separate preparation, sectioning, decontamination and waste treatment process steps and illustrates the integration of these into a functional, effective decontamination system. (5 refs.)

99684 Sectioning techniques for plutonium contaminated glove boxes. L.K.Fetrow, R.P.Allen, M.W.McCoy (Pacific Northwest Lab., Richland, WA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.103-8
The size reduction of plutonium-contaminated glove boxes can substantially reduce storage and disposal volumes and is essential to prepare material for decontamination by advanced techniques such as vibratory finishing or electropolishing. Several industrial sectioning techniques have been evaluated at Pacific Northwest Laboratory under US Department of Energy sponsorship for the size reduction of plutonium-contaminated glove boxes. The techniques evaluated include plasma arc torch cutting, mechanical sawing and nibbling, abrasive cutting, and hydraulic shearing and punching. These demonstration studies show that plutonium-contaminated glove boxes can be sectioned safely, efficiently, and with minimal secondary waste generation for size reduction or decontamination purposes using an appropriate combination of available industrial metal cutting techniques. (3 refs.)

99685 Vibratory finishing for decontamination—pilot scale operation. M.W.McCoy, R.P.Allen, L.K.Fetrow, R.F.Hazelton (Pacific Northwest Lab., Richland, WA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.109-14
The authors discuss the development of the vibratory finishing decontamination process from a laboratory demonstration to a pilot scale operation. Vibratory finishing is a standard industrial process used in a variety of manufacturing processes. Substantial progress has been made in adapting this vibratory finishing process to the needs of the nuclear industry, and especially to the management of TRU waste. The discussion includes a description of the vibratory finishing process; scale-up of the process including considerations of vibratory finisher size and configuration, rinsing and drying of the decontaminated material, materials handling, contamination control; and a cost analysis of the operation of a vibratory finishing decontamination system. (4 refs.)

99686 Design requirements for a metal smelting facility. L.C.Williams, J.E.Mack (Metals & Ceramics Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.115-18
Functional requirements for the smelting of metal scrap contaminated with low-enriched uranium in a Metal Smelting Facility (MSF) have been determined. The process will be designed to smelt ferrous metal scrap that has accumulated at the Oak Ridge Gaseous Diffusion Plant (ORGDP) into one-ton ingots at a rate of 40 ingots per day (10000 tons/year). Total scrap inventories at the ORGDP are currently estimated at 28000 tons. The diffusion plant scrap is primarily contaminated with 100 to 200 ppm Uranium at an enrichment of 0.5 to 1.5% ^{235}U. The scrap is considered special nuclear material (SNM) and cannot be handled by commercial smelters without specific licensing. Slagging will be performed to removed contaminants from the metal and concentrate them in the slag. Process systems will include scrap handling, size reduction, preheating and charging, melting and slagging, ingot casting and storage, and fume exhaust. The MSF has been proposed for FY 1984 line item funding. (no refs.)

99687 Summary of the handling and disposal of nuclear wastes. E.N.Cramer (Southern California Edison, Rosemead, CA, USA).
Greater Los Angeles Area Energy Symposium, Los Angeles, CA, USA, 28 Oct. 1980 (North Hollywood, CA, USA: Western Periodicals Company 1980), p.97-101
This summary addresses some of the accomplishments from 1955 to 1980, to provide rapid and understandable overview of the process. (11 refs.)

Neutron Radiography. Proceedings of the First World Conference .... See Entry 98644

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting .... See Entry 98646

High energy proton interactions with Sr and Cs: a contribution to the waste transmutation study .... See Entry 99569

The corrosion products in primary and secondary circuits of PWR plants .... See Entry 99691

Experience with the peaceful use of nuclear energy .... See Entry 99706

NEA Library Programs on LWR Safety ANS 1982 Annual Meeting .... See Entry 99708

SSYST—a code system to analyze LWR fuel rod behavior under accident conditions .... See Entry 99711

Resonance neutron radiography using a pulsed neutron source and a 2-dimensional scintillation detector .... See Entry 100585

The Auger spectrum of lithium metal, lithium binary and lithium ternary compounds .... See Entry 103012

Hydride precipitation in α/β zirconium alloys .... See Entry 103150

Oxidation of carburized Hastelloy X .... See Entry 103380

Six years' experience with the double beam neutron radiography facility at the Riso National Laboratory .... See Entry 103471

A ^{233}U fuelled reactor for neutron radiography .... See Entry 103472

Development of an online neutron radiography system of high resolution for nuclear materials .... See Entry 103474

Neutron radiography installation in the HFR reactor pool .... See Entry 103475

Neutron radiography installation for long fuel rods at the HFR Petten .... See Entry 103476

Small angle neutron scattering complementing neutron radiography .... See Entry 103486

The exposure of the EC population from nuclear industry effluents .... See Entry 104062

Site specific derived limits for stack discharges .... See Entry 104075

Thermodiffusional transport in pelagic clay: implications for nuclear waste disposal in geological media .... See Entry 104351

28.42H Fuel preparation and reprocessing

(inc. isotope separation and enrichment)

99688 The accelerator breeder, a viable option for the production of nuclear fuels. P.Grand (Dept. of Nuclear Energy, Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3057-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The accelerator breeder offers the only practical means of producing, or breeding, large quantities of fissile fuel from particle materials. The author gives the parameters of a nearly optimised accelerator-breeder system, and discusses the development needs, economics, and institutional problems that this breeding concept faces. (5 refs.)

99689 Non-destructive control of plutonium oxide fuel pins by neutron radiography at the BR1 neutron radiography facility. H.Tourwe (SCK/CEN, Mol, Belgium).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.369-73
The neutron radiography facility at the SCK/CEN BR1 reactor has been used since 1975 for the non-destructive quality control of mixed plutonium oxide fuel pins for thermal and fast reactors. The major purposes of this quality control are the detection of density variations and Pu-heterogeneities in the fuel pellets, the detection of voids and foreign materials and a final inspection of the fuel assembling. In the period June 1975 to June 1981 a total of 400 fuel pins were controlled, involving about 300 exposures. (2 refs.)

National and cooperative program for waste management in France .... See Entry 99671

Status of high level and alpha bearing waste management in PNC .... See Entry 99672

Industrial operating experience at the Marcoule vitrification facility .... See Entry 99679

Reprocessing, decontamination and decommissioning waste management at Eurochemic; current and planned activities .... See Entry 99680

Rotating supersonic flow about scoop inlet using an unsteady implicit technique .... See Entry 101334

28.43 FISSION REACTOR OPERATION

99690 Equipment for cassette removal at nuclear power plants. G.Suba.
Minoseg & Megbizhatosag (Hungary), vol.16, no.6, p.438-41 (1982). In Hungarian.
Hungary, namely Ganz-MAVAG Works, have joined in to build machinery for nuclear power plants. Author describes the production of the equipment of cassette removal built within the framework of CMEA specialization, with special regard to the very strict conditions for securing quality. (no refs.)

99691 The corrosion products in primary and secondary circuits of PWR plants. R.Darras.
Rev. Gen. Nucl. (France), no.2, p.138-51 (March-April 1983). In French.
The characteristics of corrosion products generated in primary and secondary circuits of PWR plants are briefly recalled. The problems involved by the relevant pollution of heat transfer media and metal surfaces are then examined. Finally, the main precautions or remedies to be applied in order to minimize this pollution by corrosion products are discussed. (70 refs.)

99692 Comparison of the technicoeconomic characteristics of nuclear power stations with modern thermal and fast reactors. A.A.Rineiskii.
Sov. At. Energy (USA), vol.53, no.6, p.807-15 (Dec. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.6, p.360-7 (Dec. 1982).
The author discusses the economics of thermal and fast reactors and their power generating units. (11 refs.)

99693 Making objects visible in non-transparent media—a method employed in breeder reactor technology. R.Hans, E.Kranz, H.Weiss (Internat. Atomreaktorbau GmbH, Bergisch Gladbach, Germany).
Siemens Power Eng. (Germany), vol.5, no.3, p.162-5 (May-June 1983).
Water-cooled nuclear reactors are inspected by means of television cameras. This method is unsuitable for non-transparent media such as the liquid sodium used as coolant for fast reactors. An ultrasonic facility, whose design and operation are described, has therefore been developed for inspection purposes. The authors explain how this facility is employed to measure the level and flow rate of liquids and to detect bubbles. (no refs.)

99694 The application of indirect radiography to neutron field studies. C.Simans (Faculty of Nuclear Sci. & Phys. Engng., Tech. Univ. of Prague, Prague, Czechoslovakia).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.971-6
Registration of ficticious axially symmetrical neutron fields in rotating conversion foils was used in neutron field studies by indirect radiography with neutron beams from a reactor or a neutron generator. Large size conversion foils consisting of dysprosium salt precipitate in gelatine on triacetate support were developed for field studies in hydrogeneous media. The use of indirect radiography with uranium conversion foils in the study of the field structure of the U 238 resonance group of neutrons is described. (3 refs.)

99695 Cold neutron spectra of the general atomic TRIGA Mk. E neutron radiography facility. J.D.Rogers (Federal Univ. of Rio de Janeiro, Rio de Janeiro, Brazil).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.977-81
Neutron spectra measurements have been carried out on the GA TRIGA Mk. F neutron radiography beam at various temperatures of the solid methane cold source. Results indicate significant number of neutrons with energy above that of the Bragg cut-off for beryllium. (7 refs.)

Neutron Radiography. Proceedings of the First World Conference .... See Entry 98644

TREAT neutron radiography facility .... See Entry 99629

Hot Fuel Examination Facility neutron radiography reactor design .... See Entry 99630

Operation and modification of the HEDL Neutron Radiography Facility (NRF) .... See Entry 99631

Design of the Fuels and Materials Examination Facility (FMEF) neutron radiography facility for irradiated fuel .... See Entry 99632

On the coolability of degraded LWR cores .... See Entry 99699

Evaluation of events involving unplanned boron dilutions in nuclear power plants .... See Entry 99701

Experimental investigations on the behaviour of main cooling pumps at loss-of-coolant accidents .... See Entry 99702

Numerical simulation of thermal-hydraulic transients in LMFBR piping systems .... See Entry 99707

Radiation environment during the commissioning and power runup in the fifth unit at the Novyiu Voronezh nuclear power station .... See Entry 99739

Equipment 'VAIR' for mechanical tests on materials in a nuclear reactor .... See Entry 103448

Neutron radiography facilities using neutron beams from nuclear reactors .... See Entry 103454

Review of neutron radiography development activities at Argonne National Laboratory .... See Entry 103455

A review of ten years of operation of the industrial neutron radiography facilities associated with the Triton reactor at the Fontenay aux Roses nuclear research center .... See Entry 103456

Neutron radiography at Lucas Heights .... See Entry 103458

Neutron radiography in Brazil .... See Entry 103459

Use of a neutron guide in industrial neutron radiography .... See Entry 103460

Status report on the activity of the neutron radiography group in Pusat Penelitian Teknik Nuklir Bandung .... See Entry 103461

Characteristics of neutron radiography systems using accelerators and a research reactor .... See Entry 103462

Development of a neutron radiography system at the TRIGA mark III reactor of the nuclear center of Mexico .... See Entry 103463

Neutron radiography experiences at the low flux reactor .... See Entry 103464

Progress in NR techniques and applications at AWRE Aldermaston .... See Entry 103465

Neutron radiography DIDO reactor .... See Entry 103466

Neutron radiography at the general electric nuclear test reactor .... See Entry 103467

Neutron radiography facilities at Sandia National Laboratories, Albuquerque (SNLA) .... See Entry 103468

Neutron radiography techniques at Sandia National Laboratories, Albuquerque (SNLA) .... See Entry 103469

Description and characterization of the BR1 neutron radiography facility .... See Entry 103470

Six years' experience with the double beam neutron radiography facility at the Riso National Laboratory .... See Entry 103471

A ^{233}U fuelled reactor for neutron radiography .... See Entry 103472

Design and safety aspects of neutron radiography rig for examination of irradiated objects .... See Entry 103473

Development of an online neutron radiography system of high resolution for nuclear materials .... See Entry 103474

Neutron radiography installation in the HFR reactor pool .... See Entry 103475

Neutron radiography installation for long fuel rods at the HFR Petten .... See Entry 103476

28.44 FISSION REACTOR PROTECTION SYSTEMS, SAFETY AND ACCIDENTS

99696 Averting danger and protecting against damage in the design of nuclear power plants. H.-P.Bochmann (Bundesministerium des Innern, Bonn, Germany).
Atomwirtsch.-Atomtech. (Germany), vol.28, no.7-8, p.366-72 (July-Aug. 1983). In German.
Under the Atomic Energy Act of the Federal Republic of Germany it is up to the executive branch to determine the adequate risk to society to be tolerated in the peaceful uses of nuclear energy. In the regulatory practice of the Federal and State Governments, two different hazard areas are defined for protective purposes: the avoidance of risks arising to individuals so as to protect third parties, and the minimisation at the executive's discretion, of the risk to the public, beyond the individual risks of life and health, on the basis of balanced expenditures and benefits. Accident guidelines based on deterministic concepts are supplemented, to this end, by probabilistic reliability and risk analyses. (no refs.)

99697 Reactor accidents: a global reassessment of consequences. T.Moore.
EPRI J. (USA), vol.8, no.6, p.16-23 (July-Aug. 1983).
Three Mile Island has prompted a tough reappraisal of fission product release that will lead to a clearer perception of the public risk from nuclear power. The paper discusses the accident source term, giving its definition and shows how previous estimates about its magnitude are grossly exaggerated due to lack of technical and experimental data. Current research into this field world-wide is pointed to and the implications of this on future improved safety are hinted at. (4 refs.)

99698 LWR safety research at EPRI: an update. W.B.Loewenstein, S.P.Kalra (Nuclear Power Div., Electric Power Res. Inst., Palo Alto, CA, USA).
Nucl. Saf. (USA), vol.24, no.3, p.293-318 (May-June 1983).
The philosophy, objectives, approach, and updated status of the Electric Power Research Institute's Light-Water-Reactor Safety Research Program are presented. In light of current industry needs, the major research and development emphases are described. The program focuses on providing enhanced capability, via large-scale test projects, for understanding and predicting the behavior of nuclear power plants. This leads to a realistic quantification of the safety margins and to ways of improving reliability, availability, and productivity and thus to significant economic benefits for the nuclear industry. The major accomplishments resulting from various projects in the program categories of risk assessment, code development and validation, and analysis and testing are presented with the goal of technology transfer to the nuclear industry. (90 refs.)

99699 On the coolability of degraded LWR cores. V.K.Dhir (Univ. of California, Los Angeles, CA, USA).
Nucl. Saf. (USA), vol.24, no.3, p.319-37 (May-June 1983).
Continued undercooling of the core of a light-water reactor can result in loss of integrity of the fuel pins and the structural materials in the core. In such a state the core may behave as a bed of volumetrically heated particles. Similar states of core debris may exist in the lower vessel head if in-place recovery does not occur or in the reactor cavity if the vessel fails but sufficient water exists in the cavity. The author reviews various models on coolability of debris beds submerged in a pool of liquid or subjected to upward flow of coolant.

Variables discussed are particle size, liquid subcooling, liquid-layer height, bottom cooling, particle-size distribution, and nonheated constituents. Heat fluxes predicted by various models for the porous layer to dryout are compared. (40 refs.)

99700 Failures in air-cleaning, air-monitoring, and ventilation systems in commercial nuclear power plants, 1978-1981. D.W.Moeller, L.-S.C.Sun (School of Public Health, Harvard Univ., Cambridge, MA, USA).
Nucl. Saf. (USA), vol.24, no.3, p.352-71 (May-June 1983).
An analysis of Licensee Event Reports (LERs) submitted by commercial nuclear power plant operators during the 4-yr period from 1978 through 1981 showed that 11 to 17% of those LERs reported by pressurized-water-reactor (PWR) installations and 20 to 29% reported by boiling-water-reactor (BWR) installations pertained to air treatment systems. The majority of these pertained to problems in air monitors. Problems with gaseous and particulate radiation monitors accounted for 68 and 41% of the air-monitoring events in PWR and BWR installations, respectively. Information available to prevent and/or correct these problems is not being effectively used, as is illustrated by the major role that human errors continue to play in these failures. As one solution to these problems, the authors recommend an increase in the training of both nuclear power plant personnel and staff members of the Nuclear Regulatory Commission in the areas of heating, ventilation, and air conditioning systems in general and nuclear air-cleaning technology in particular. (16 refs.)

99701 Evaluation of events involving unplanned boron dilutions in nuclear power plants. E.W.Hagen.
Nucl. Saf. (USA), vol.24, no.3, p.383-8 (May-June 1983).
Reviews and evaluates events concerned with the inadvertent dilution of boron concentrations to the reactor coolant system of pressurized-water-cooled thermal reactors in commercial service. The safety concern is the unplanned addition of reactivity. Results from information obtained were collated and analyzed for significance and impact on power plant safety performance. Several operating experience events are reviewed. This study revealed no boron dilution incidents resulting in a reactivity excursion or transient that scrammed a unit, nor was a reactor protection system challenged by any of the events. The most common cause for unplanned boron dilutions was human error of which one was a common-mode/common-cause failure. (15 refs.)

99702 Experimental investigations on the behaviour of main cooling pumps at loss-of-coolant accidents. W.Kastner, K.Riedle, G.Seeberger.
Brennst.-Waerme-Kraft (BWK) (Germany), vol.35, no.6, p.271-8 (June 1983). In German.
For an analysis of loss-of-coolant accidents in PWRs the stationary and transient behaviour of main cooling pumps during the flowing of single and two-phase media has to be known. Experiments in important parameter carried out on two axial, scaled down model pumps are described. The stationary experimental results show that the laws of similarity for pump behaviour at single-phase flow apply to two-phase flow, it volumetric steam content and pressure are taken into account. The results of the blowdown experiments correspond to the stationary measured values as long as no critical flow conditions occur. (6 refs.)

99703 Chemical equilibria for accident analysis in pressurised water nuclear reactor systems. P.E.Potter, M.H.Rand (Chem. & Materials Dev. Div., AERE, Harwell, England).
CALPHAD: Comput. Coupling Phase Diagrams & Thermochem. (GB), vol.7, no.2, p.165-74 (April-June 1983).
Some chemical equilibria for the safety analysis of water cooled nuclear reactors have been calculated using the programme SOLGASMIX. Particular attention has been paid to the behaviour of the fission product elements Cs, I, Te, Ba and Sr. The chemical states of these elements have been calculated for a variety of conditions likely to be encountered in the core of a reactor before and during degradation. (8 refs.)

99704 Some applications of holography at the Idaho National Engineering Laboratory. V.A.Deason (Instrument Dev. Branch, EG&G Idaho Inc., Idaho Falls, ID, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353, p.131-7 (1983). (Industrial and Commercial Applications of Holography, San Diego, CA, USA, 24-25 Aug. 1982).
A project was recently completed that investigated possible uses of holography in the nuclear reactor safety program. A portable holographic camera which uses a pulsed ruby laser for illumination was constructed and used in various studies, including several designed to clarify the properties of steam/water mixtures that occur during loss-of-coolant accidents in nuclear reactors. The flexibility of the camera's optical configuration also enables it to produce holographic interferograms, which have several advantages over conventional interferograms and which can be used to measure very small physical changes in a given environment. (5 refs.)

99705 Four-inch pipe whipping tests under BWR LOCA conditions. Effect of pipe-restraints clearance. S.Ueda, R.Kurihara, T.Isozaki, N.Miyazaki, R.Kato, S.Miyazono, K.Saito.
J. At. Energy Soc. Jpn. (Japan), vol.25, no.5, p.383-93 (May 1983). In Japanese.
Describes results of the experimental and analytical research concerning the phenomenon of pipe whipping and the behavior of restraints to limit the pipe movement in a postulated loss-of-coolant accident of BWR nuclear power plants. The test pipe, which was made of type 304 stainless steel, was 114.3 mm in diameter and 8.6 mm in thickness. Four retraints of U-type were used. The rod of the restraint which was made of type 304 stainless steel, was 8 mm in diameter. The overhang length between the pipe exit and the restraints was 400 mm. The clearances between the pipe and the restraint were 30, 50 and 100 mm. In all the experiments the restraints limited the pipe movement. The residual restraint strain was less than the elongation of this material. The peak value of the pipe strain occurred near the restraints due to the rotation of the pipe after the impact. This value was less than the elongation of the pipe material. Calculations of the restraint strain, restraint force and the impact time were performed using the general purpose finite element program ADINA. (5 refs.)

99706 Experience with the peaceful use of nuclear energy. A.Birkhofer (Gesellschaft fur Reaktorsicherheit mbH, Garching, Germany).
Maschinenschaden (Germany), vol.56, no.3, p.69-79 (1983). In German.
The operating experience gained with nuclear plants in the western world is discussed including availability, accidents, radiation exposure and waste disposal. The extent and type of nuclear reactor accidents to date are debated with reference to the safety aspects of the power plants in the Federal Republic of Germany, including their treatment in the mass media. Finally the special role played by the human factor. (15 refs.)

99707 Numerical simulation of thermal-hydraulic transients in LMFBR piping systems. I.K.Madni (Mech. Engng. Dept., Univ., of Petroleum & Minerals, Dhahran, Saudi Arabia).
Numer. Heat Transfer (USA), vol.6, no.2, p.189-208 (April-June 1983).
The transient performance characteristics of liquid metal-cooled fast breeder reactor (LMFBR) systems are strongly influenced by the energy transport in the piping interconnecting the system components. A one-dimensional coolant-wall model is used to simulate the thermal transport processes, with energy equations. Formulated by using nodal heat balances. An implicit scheme is applied to the coolant equation with an explicit formulation of the wall heat flux, allowing the solution to march in the flow direction. The impact of uncertainties in Nusselt number predictions based on generally used correlations is examined. For coolant dynamics, each pipe run between components is treated as a lumped control volume. (26 refs.)

99708 NEA Library Programs on LWR Safety ANS 1982 Annual Meeting.
Newsl. NEA Data Bank (France), no.28 (Sept. 1982). [received: Aug. 1983]
Conference held at: Los Angeles, CA, USA. Date 6-11 June 1982. The following topics were dealt with: LWR safety; computer programs; BWR emergency cooling; LWR fuel rod behaviour; accidents; LWR blowdown analysis. Abstracts of individual papers can be found under the relevant classifcation codes in this or future issues.

99709 NORCOOL-I, a best-estimate model for BWR emergency cooling during reflood. I. P.Astrup (Dept. of Energy Technol., Riso Nat. Lab., Roskilde, Denmark).
Newsl. NEA Data Bank (France), no.28, p.5-46 (Sept. 1982). [received: Aug. 1983] (NEA Library Programs on LWR Safety ANS 1982 Annual Meeting, Los Angeles, CA, USA, 6-11 June 1982).
NORCOOL-I is a computer code for the calculation of the emergency core cooling transient for a BWR. The code considers both bottom flooding and spray cooling, and calculates the transient from the time where critical flow no longer exists. NORCOOL-I consists of a model for the heat conduction in the fuel rods and the structural materials and a model for the two-phase flow. The two-phase flow model includes separate descriptions of the water and steam phases and allows for thermodynamic non-equilibrium and counter current flow. The coupling between the heat conduction and the two-phase flow model is taken into account through a number of correlations for the heat transfer, which includes both convection and thermal radiation. (10 refs.)

99710 NORCOOL-I, a best-estimate model for BWR emergency cooling during reflood. II. J.Miettinen (Nuclear Engng. Lab., Tech. Res. Center of Finland, Helsinki, Finland).
Newsl. NEA Data Bank (France), no.28, p.47-72 (Sept. 1982). [received: Aug. 1983] (NEA Library Programs on LWR Safety ANS 1982 Annual Meeting, Los Angeles, CA, USA, 6-11 June 1982).
For pt.I see ibid., no.28, p.5 (1982). Describes the application of NORCOOL-I to emergency cooling systems such as top spray and reflooding experiments. An analysis of the 7th CSNI standard problem is also discussed. (3 refs.)

99711 SSYST—a code system to analyze LWR fuel rod behavior under accident conditions. W.Gulden (Projekt Nukleare Sicherheit, Kernforschungszentrum Karlsruhe GmbH, Karlsruhe, Germany), R.Meyder, H.Borgwaldt.
Newsl. NEA Data Bank (France), no.28, p.73-102 (Sept. 1982). [received: Aug. 1983] (NEA Library Programs on LWR Safety ANS 1982 Annual Meeting, Los Angeles, CA, USA, 6-11 June 1982).
SSYST (Safety System) is a modular system to analyze the behavior of light water reactor fuel rods and fuel rod simulators under accident conditions. It has been developed in close cooperation between Kernforschungszentrum Karlsruhe (KfK) and the Institut fur Kerntechnik und Energiewandlung (IKE). University Stuttgart, under contract of Projekt Nukleare Sicherheit (PNS) at KfK. Although originally aimed at single rod analysis, features are available to calculate effects such as blockage ratios of bundles and whole cores. A number of inpile and out-of-pile experiments were used to assess the system. (26 refs.)

99712 DRUFAN, an advanced best-estimate code for LWR blowdown analysis. M.Burwell (Gesellschaft fur Reaktorsicherheit mbH, Garching, Germany).
Newsl. NEA Data Bank (France), no.28, p.103-42 (Sept. 1982). [received: Aug. 1983] (NEA Library Programs on LWR Safety ANS 1982 Annual Meeting, Los Angeles, CA, USA, 6-11 June 1982).
DRUFAN-01/MOD2 computer program is a blowdown code for the simulation of loss-of-coolant accidents. The code can be applied to all possible blowdown geometries from a very simple one to complicated reactor systems. However, this code version is not meant to simulate phenomena where the non-homogeneous phase separation effects are important. (17 refs.)

99713 Inherent safety in liquid metal-cooled breeder reactors. R.T.Lancet, J.C.Mills (Atomics Internat. Div., Rockwell Internat., Canoga Park, CA, USA).
Greater Los Angeles Area Energy Symposium, Los Angeles, CA, USA, 28 Oct. 1980 (North Hollywood, CA, USA: Western Periodicals Company 1980), p.91-6
The major safety functions of a Liquid Metal Fast Breeder Reactor are reviewed. It is shown that these functions are carried out using diverse and redundant systems. Emphasis is placed on the approach of achieving the goal of providing at least one inherently actuated system for each major safety function. (no refs.)

High-level waste immobilization .... See Entry 99674

Access control system in the Hamaoka Nuclear Power Station .... See Entry 99737

Radiation environment during the commissioning and power runup in the fifth unit at the Novyiu Voronezh nuclear power station .... See Entry 99739

A new method of monitoring radioactive aerosols from nuclear power stations with RBMK reactors .... See Entry 99740

Oxidation of carburized Hastelloy X .... See Entry 103380

Assessments of the radiological consequences of postulated accidental releases from the Sizewell PWR .... See Entry 104074

28.50 FISSION REACTOR TYPES AND APPLICATIONS

99714 Advanced breeder systems—present status and prospects of development. I.G.Morozov.
Atomwirtsch.-Atomtech. (Germany), vol.28, no.7-8, p.400-7 (July-Aug. 1983). In German.
Delays in the use of breeders and the increased consumption of natural uranium this would entail could be offset in part by the introduction, on a larger scale, of thermal reactors, including converter reactors of the light water type with uranium-plutonium fuel and of the heavy water type with a uranium-thorium cycle. The most attractive and also the most promising strategy could turn out to be the three-component structure concept. In this case, the longer span required by nuclear power to become independent of natural uranium can, under certain conditions, be bridged by a reduction in capital outlay and by restricting the types of fuel cycles to only one uranium-plutonium cycle. (no refs.)

99715 Nuclear power developments and trends. J.J.Thompson, Z.J.Holy.
Energy 83. Towards an Energy Policy for Australia, Canberra, Australia, 11-13 May 1983 (Barton, Australia: Instn. Eng., Australia 1983), p.249-53
At the present time there are three types of nuclear reactors in commercial operation throughout the world, the light water reactor (LWR), the heavy water reactor (HWR), and the advanced gas cooled reactor (AGR). The latter has now been discontinued and the HWR has only been built in limited numbers. Currently, the LWR is the preferred system and makes up some 90% of nuclear plants in operation, under construction and planned throughout the world. The LWR system comprises two systems; the pressurised water reactor (PWR) and the boiling water reactor (BWR). Of these two types the PWR represents more than two-thirds of current nuclear plants in operation, and this proportion will increase when plants under construction and planned come into operation. In general, the nuclear fuel cycle for the PWR and BWR are similar, differing essentially in specific areas of fuel design and fuel management within the reactor core. The Canadian HWR, though highly successful, lies outside the main stream of development. (no refs.)

Neutron Radiography. Proceedings of the First World Conference .... See Entry 98644

Physical characteristics of an RBMK reactor in the transitional period .... See Entry 99614

Chemical thermodynamics of iodine species in the HTGR fuel particle .... See Entry 99621

Sodium, a domesticated metal .... See Entry 99624

TREAT neutron radiography facility .... See Entry 99629

Hot Fuel Examination Facility neutron radiography reactor design .... See Entry 99630

Application of epithermal neutron radiography to performance tests on advanced LMFBR fuel .... See Entry 99638

In pool neutron radiography of a BWR control blade .... See Entry 99645

Neutron radiography feasibility studies for steel examination for the liquid metal fast breeder reactor program .... See Entry 99647

Development of enriched boron track-etch convertor screens for neutron radiographic applications .... See Entry 99656

Application of neutron radiography in light water reactor fuel pin testing programs at the high flux reactor Petten .... See Entry 99659

The corrosion products in primary and secondary circuits of PWR plants .... See Entry 99691

Comparison of the technicoeconomic characteristics of nuclear power stations with modern thermal and fast reactors .... See Entry 99692

Cold neutron spectra of the general atomic TRIGA Mk. E neutron radiography facility .... See Entry 99695

LWR safety research at EPRI: an update .... See Entry 99698

On the coolability of degraded LWR cores .... See Entry 99699

Evaluation of events involving unplanned boron dilutions in nuclear power plants .... See Entry 99701

Experimental investigations on the behaviour of main cooling pumps at loss-of-coolant accidents .... See Entry 99702

Chemical equilibria for accident analysis in pressurised water nuclear reactor systems .... See Entry 99703

Four-inch pipe whipping tests under BWR LOCA conditions. Effect of pipe-restraints clearance .... See Entry 99705

Numerical simulation of thermal-hydraulic transients in LMFBR piping systems .... See Entry 99707

NEA Library Programs on LWR Safety ANS 1982 Annual Meeting .... See Entry 99708

NORCOOL-I, a best-estimate model for BWR emergency cooling during reflood. I .... See Entry 99709

NORCOOL-I, a best-estimate model for BWR emergency cooling during reflood. II .... See Entry 99710

SSYST—a code system to analyze LWR fuel rod behavior under accident conditions .... See Entry 99711

DRUFAN, an advanced best-estimate code for LWR blowdown analysis .... See Entry 99712

Inherent safety in liquid metal-cooled breeder reactors .... See Entry 99713

Radiation environment during the commissioning and power runup in the fifth unit at the Novyiu Voronezh nuclear power station .... See Entry 99739

A new method of monitoring radioactive aerosols from nuclear power stations with RBMK reactors .... See Entry 99740

Evaluation method of fast neutron irradiation dose in JMTR .... See Entry 101803

Oxidation of carburized Hastelloy X .... See Entry 103380

Neutron radiography facilities using neutron beams from nuclear reactors .... See Entry 103454

Review of neutron radiography development activities at Argonne National Laboratory .... See Entry 103455

A review of ten years of operation of the industrial neutron radiography facilities associated with the Triton reactor at the Fontenay aux Roses nuclear research center .... See Entry 103456

Neutron radiography at Lucas Heights .... See Entry 103458

Neutron radiography in Brazil .... See Entry 103459

Use of a neutron guide in industrial neutron radiography .... See Entry 103460

Status report on the activity of the neutron radiography group in Pusat Penelitian Teknik Nuklir Bandung .... See Entry 103461

Characteristics of neutron radiography systems using accelerators and a research reactor .... See Entry 103462

Development of a neutron radiography system at the TRIGA mark III reactor of the nuclear center of Mexico .... See Entry 103463

Neutron radiography experiences at the low flux reactor .... See Entry 103464

Progress in NR techniques and applications at AWRE Aldermaston .... See Entry 103465

Neutron radiography DIDO reactor .... See Entry 103466

Neutron radiography at the general electric nuclear test reactor .... See Entry 103467

Neutron radiography facilities at Sandia National Laboratories, Albuquerque (SNLA) .... See Entry 103468

Neutron radiography techniques at Sandia National Laboratories, Albuquerque (SNLA) .... See Entry 103469

Description and characterization of the BR1 neutron radiography facility .... See Entry 103470

Six years' experience with the double beam neutron radiography facility at the Riso National Laboratory .... See Entry 103471

A ^{233}U fuelled reactor for neutron radiography .... See Entry 103472

Design and safety aspects of neutron radiography rig for examination of irradiated objects .... See Entry 103473

Development of an online neutron radiography system of high resolution for nuclear materials .... See Entry 103474

Neutron radiography installation in the HFR reactor pool .... See Entry 103475

Neutron radiography installation for long fuel rods at the HFR Petten .... See Entry 103476

28.52 FUSION REACTORS

(for confinement, see 52.55)

99716 Heavy ion fusion. R.Bock (GSI Darmstadt, Darmstadt, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3049-54 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The heavy ion accelerator has been proposed as a driver for an inertial confinement fusion (ICF) power plant. The author presents the results of conceptual design studies for two accelerator scenarios: the RF-linac with storage rings and the induction linacs. Current and future experiments in heavy ion fusion are discussed. (18 refs.)

99717 Improvements on the HIBALL heavy ion fusion driver. I.Hofmann, A.Jahnke (Max-Planck-Inst. fur Plasmaphys., Garching, Germany), K.Beckert, D.Bohne, R.W.Muller.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3070-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Preliminary studies of accelerator scenarios suitable for the HIBALL heavy ion fusion reactor study have shown that it is of interest to consider an RF linac beam current as high as possible in order to reduce the filling time of the storage rings to about 1 msec. It is shown here for singly charged Bi ions (10 GeV kinetic, 5 MJ total energy) that such a scenario helps to avoid growth of the resistive microwave mode and reduces the complexity of transverse stacking manipulations in the rings. This work indicates that it might be desirable for future studies to lower the linac current and thus the enormous instantaneous RF power consumption by finding ways to suppress microwave growth in order to stretch the storage ring filling time. (6 refs.)

99718 The role of radiation damage analysis in the fusion program. D.G.Doran (Hanford Engng. Dev. Lab., Richland, WA, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.1-3 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
The objective of radiation damage analysis is the prediction of the performance of facility components exposed to a radiation environment. The US Magnetic Fusion Energy materials program includes an explicit damage analysis activity within the Damage Analysis and Fundamental Studies (DAFS) program. The emphasis of this program is on developing procedures, based on an understanding of damage mechanisms, for applying data obtained in diverse radiation environments to the prediction of component behavior in fusion devices. It is assumed that the Fusion Materials Irradiation Test Facility will be available in the late 1980s to test (and calibrate where necessary) correlation procedures to the high fluences expected in commercial reactors. (5 refs.)

99719 Observation of compression of high-aspect-ratio shell targets in the DEL'FIN-1 laser-fusion device. N.G.Basov, A.A.Galichii, A.E.Danilov, A.I.Isakov, M.P.Kalashnikov, Yu.A.Merkul'ev, Yu.A.Mikhailov, A.V.Rode, G.V.Sklizkov, S.N.Fedotov.
JETP Lett. (USA), vol.37, no.2, p.134-9 (20 Jan. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.2, p.109-12 (20 Jan. 1983).
Experimental results on the compression of glass shell targets with an aspect ratio $R/\Delta R=150\text{-}250$ in the DEL'FIN-1 laser-fusion device are reported. The absorbed laser energy was $E=0.3\text{-}0.5$ kJ. The average shell velocity toward the center of the target was found to be $C=160$ km/s, and the maximum compression was $V_0/V_f=3.5\times10^3$. (6 refs.)

99720 A simple model of liner compression of plasma in a cylindrical system. A.Galkowski, R.Swierczynski, E.Wlodarczyk.
J. Tech. Phys. (Poland), vol.23, no.2, p.213-21 (1982).
Some numerical results previously obtained for a cylindrical compression system of deuterium plasma by concentric implosion of a cylindrical copper liner. Acceleration of the liner to a very high velocity was achieved by a layered explosion generator composed of a light shock absorbing layer spread over the imploding liner and an additional liner driven directly by the detonation products of the explosive. The transfer of the explosion energy access of the shock absorbing layer ensures profiled loading of the liner imploding into the deuterium region. The further optimisation of the system to attain higher neutron yield and the possibility of attaining a thermonuclear regime in a cylindrical explosion system are discussed. (10 refs.)

99721 Burn performance of deuterium-tritium, deuterium-deuterium, and catalyzed deuterium ICF targets. D.B.Harris, T.E.Blue (Fusion Studies Lab., Univ. of Illinois, Urbana, IL, USA).
Nucl. Fusion (Austria), vol.23, no.8, p.1071-7 (Aug. 1983).
The University of Illinois hydrodynamic burn code, AFBURN, has been used to model the performance of homogeneous D-T, D_2, and catalyzed deuterium

ICF targets. Yields and gains are compared for power-producing targets. AFBURN is a one-dimensional, two-temperature, single-fluid hydrodynamic code with non-local fusion product energy deposition. The initial conditions for AFBURN are uniformly compressed targets with central hot spots. AFBURN predicts that maximum D_2 target gains are obtained for target ρR and spark ρR about seven times larger than the target and spark ρR for maximum D-T target gains, that the maximum D_2 target gain is approximately one third of the maximum D-T target gain, and that the corresponding yields are approximately equal. By recycling tritium and ^{3}He from previous targets, D_2 target performance can be improved by about 10%. (11 refs.)

99722 Energy gain of D-T targets for inertial confinement fusion. S.Atzeni, A.Caruso (ENEA sulla Fusione, Centro Ricerche Energia Frascati, Rome, Italy).
Nucl. Fusion (Austria), vol.23, no.8, p.1092-7 (Aug. 1983).
A model for the computation of the minimum ignition energy and of the fuel gain of D-T targets which are isobaric at ignition is formulated, making use of the relevant ignition criterion. Scaling relations for the limiting gain curves, as functions of the energy delivered to the fuel, the fuel mass and the isentrope parameter, are given and illustrated by several examples. (15 refs.)

99723 Hydrogen recycling processes in plasma device. S.Yamaguchi (Dept. of Nuclear Engng., Tohoku Univ., Sendai, Japan).
Oyo Buturi (Japan), vol.52, no.3, p.220-6 (March 1983). In Japanese.
The fusion reaction that requires the lowest temperature and the least effective containment, and offers the prospect of the highest power densities, is one of deuterium and tritium. $D+T \rightarrow He+n+17.6$ MeV. Most of the energy released (14.1 MeV) is carried by the escaping neutron. Tritium is almost nonexistent in nature and must be regenerated in the fusion fuel cycle after use in deuterium-tritium (D-T) reaction. The author reviews recent studies on reflection, desorption, and retention/re-emission processes among the hydrogen recycling processes in nuclear fusion reactors, and briefly describes these processes. (22 refs.) *K.B.*

99724 The development of the Tokamak reactor in the light of new experimental results. K.Lackner (Euratom Assoc., Garching, Munchen, Germany).
Phys. Bl. (Germany), vol.39, no.7, p.211-19 (July 1983). In German.
The diverter type Tokamak fusion reactor has the advantage over the arrester type that the plasma remains uncontaminated by sputtered metal which is inevitably formed in an arrester type Tokamak. There are still to be solved many of the plasma-wall interaction problems, such as overheating of the diverter chamber and arrangement and shape of the exit slits with respect to higher heat generation and stronger plasma currents. (11 refs.) *R.S.*

99725 Geometrical efficiency of the prototype neutral beam injector unit for JT-60. Y.Ohara, M.Akiba, M.Araki, H.Horiike, M.Kuriyama, S.Matsuda, M.Matsuoka, Y.Okumura, S.Tanaka (Div. of Thermonuclear Fusion Res., JAERI, Ibaraki-ken, Japan).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.921-7 (Aug. 1983).
The geometrical efficiency of the prototype neutral beam injector unit for the JT-60 was measured experimentally and was compared with numerical estimates. The measurements agreed well with the calculations in the wide range of perveance by taking into account the distortion of the beamlet intensity distribution function from a Gaussian distribution. Overdense operation of the ion source was preferable in that the high geometrical efficiency could be obtained at high perveance values. (12 refs.)

99726 Analysis of the surface and erosion of the graphite diaphragm of the T-3M Tokamak in the tearing mode. D.G.Baratov, G.V.Gordeeva, M.I.Guseva, V.N.Dem'yanenko, A.N.Mansurova, S.V.Mirnov, V.A.Stepanchikov, V.P.Fokin.
Sov. At. Energy (USA), vol.53, no.6, p.854-7 (Dec. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.6, p.396-8 (Dec. 1982).
A major difficulty in constructing large Tokamaks and Tokamak-reactors will be posed by the tearing-mode instability which manifests itself in fast expansions of the current channel (tears) right up to the diaphragms and walls of the discharge chamber. (6 refs.)

99727 Direct charged-particle energy conversion in a system composed of a magnetic expander and planar collector. S.K.Dimitrov, A.V.Makhin.
Sov. At. Energy (USA), vol.53, no.6, p.861-3 (Dec. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.6, p.400-1 (Dec. 1982).
Direct energy conversion should be used with charged particles emerging from plugs, in order to improve the efficiency of a fusion reactor based on an open trap and to solve the problem of cooling constructional components. The authors have examined the electron retardation in a conical magnetic expander with a planar collector. The electron beam, lay at the top of a conical vacuum chamber with a semivertex angle of 30° in the region of maximum magnetic field. (3 refs.)

99728 Use of two-dimensional schemes in the finite-element method in calculating the coil system for the toroidal magnetic field in a Tokamak. A.N.Podgornyi, P.P.Gontarovskii, B.F.Zaitsev, Ya.B.Naidenov, V.I.Koryavko (Inst. of Engng. Problems, Acad. of Sci., Kharkov, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.7, p.908-12 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.45-9 (July 1982).
The FEM has been used in two-dimensional schemes for determining the state of stress in the arch part of a coil system providing a toroidal magnetic field. There may be a deviation from contact between the coils when the system is subject to ponderomotive forces and a temperature distribution. The zones determined in this way from both schemes are similar. (12 refs.)

99729 Redundant control systems for TSTA. J.J.Damran (Los Alamos Nat. Lab., Los Alamos, NM, USA).
24th Midwest Symposium on Circuits and Systems, Albuquerque, NM, USA, 29-30 June 1981 (North Hollywood, CA, USA: Western Periodicals 1981), p.121-9
The tritium systems test assembly (TSTA) is a Los Alamos National Laboratory facility being constructed for the purpose of developing, demonstrating, and interfacing technologies required in the deuterium-tritium fuel cycle of future fusion reactor systems. The control of the facility is performed by the master data acquisition and control system (MDAC). The MDAC employs eight computers in a multi-redundant configuration ensuring both the safe and reliable operation of the facility and a high degree of system availability. To accomplish this task, MDAC is separated into two isolated branches, one designated as the process branch and the other as the safety branch. (no refs.)

Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors .... See Entry 98632

Atomic displacement rates of light ions in cubic metals .... See Entry 99626

Long-pulse induction acceleration of heavy ions .... See Entry 99807

Threshold behavior for longitudinal stability of induction linac bunches .... See Entry 99959

Studies of heavy ion beam transport in a magnetic quadrupole channel .... See Entry 99973

Theoretical study of high-current beams in storage rings .... See Entry 99974

Computer simulation of multiple-beam final focusing systems for heavy ion fusion .... See Entry 99999

Inertial fusion with low energy heavy ions .... See Entry 100065

Laser driven compression experiments using low X-ray opacity polymer shells .... See Entry 101444

Inertial confinement fusion research by particle beams at ILE Osaka .... See Entry 101456

Nuclear spin-polarized fuel in inertial fusion .... See Entry 101464

Threshold energy surface and Frenkel pair resistivity for Cu .... See Entry 101690

Computer simulation of defect behavior under fusion irradiation environments .... See Entry 101750

Defect production in simulated cascades: cascade quenching and short-term annealing .... See Entry 101751

Atomic displacement functions of cubic metals .... See Entry 101753

Quantitative modelling of swelling in M316 steel .... See Entry 101754

Theory of pulsed irradiation microstructures .... See Entry 101757

The growth of gas-bubbles by coalescence in solids during continuous gas generation .... See Entry 101758

Microstructural and microchemical comparisons of AISI 316 irradiated in HFIR and EBR-II .... See Entry 101804

Impact of the injected interstitial on the correlation of charged particle and neutron-induced radiation damage .... See Entry 101805

Compositional changes in Fe-Cr-Ni alloys under proton bombardment at elevated temperatures .... See Entry 101807

Effects of pulsed dual-ion irradiation on phase transformations and microstructure in Ti-modified austenitic alloy .... See Entry 101809

Depth dependent damage profile in stainless steel irradiated with He-ions .... See Entry 101810

Effect of helium preinjection and prior thermomechanical treatment on the microstructure of type 316 SS .... See Entry 101811

Influence of helium injection schedule and prior thermomechanical treatment of the microstructure of type 316 SS .... See Entry 101812

Evolution of cavity size distributions in dual-ion irradiated austenitic stainless steel and Fe-Cr-Ni ternary alloys .... See Entry 101813

Effects of temperature and helium on void formation in self-ion irradiated aluminum .... See Entry 101814

Helium bubble formation in Cu, Ni and Cu-Ni alloys .... See Entry 101815

Effect of irradiation on phosphorus segregation .... See Entry 101816

Saturation of proton-induced swelling in AISI 316 .... See Entry 101817

Simulation of reactor conditions in investigations of radiation damage of the surface of materials .... See Entry 101822

Thermochemical hydrogen production based on magnetic fusion .... See Entry 103733

28.58 INTEGRATED REACTOR SYSTEMS

99730 Target system for an intense neutron source using a spallation process.
J. At. Energy Soc. Jpn. (Japan), vol.25, no.5, p.344-55 (May 1983). In Japanese.
Two types of neutron emitting and breeding target systems were considered, those consisting mainly of heavy metals and molten salt containing fertile material like Th or U. Their performance studies have been made by applying a computational procedure for hadron transport incorporated with high energy fission. Structural models of a molten salt reactor system are presented for the future studies. A review is made of the neutron nuclear data in the energy range of tens-thousands MeV. Surveys have been also made for accelerators to supply sufficient protons to the target. These studies suggest three types of accelerators which will match each phase of the development and also be useful as themselves: (1) intense proton synchrotron like 'Gemini' now under study at KEK, (2) intermediate scale proton linac for the engineering study, (3) high power proton linac for the demonstration accelerator breeder system. (30 refs.)

28.70 NUCLEAR EXPLOSIONS

(see also 47.40 Shock and detonation phenomena)

99731 EMP, the electromagnetic superblitz: how safe are communications paths in emergencies?. A.Kukan.
Funk-Tech. (Germany), vol.38, no.6, p.235-7 (June 1983). In German.
The EMP (electromagnetic pulse) generation due to a nuclear explosion in the ionosphere can cause even on the earth surface fields strengths of 50 kV/m and play havoc with electronic installations and communications. At 500 km release height of a nuclear event, the whole of United States could be blanked out. The first USA tests of EMP consequences in 1962 are briefly described. Since 1977 a NATO specification list of equipment 'hardening' proposals exists; even partial protection or protection of key positions only requires enormous expenditure. Schematic diagrams illustrate the effects of an explosion by plots of electric and magnetic vectors vs. height, and the comparison of the EMP and a lightning discharge, the former having a faster time of rise, higher peak and wider frequency spectrum. Some simple safety circuit elements are discussed, like gas-filled surge fuses and Zener diodes. *A.L.*

28.80 RADIATION TECHNOLOGY, INCLUDING SHIELDING

(see also 87.60 Medical and biomedical uses of fields, radiations and radioactivity)

99732 Inter-laboratory standardization of glass dosimeters. S.K.Modgil, H.S.Virk (Dept. of Phys., Guru Nanak Dev Univ., Amritsar, India).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.367-70 (1 July 1983).
Intercalibration charts for various glass dosimeters have been prepared using Fleischer's glass as reference standard. Calibration constants have been deter-

mined using two different irradiation thermal neutron doses. The geometrical factor and uranium content for these glasses are determined. The U-content of the dosimeters varies from 0.35±0.02 ppm to 41.93±1.0 ppm and the geometrical factor *G* lies within the range 0.57-0.77. (12 refs.)

99733 Fast neutron detection with Al_2O_3 thermoluminescence dosimeter. M.Ranogajec-Komor (Inst. Ruder Boskovic, Zagreb, Yugoslavia), M.Osvay, I.Dvornik, T.Biro.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.383-6 (1 July 1983).
The technique of thermoluminescent (TL) dosimeter activation can be used to detect any radiation making TL dosimeters radioactive. In the experiment discussed in the paper Al_2O_3:Mg, Y TL dosimeters were irradiated by cyclotron neutrons with 5±1 MeV mean energy and by accompanying gamma rays. The gamma and the fast neutron component can be separately measured by the same dosimeter. Because of low neutron sensitivity of Al_2O_3 the gamma dose can be determined by the first TL reading while the $^{27}Al(n,\alpha)^{24}Na$ reaction provides the possibility of fast neutron detection by the subsequent reading of thermoluminescence induced in the TL material by the decay of ^{24}Na. (19 refs.)

99734 An alpha-particle imaging system for detecting plutonium contamination. T.Iida, S.Yamamoto, Y.Ikebe (Dept. of Nuclear Engng., Faculty of Engng., Nagoya Univ., Nagoya, Japan), A.Seki, K.Nakata, M.Ebana, M.Kanamori, M.Yoshida.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.413-18 (1 July 1983).
A new type of alpha-particle imaging system was constructed to reduce the time required for detecting plutonium contamination. The imaging system consists of a ZnS(Ag) screen, two tapered fibers, an image intensifier, and polaroid film. Spots due to single alpha-particles can easily be obtained on the polaroid film. The observed spatial resolution is more than 3 lp/mm. This system requires about one-seventh of the exposure time required by ZnS(Ag) autoradiography in order to distinguish between plutonium contamination and radon and thoron daughter products. (9 refs.)

99735 Enhanced intensity of 7.6 MeV gamma rays from an $^{241}Am/Be$ source in a multilayered CH_2-Fe shield. H.F.Atwater (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.555-7 (1 July 1983).
Monte Carlo neutron-photon transport calculations were used in the empirical design of spherical shields that enhance the 7.6 MeV gamma-ray intensity from a shielded $^{241}Am/Be$ source. (5 refs.)

99736 The 'CBA' dosimeter for determination of high dose. Wu Zhili, Chen Xinwei (Shanghai Inst. of Nuclear Res., Acad. Sinica, Shanghai, China).
Nucl. Tech. (China), no.2, p.49-50, 60 (April 1983). In Chinese.
The authors study the effects of constituent concentration, chemical purity, irradiation temperature, absorbed dose and dose rate on dose response of the ethanol-chlorobenzene dosimeter in ^{60}Co γ-rays. The stability of the dosimeter before and after irradiation is also considered. The $G(Cl^-)$ values of 10 vol.% chlorobenzene-4 vol.% water system at different dose rates are given. Results show that such a dosimeter is suitable, in an irradiation plant, for the determination of ordinary dose within $10^3 \sim 10^5$ Gy. (3 refs.)

99737 Access control system in the Hamaoka Nuclear Power Station. H.Kaneda (Dept. of Radiat. Protection, Chubu Elec. Power Co., Nagoya, Japan), S.Shimura, K.Suzuki, T.Kitazawa.
J. At. Energy Soc. Jpn. (Japan), vol.25, no.5, p.356-71 (May 1983). In Japanese.
A new computerized system has been introduced to improve the function of radiation protection for those who enter the radiation control area, by dealing with the measurement of radiation dose, checking of personal qualification, resistration of working conditions and statistical treatment of these data. This system uses a combined TLD, 'TL BADGE', as a radiation detection sensor, instead of conventional pocket dosimeter and film badge. TL BADGE reading instruments are installed at the entrance to the control area and at working areas. The data of radiation dose, personal qualification, etc. read by the reading instrument are transmitted directly to the computer system, which compiles and transacts these data. This system consists of three minicomputers, double memory files, CRTs for effective data search and display and floppy disks as a medium for registration, etc. Thus the computer system improves its reliability and the maintainability of data, being capable of the automatical transaction of a great amount of data quickly. (15 refs.)

99738 Neutron dosimetry with spherical ionisation chambers. V. Experimental measurements and comparison with calculations of the cavity size dependence of the specific ionisation. A.Rubach (Univ. of Washington, Settle, WA, USA), H.Bischsel, A.Ito.
Phys. Med. & Biol. (GB), vol.28, no.8, p.913-24 (Aug. 1983).
For pt.IV see ibid., vol.27, p.1455, 1982. An experiment is described in which the cavity size dependence of the ionisation per unit mass was investigated in three different neutron beams for chambers with tissue equivalent walls filled with tissue equivalent gas or air and for graphite chambers filled with carbon dioxide. Different cavity sizes were achieved by changing the gas pressure in the ionisation chamber. Special care was taken with the measurement and analysis of saturation curves. It was found that the specific charge, *q*, changed with cavity size by 2% for the chambers with tissue equivalent walls and by more than 10% for the C/CO_2 chamber for mass diameters, τ, from 0.1 to 3 mg cm^{-2}. These results are in agreement with the results calculated in parts III and IV (Rubach and Bichsel 1982). (20 refs.)

99739 Radiation environment during the commissioning and power runup in the fifth unit at the Novyiu Voronezh nuclear power station. N.A.Verkhovetskii, V.P.Ivannikov, V.F.Kozlov, V.P.Kruglov, L.M.Luzanova, A.T.Pocevin, P.D.Slavyagin, L.P.Kham'yanov.
Sov. At. Energy (USA), vol.53, no.6, p.825-7 (Dec. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.6, p.373-5 (Dec. 1982).
The authors discuss the behaviour of the biological shield during commissioning and power run-up. Other areas were also examined for radiation penetration and levels. (3 refs.)

99740 A new method of monitoring radioactive aerosols from nuclear power stations with RBMK reactors. L.N.Moskvin, G.G.Leont'ev, S.N.Nekrest'yanov, A.P.Eperin, V.G.Shcherbina, A.G.Mokhnachev.
Sov. At. Energy (USA), vol.53, no.6, p.828-31 (Dec. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.6, p.376-8 (Dec. 1982).
A new method has been proposed for monitoring radioactive aerosols in the gases from nuclear power stations. It is possible to determine the activity α_{ji} or nuclide i at point j by multiplying the activity in the coolant α_{oi} by the dilution factor R_j, is found from the activity ratio for a base reference nuclide (B reference) at the given point of release and in the coolant in the first loop. When this scheme is realized, the monitoring sensitivity under normal operating conditions is increased by a factor 10^2-10^4, while the analysis times for the individual nuclides are reduced by factors of 10-100. (7 refs.)

Radiological bases of the long term management of radioactive wastes ...... See Entry 99625

Failures in air-cleaning, air-monitoring, and ventilation systems in commercial nuclear power plants, 1978-1981 ...... See Entry 99700

Synchrotron radiation lead shielding of the vacuum chambers for LEP ...... See Entry 99845

Bulk response of some polymeric nuclear track detectors to ionizing radiation ...... See Entry 100186

Response characteristics of cellulose nitrate track-detectors to radon and radon-daughter mixtures ...... See Entry 100188

On the use of cellulose nitrate as solid state nuclear track detector. II. Response to light particles and applications ...... See Entry 100191

The pairing extrapolation ionization chamber for (n,γ) mixed field dosimetry ...... See Entry 100194

Radon concentration and exhalation measurement with a semiconductor detector and an electrostatic precipitator working in a closed circulation system ...... See Entry 103772

Ionizing radiation: sources and biological effects ...... See Entry 103951

Radiation doses from the transport of radioactive materials . See Entry 104061

The exposure of the EC population from nuclear industry effluents ...... See Entry 104062

28.90 OTHER TOPICS IN NUCLEAR ENGINEERING AND NUCLEAR POWER STUDIES

Reprocessing, decontamination and decommissioning waste management at Eurochemic; current and planned activities ...... See Entry 99680

29.00 EXPERIMENTAL METHODS AND INSTRUMENTATION FOR ELEMENTARY-PARTICLE AND NUCLEAR PHYSICS

29.10 PREACCELERATION (INJECTION)

99741 A high current injector for the Boeing radiation laboratory FEL experiment. J.L.Adamski, W.J.Gallagher, R.C.Kennedy, A.D.Yeremian (Boeing Aerospace Co., Seattle, WA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2696-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A two-stage subharmonic injector has been designed and installed to accelerate 150 ampere micropulses with the Boeing 20 MeV, S-band linac. The accelerator will provide microbunches with interpulse time of 50 nanoseconds throughout the RF macropulse of 20 microseconds. The electron source is a 5 cm^2 triode electron gun which is gated to produce 5 A, 3 ns pulses. Two standing wave prebuncher cavities are used, the first at 119 MHz, the 24th subharmonic of the linac frequency, and the second at 476 MHz, the sixth subharmonic. A short tapered phase velocity traveling wave structure provides the final bunching. The solenoidal containment field is adjustable for optimization using injector profile diagnostics. Computer analysis of bunching and radial trajectories predict beams of 2.2 nanocoulombs with radius of 0.2 cm and phase width of $\pi/2$ of the fundamental at the entrance to the traveling wave section. (4 refs.)

99742 The advanced test accelerator (ATA) injector. C.H.Jackson, D.G.Bubp, T.J.Fessenden, R.E.Hester, V.K.Neil, A.C.Paul, D.S.Prono (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2725-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The ATA injector, developed from experience gained from the Experimental Test Accelerator (ETA) linac, has recently been completed. The injector consists of ten 0.25 MV cells that are used to develop 2.5 MV across a single diode gap. The 10 kA beam is extracted from a 500 cm^2 plasma cathode at average rates of up to 5 Hz and burst rates to 1 kHz. Pulsed power from 20 water filled blumleins is divided and introduced symmetrically through four ports on each cell. All major insulators are fabricated from filled epoxy castings. With these improvements, the ATA injector is smaller than the ETA injector; has a faster pulse response; has lower voltage stress on insulators and higher ultimate performance. Injector characterization tests began in October, 1982. These tests include beam current, energy, and emittance measurements. (2 refs.)

99743 Relativistic injection into a high-current betatron. F.S.Felber, D.Mitrovich, J.Vomvoridis, R.K.Cooper (Western Res. Corp., San Diego, CA, USA), A.Fisher, T.P.Hughes, B.B.Godfrey.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2781-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A method of injection into betatrons, which employs relativistic beams to overcome space charge limitations, is discussed. The method eliminates the need to modify the betatron with a toroidal magnetic field and avoids the attendant complications. More over, multiturn injection can reduce current and power requirements on the injector by orders of magnitude. Multiturn injection by RF linacs, however, may use a substantial fraction of the phase area in a betatron, which requires some means of painting the available phase space and missing the injector on subsequent turns. An example of such a betatron injection system is presented. (3 refs.)

99744 185-MeV injector design for the ANL 4-GeV microtron project. E.Colton (Phys. Div., Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3232-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The injector starts with a 5 MeV preinjector followed by an 18 MeV S-band linac. The 23 MeV electrons are transported and injected into a racetrack microtron via a 10° achromatic bend system. Twenty-seven turns are used to boost the energy to 185 MeV. Reverse-field stripes on the 180° end magnets

and quadrupole focusing on the return paths maintain a matched-dispersion free beam with transverse $\beta^*=5.0$ m in the center of the 4.6 m long linac. The beam is recirculated outside of the RTM linac to shear the longitudinal phase-space ellipse before extraction. The extracted beam is transported and injected into the six-sided microtron at 185 MeV. (4 refs.)

Emittance calculations for the Stanford Linear Collider injector .... See Entry 99750

Automatic tuning of the LBL SuperHILAC third injector transport line .... See Entry 99756

SORE—a pulse stretcher for the Saskatchewan 300-MeV linac .... See Entry 99779

CW side-coupled linac for the Los Alamos/NBS racetrack microtron .... See Entry 99784

Study of peak power doublers with spherical resonators .... See Entry 99799

Modifications to the injection system of the K800 superconducting cyclotron .. See Entry 99823

Storage ring filling via direct production of electron and positrons by high energy protons .... See Entry 99858

The beam bunching system for the Chalk River superconducting cyclotron .... See Entry 99859

Injection and extraction for use .... See Entry 99860

Pulsed beam chopper for the PSR at LAMPF .... See Entry 99862

Performance of the 800-MeV injector for the BESSY storage ring .... See Entry 99881

Conceptual design for a CW 1-GeV double-sided microtron .... See Entry 99893

150-MeV pulse stretcher of Tohoku University .... See Entry 99895

Relativistic collective effect accelerator to reach ultrahigh energies .... See Entry 99896

ELSA, a stretcher and post accelerator for the Bonn 2.5-GeV electron synchrotron .... See Entry 99899

The NBS proposal for a one GeV CW racetrack microtron facility .... See Entry 99903

The Montreal electron accelerator proposal .... See Entry 99905

ALS II: the Saclay proposal for a 2-GeV, CW electron facility .... See Entry 99906

Remote handling and accelerators .... See Entry 99929

The lattice design and tolerance analysis of the CBA transport line .... See Entry 99952

Analytic and numerical studies of the modified betatron .... See Entry 99968

Electron beam dynamics in the CERN PS .... See Entry 99998

Tests for pulsed high current heavy ion synchrotron injection with an MP-tandem Van de Graaff .... See Entry 100033

The Los Alamos Proton Storage Ring (PSR) injection deflector system .... See Entry 100059

The Fermilab injection kicker .... See Entry 100062

The Advanced Light Source .... See Entry 100071

Dual frequency ring magnet power supply with flat-bottom .. See Entry 100206

29.15 ELECTROSTATIC AND LINEAR PARTICLE ACCELERATORS

99745 RF characteristics of coupled split coaxial lines for RFQ structure. Y.Katayama, H.Takekoshi.
Bull. Inst. Chem. Res. Kyoto Univ. (Japan), vol.61, no.1, p.1-11 (March 1983).
The radio frequency quadrupole (RFQ) structure for injection of low velocity ions into a linear accelerator was studied. The structure consisted of coupled split coaxial lines. A full scale model of the RF cavity was made and the resonant frequencies and the RF field distributions were measured. At the lowest resonance, the transverse electric quadrupole was observed along the central axis of the cavity. The resonant frequency, the Q value and the shunt impedance of the cavity was investigated. In conclusion, the coupled split coaxial RFQ structure was as usuable as the four-vane RFQ structure, and the fabrication of the former is easier than that of the latter. (9 refs.)

99746 The improvement of electron electrostatic accelerator focusing performance. Ma Xinsheng, Jin Jialan (Shanghai Inst. of Nuclear Res., Acad. Sinica, Shanghai, China).
Nucl. Tech. (China), no.2, p.45, 54 (April 1983). In Chinese.
The improvement made on the electrostatic accelerator to enhance its focusing performance with a single potential lens is described. Since the improvement, the beam size has become smaller. The test results are given. (6 refs.)

99747 The Argonne tandem-linac accelerator system. L.M.Bollinger (Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2065-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Design considerations and operational experience for the existing heavy-ion accelerator consisting of a tandem injecting into a superconducting linac are summarized, with emphasis on the general features of the system. This introduction provides the basis for a discussion of the objectives and design of ATLAS, a larger tandem-linac system being formed by expanding the existing superconducting linac. (8 refs.)

99748 Upgrading the Heidelberg MP-tandem postaccelerator combination. M.Grieser, R.Hammel, B.Huck, H.Ingwersen, E.Jaeschke, R.Repnow (Max-Planck-Inst. fur Kernphys., Heidelberg, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2095-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The Heidelberg Tandem Postaccelerator Combination is undergoing a stepwise upgrading program intended to further considerably extend its mass and energy range as well as to increase the available intensity of heavy ion beams. In a first step in 1982 a resonator module of four newly developed $\beta=0.12$ spiral-split-ring resonators had been added to the high energy end of the linear accelerator. These resonators deliver RF-voltages of 0.5 MV (CW) and 1.0 MV (d.f.=0.25) each, increasing the effective acceleration voltage of the booster to 22.5 MV. To improve the performance of the accelerator system for heaviest projectiles two extensions are under construction. A 3 MV negative ion injector based on a reconstructed single ended pelletron accelerator is nearing completion. It is designed to facilitate the injection of well isotope separated low emittance beams of the highest masses into the low acceptance acceleration tubes of the MP-Tandem, thus reducing beam loading and allowing for considerably higher intensities of beams like ^{197}Au, ^{208}Pb, and ^{238}U. Later on a module of four $\beta=0.04$-spiral-split-ring resonators will be installed in front of the linac to match the velocity of heavy ions like ^{238}U to the presently operating machine. (5 refs.)

99749 Deceleration of highly stripped ions by the Heidelberg RF-postaccelerator. M.Grieser, R.Hammel, B.Huck, H.Ingwersen, E.Jaeschke, B.Kolb, R.Repnow (Max-Planck-Inst. fur Kernphys., Heidelberg, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2099-101 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The Heidelberg MP-tandem has been used to produce highly stripped ions of $S^{14,15,16+}$, Ni^{20+} and Br^{23+} which subsequently were decelerated by the normal conducting RF-postaccelerator. The minimum energy obtained so far in the deceleration mode is 0.15 MeV/amu for S^{15+}. Although the beam transmission is decreasing with decreasing final energy because of a longitudinal and transverse emittance growth, decelerated beams have been routinely used for atomic physics experiments. (9 refs.)

99750 Emittance calculations for the Stanford Linear Collider injector. J.C.Sheppard, J.E.Clendenin, R.H.Helm, M.J.Lee, R.H.Miller (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA), C.A.Blocker.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2161-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A series of measurements have been performed to determine the emittance of the high intensity, single bunch beam that is to be injected into the Stanford Linear Collider. Online computer programs were used to control the linac for the purpose of data acquisition and to fit the data to a model in order to deduce the beam emittance. The paper describes the method of emittance calculation and presents some of the measurement results. (4 refs.)

99751 Water-cooled target box design at LAMPF. D.Grisham, J.Lambert (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2270-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The target boxes in the main experimental beam line (Line A) at the Clinton P. Anderson Meson Physics Facility (LAMPF) have operated since 1976. A program of replacing the boxes is underway. This paper will present past history, design considerations, calculational results and the final box design. (1 ref.)

99752 Status of the SLAC SNOOP Diagnostic Module for FASTBUS. H.V.Walz, D.B.Gustavson (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2276-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A SNOOP Diagnostic Module for FASTBUS is under development at SLAC. The SNOOP Module resides on a FASTBUS crate segment and provides diagnostic monitoring and testing capability. It consists of a high-speed ECL front-end to monitor and single-step segment operations, a simple master interface, and a control processor with two serial communication ports. Module features and specifications are summarized, and prototype hardware is shown. (8 refs.)

99753 Computer-automated Linac diagnostics and data acquisition. A.Yeremian, J.Adamski, D.Shoffstall (Boeing Aerospace Co., Seattle, WA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2279-80 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Computer interactive diagnostics have been developed and tested for measuring RF Linac electron beam position and emittance. Electron beam position is measured with ferrite-loaded stripline monitors. The measured signals are processed by an APPLE-II computer, displayed and updated (at the Linac repetition rate) on a monitor. Data to determine emittance is collected by measuring electron beam spot size (using the wire scanner technique) as the focal strength of a quadrupole triplet is adjusted around the focus at the scanner. The emittance is calculated by the APPLE-II making a hyperbolic curve fit to these data. (2 refs.)

99754 The use of a commercial data base management system in the LAMPF control system. S.K.Brown (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2302-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The control system for the accelerator at the Los Alamos Meson Physics Facility (LAMPF) is currently being upgraded to run on a DEC VAX 11/780. To unify the several disparate control hardware protocols into one consistent software protocol requires that the hardware devices be addressed logically rather than physically, the physical connections being supplied by the control system. To accomplish this, the control system must have some link between the devices' logical names and their physical connections. This link is supplied by a data base which is managed by a commercial data base management system. This paper discusses the reasoning behind the choice of a commercial system, the particular DBMS chosen and some of the pros and cons of using the DBMS as well as some of the author's experiences trying to join tools of the commercial world with the real-time world. (2 refs.)

99755 Data acquisition software for the LAMPF control system. S.C.Schaller, P.A.Rose (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2308-10 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
As part of the upgrade of the Los Alamos Meson Physics Facility (LAMPF) control computer, the software providing the interface between application programs and the accelerator hardware was redesigned. This new Data System design—which handles more than 12000 widely different devices—allows greater uniformity, flexibility, maintainability, and hardware independence than before. The Data System portion of the LAMPF Control System is described. (2 refs.)

99756 Automatic tuning of the LBL SuperHILAC third injector transport line. H.Pines (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2314-16 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Testing of a new automatic tuning procedure in an LBL SuperHILAC beam transport line has been conducted with the third injector microcomputer control system. The computer performs steering/focusing adjustments simultaneously on a number of quadrupole and dipole magnets comprising mul-

iple-station sections of the injection line. New magnet currents are computed from equations governing beam optics in a real-time simulation of the beam line. The key to this technique is the calculation of beam transverse emittance utilizing the same control magnets and beam profile monitors used for manual tuning of the line. This emittance calculation requires high resolution beam profile measurements using multiwire profile monitors recently installed in the third injector line. (2 refs.)

99757 Application of local area networks to accelerator control systems at the Stanford Linear Accelerator. J.D.Fox, E.Linstadt, R.Melen (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2317-19 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The history and current status of SLAC's synchronous data link control (SDLC) networks for distributed accelerator control systems are discussed. These local area networks have been used for instrumentation and control of the linear accelerator. Network topologies, protocols, physical links and logical interconnections are discussed for specific applications in distributed data acquisition and control systems, computer networks and accelerator operations. (6 refs.)

99758 On-line control models for the Stanford Linear Collider. J.C.Sheppard, R.H.Helm, M.J.Lee, M.D.Woodley (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2320-2 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Models for computer control of the SLAC three-kilometer linear accelerator and damping rings have been developed as part of the control system for the Stanford Linear Collider. Some of these models have been tested experimentally and implemented in the control program for routine linac operations. The authors describe the development and implementation of these models, as well as some of the operational results. (4 refs.)

99759 A new control system for the SLAC accelerator klystrons for SLC. R.K.Jobe (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2325-7 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A general overview of a new control system for SLAC klystrons is presented along with a detailed description of the remote controller for measurement and control of accelerator components. (3 refs.)

99760 An interactive alarm system for the CERN PS accelerator complex. J.Cuperus (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2337-9 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The new CPS controls system started operation in 1980 and is gradually being extended to control several accelerators and beam lines of the CPS complex. Part of the system and growing with it is a data-base driven alarm system. In each front-end computer, a program monitors the equipment, another the CAMAC interface and a third the beam currents. These programs send data to a central computer. In general-purpose consoles, a screen and touch-panel are dedicated to the alarm system. The alarms are displayed in various formats and levels of detail according to the wishes of the operator, who can also attempt automatic reset of individual faults or groups of related faults. Except for beam current monitoring, no details about the equipment are coded in the programs. The list of the equipment to be checked and information about it are stored in an off-line data base from which the necessary real-time files can be derived automatically. The result is a powerful and unified alarm system which can be easily maintained and updated. (2 refs.)

99761 Solution to the transverse phase space time dependence problem with LAMPF's high intensity H^+ beam. J.Hurd (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2487-8 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The 750 keV H^+ beam at LAMPF has a transverse phase space time dependent transient during the first 200 μs of each 750 μs long macro-pulse. The time dependence is documented in an earlier report (Hurd and Browman, 1981). Further studies indicate that the time dependence is due to space charge neutralization resulting from secondary emission of electrons produced by collisions of the H^+ and $H_2{}^+$ beams on the transport walls. One of several possible solutions has been tested and has proven successful in eliminating the time dependence of the beam entering the linac. (1 ref.)

99762 The present status of the Daresbury nuclear structure facility. R.G.P.Voss (Sci. & Engng. Res. Council, Daresbury Lab., Daresbury, Warrington, England).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2680-4 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The development of the Daresbury nuclear structure facility since 1973 is described, including the construction and voltage tests. The successful running of various ion beams for experiments is now underway. (12 refs.)

99763 A 35-MV tandem Van de Graaff—the Vivitron. M.Letournel (CRN, Strasbourg, France).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2713-15 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The Strasbourg project is a 35 MV Van de Graaff tandem whose design incorporates some new features and ideas. All the electrical characteristics are very conservative, especially for the accelerating tube which is a standard one, but the philosophy and some rules to build such an accelerator are new. (1 ref.)

99764 IBEX foilless diode experiments. R.B.Miller, M.G.Mazarakis, J.W.Poukey (Sandia Nat. Labs., Albuquerque, NM, USA), R.J.Adler.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2722-4 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A new high voltage isolated Blumlein accelerator (IBEX) has been designed and constructed. A new accelerator pulse-forming-line (PFL) configuration produces an output voltage pulse equal to the PFL charge voltage for a matched load (as in a conventional Blumlein circuit); however, the prepulse level is negligible and both sides of the diode remain at electrostatic ground potential. With a matched planar diode load, IBEX has generated a 4 MeV, 100 kA electron beam. In the present stage of experimentation, a foilless diode load is being used to produce 3-4 MeV, 20-30 kA annular electron beams with an applied magnetic field strength of ~10 kG. (7 refs.)

99765 PHERMEX electron gun development. L.A.Builta, J.C.Elliott, D.C.Moir, T.P.Starke, C.A.Vecere (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2728-30 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The PHERMEX facility is a 50-MHz standing wave linear accelerator. The authors describe the progress of PHERMEX electron gun development. The goal of this program is to generate and transport a 200-ns, 1-MV, 1-kA electron beam into the first PHERMEX accelerating cavity. The standard gun is operated at a pulse voltage of 550 kV, which is the limit determined by internal breakdown of the vacuum insulator. This insulator has been redesigned, and the gun has been pulsed at 750 kV without internal breakdown. The current output is not limited by voltage but by a phenomenon called pulse shortening, which occurs at a pulse voltage of approximately 650 kV. The phenomenon has been investigated and the results are presented. (5 refs.)

99766 Modelling of multiple electrode Van de Graaff generators with up-charge and down-charge processes. J.Takacs (Nuclear Phys. Lab., Univ. of Oxford, Oxford, England).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2749-53 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Van de Graaff generators with multiple electrodes came about as a result of the demand for ever increasing voltages in various fields of science. The transient behaviour of these generators is mostly determined by their internal electrode arrangements. In the analysis given here these effects are divided into two categories; the effect of the column electrode structure and that caused by the large intermediate shields. The modelling shown here takes into consideration both effects and shows the way of analysing these high voltage generators with up to n internal electrodes. The results show the striking difference in behaviour of these generators with up-charge and down-charge processes. The numerical example given was based on one of the existing Van de Graaff generators in Oxford. (9 refs.)

99767 Mechanical design of the high-energy beam-transport line for the FMIT 2-MeV accelerator. D.Lisk, L.Carlisle, F.Sigler, J.McCormick, D.Greenwood, R.Grieggs, J.Uher, G.Zimmerman (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2824-6 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The beam-transport line for the high-power 2-MeV Fusion Materials Irradiation Test (FMIT) accelerator is one of the most heavily instrumented ever designed. A wide variety of diagnostics is required to accurately determine the characteristics of the beam that will ultimately be used. Because the machine is only 2 MeV, the packing factor in the high-energy beam transport (HEBT) is high, especially since full-scale FMIT-grade components are used where possible. The HEBT's mechanical design aspects and its instrumentation are described. (2 refs.)

99768 An adiabatic matching device for the Orsay linear positron accelerator. R.Chehab, G.Le Meur, B.Mouton, M.Renard (Lab. de l'Accelerateur Lineaire, Univ. de Paris-Sud, Orsay, France).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2850-2 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
An adiabatically tapered solenoidal magnetic field is used to match positron beam source emittance to accelerating section acceptance. Such a matching system improves the accepted energy band which has been accurately computed and compared with analytical determination. The tapered field is provided by stacked pancakes and solenoids of various radii; total lens length is about 0.75 m. The adiabatic matching system took place of a quarter wave transformer system and has been in operation for two years. Positron conversion ratio is 3.3% for a 1 GeV incident electron beam and presents a factor of nearly 2.5; the output positron beam energy is of 1.2 GeV. (4 refs.)

99769 Characteristics and transport of a proton beam generated in a linear induction accelerator. I.S.Roth, J.A.Nation (Lab. of Plasma Studies & School of Electrical Engng., Cornell Univ., Ithaca, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2853-5 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A seven Ohm Blumlein has been used to generate a proton beam in an induction linac using a single magnetically insulated accelerating gap. The proton beam generated has an energy of up to 1.3 MeV at 4.0 kA and a pulse duration of 50 nsec. The authors report measurements of the beam characteristics and beam transport. Lack of complete neutralization was apparent and a modified system which relies on collective focusing of the ion beam by an electron cloud in an axial magnetic field has been developed. First results obtained using the collective focusing show evidence of improved transport over, at least, short distances. Further measurements are needed to confirm the adequacy of the present system for transport over the scale lengths needed for a multi-gap accelerator. (12 refs.)

99770 Discrete precision beam switching in linear induction accelerators through harmonics control. K.Denno (New Jersey Inst. of Technol., Newark, NJ, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2915-17 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Continued development in inertial fusion reactor research identifies the potential of providing beam of heavy ions associated with long pulse duration, low level of kinetic energy and multi-kiloamperes current. The author presents a continuation of work for the ultimate goal of precision design in the spark gap switching mechanism for the linear induction accelerators including the core type as well as the line type. The pulse switching involves the utilization of the saturable-resistor with hard ferromagnetic material core, where sudden changes in its ohmic value can provide precise automatic switching synchronized with that of the charging beam. Calculations centered on establishing remarkable switching sequence spectrum with respect to the fundamental frequency as well as for a discrete sequence of harmonics contained in the saturable-resistor exciting current. Discrete time switchings are characterized in the form of discrete pulses with continuous ascending sharp increase in amplitude and controlled reduction in time duration. (7 refs.)

99771 Industrial and medical applications of accelerators with energies less than 20 MeV. J.L.Duggan (North Texas State Univ., Denton, TX, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3039-43 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The medical and industrial application of small accelerators is reviewed. The areas covered will include medical linacs, cyclotron design and production of medical radioisotopes, radiation processing, ion implantation for the metallur-

gical and semiconductor industries, oil and mineral exploration, trace, surface and bulk analysis and unique accelerators for all of the above applications. (34 refs.)

99772 Multistage pulsed-power electron accelerators. K.R.Prestwich, D.E.Hasti, R.B.Miller, A.W.Sharpe (Pulsed Power Appl. Dept., Sandia Nat. Labs., Albuquerque, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3155-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Pulse power developments in high-current linear accelerators (RADLAC I) and low impedance water transmission lines (PBFA I) are reviewed. The design of Hermes III, a 1.1 MA, 15 MV linear accelerator based on these technologies is discussed and initial data on the development of this accelerator is presented. (14 refs.)

99773 Simulation of preaccelerated particles in the plasma beatwave accelerator. D.J.Sullivan (Mission Res. Corp., Albuquerque, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3159-61 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
One-dimensional relativistic and electromagnetic simulations show the Plasma Beatwave Accelerator to be a viable approach to obtaining large accelerating fields. The plasma wave excited by Raman Forward Scattering has a longitudinal electric field on the order of 100 MeV/cm to 10 GeV/cm based on plasma densities of 10^{16} cm^{-3} to 10^{20} cm^{-3}. The use of optical mixing to grow a plasma wave of the proper frequency above the noise level greatly reduces the laser intensity needed to drive the Raman instability. TeV energies for plasma electrons or preaccelerated charged particles in short distances appear feasible. Results where an injected electron beam is accelerated coherently from 1 MeV to 20 MeV in one millimeter are presented. Two- and three-dimensional effects must still be resolved. (11 refs.)

99774 The radio-frequency coaxial linear accelerator for high-current hollow beams. P.Krejcik (KFI Julich GmbH, Julich, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3168-70 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A structure with modulated coaxial electrodes accelerates a hollow beam and is able to provide strong focusing over the annular aperture of the beam, making it suitable for high beam currents. The theory for this transport system is presented and experimental investigations described. (6 refs.)

99775 Collective electron driven linac for high energy physics. J.T.Seeman (Lab. of Nuclear Studies, Cornell Univ., Ithaca, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3180-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A linac design is presented in which an intense ultrarelativistic electron bunch is used to excite fields in a series of cavities and accelerate charged particles. The intense electron bunch is generated in a simple storage ring to have the required transverse and longitudinal dimensions. The bunch is then transferred to the linac. The linac structure can be inexpensively constructed of spacers and washers. The fields in the cells resulting from the bunch passage are calculated using the program BCI. The results show that certain particles within the driving bunch and also trailing particles of any sign charge can be accelerated. With existing electron storage rings, accelerating gradients greater than 16 MV/m are possible. Examples of two accelerators are given: (1) A 30 GeV electron/positron accelerator useful as an injector for a high energy storage ring and (2) a 110 GeV per beam electron-positron collider. (10 refs.)

99776 Self-trapping electron ring accelerators. G.Gisler, R.Faehl (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3204-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Simulations performed with a fluid MHD extension to the PIC plasma code CCUBE show that it is in principle possible to design liner-driven ring accelerators so that they generate their own trapping well. The liner elements are tapered in mass and respond in a predictable way to the driving acceleration. Currents arise as the liner moves through an imposed axial field, and if the liner shape is appropriate, a magnetic trapping well results. A cusp-injected electron ring is then introduced, trapped, and accelerated to high energies. (no refs.)

99777 Laser beat-wave accelerator for ultra-high energies. TG.Tajima (Dept. of Phys., Univ. of Texas, Austin, TX, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3209-11 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Parallel intense laser beams ω_0,k_0 and ω_1,k_1 shone on a plasma with frequency separation equal to the electron plasma frequency ω_{pe} capable of creating a coherent large longitudinal electric field $E_L=\gamma_\perp^{1/2}$ mc ω_{pe}/e of the order of 1-10 GeV/cm for plasma density 10^{18-20} cm^{-3} through the forward Raman scattering. A concept of applying this process to an ultra-high energy (100-1000 TeV range) accelerator is considered. Associated physics questions such as the laser beam propagation, self-trapping, filamentation, and longitudinal dephasing , etc., are discussed. As a method to overcome the longitudinal dephasing, the relativistic forward Brillouin scattering process is proposed, where the frequency separation of two lasers is now ω_{pi} with ω_{pi} being the ion plasma frequency. (7 refs.)

99778 A transverse-field-focusing (TFF) accelerator for intense ribbon beams. O.A.Anderson, D.A.Goldberg, W.S.Cooper, L.Soroka (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3215-17 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
In a TFF accelerator, a transverse electric field is set up between pairs of curved deflecting plates. Charged particles passing between the plates are both deflected and strongly focused by the field. Average-straight-line motion is obtainable by having the successive pairs of plates curve in alternating directions (with corresponding reversal of the field). Acceleration is achieved by adjusting the mean voltage on each succeeding pair of plates. Computer simulations are in good agreement with the analytically calculated beam dynamics; they show no evidence of beam instabilities and almost no emittance growth. A design for a 400 keV, 8 A/meter, single-ribbon DC accelerator is presented. (10 refs.)

99779 SORE—a pulse stretcher for the Saskatchewan 300-MeV linac. J.C.Bergstrom, H.S.Caplan, R.V.Servranckx (Accelerator Lab., Univ. of Saskatchewan, Saskatoon, Saskatchewan, Canada), B.E.Norum.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3226-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A design study has been made of a pulse stretcher to increase the duty factor of the 300 MeV electron accelerator of the Saskatchewan Accelerator Laboratory. The design was constrained by the desire to house the pulse stretcher within the existing accelerator building and to make maximal use of existing beam transport lines. Only minor alterations will be required to the accelerator vault architecture and a minimal length of additional beam transport lines will be required. The parameters of the extracted beam will be good. Preliminary calculations indicate that a transverse emittance of 0.3 π mm-mr should be attainable in the horizontal plane. The vertical emittance of the extracted beam will be determined primarily by that of the injected beam since both injection and extraction occur in the horizontal plane. The energy spread of the beam will be of the order of 0.1% when the monochromatic extraction technique is employed. (4 refs.)

99780 A plasma wave accelerator—Surfatron. I. T.Katsouleas, J.M.Dawson (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3241-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The limitation on the total energy gain possible with recent plasma accelerator schemes such as the beam-wave accelerator of Tajima and Dawson (1979) is overcome by the Surfatron. By introducing a perpendicular magnetic field it is possible to keep particles in phase with the laser-induced plasma waves and hence accelerate them to arbitrarily high energy. (6 refs.)

99781 A plasma wave accelerator—Surfatron. II. W.Mori, C.Joshi, J.M.Dawson (Dept. of Electrical Engng., Univ. of California, Los Angeles, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3244-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
For pt.I see ibid., vol.NS30, p.3241 (1983). With the advent of high power lasers it has become possible to generate fast large-amplitude electrostatic waves in a plasma. These waves have been the basis for several accelerator schemes. Inherent in all these schemes is the limitation that the particles eventually outrun the wave. Therefore, although the plasma wave has an enormous electric field, the particles only interact with the field for a limited length of time. Straightforward calculations show that in either the wake plasmon or the beat wave accelerator schemes the maximum obtainable energy is $2(\omega/\omega_p)^2mc^2$ and that this energy is obtained in a time which is roughly $2(\omega/\omega_p)^2 1/\omega_p$. Here ω represents the incoming laser frequency and ω_p represents the plasma frequency. Theory and computer simulations are presented which demonstrate that, when a magnetic field is inserted perpendicular to the direction of wave propagation, the particles remain in phase with the wave. (4 refs.)

99782 Accelerator development at Bates. C.P.Sargent (MIT Bates Linear Accelerator, Middleton, MA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3262-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The past year has seen the completion of a major expansion of the Bates Accelerator Laboratory. A second experimental hall (the South Hall) and several magnetic spectrometers have been constructed. These now allow extension of the experimental program beyond the area of high-resolution electron scattering which has been the main activity to date. The accelerator's maximum energy has been increased from 400 MeV to 750 MeV by means of beam recirculation. A current two-year project for the fabrication of an additional RF transmitter plus a 30% increase in RF peak power capability will increase energy further to approximately 1 GeV. During the same period pulse-to-pulse beam sharing between high-resolution spectrometer area and South Hall will become available. As part of an experiment on parity violation in elastic electron scattering, a Yale University-CUNY group has constructed a polarized electron source which will be installed during 1983. (4 refs.)

99783 Microwave matching and tuning on the 20-MeV medical electron linac with feedback of RF power. Wang Yuan-ling (Dept. of Phys., Univ. of Nanjing, Nanjing, China).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3463-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
In a linac with feedback (or with the resonator) the reflection affects the energy gain of the electron and the performance of the accelerator. By means of the theory of the traveling wave resonator, the field multiplication factor and the reflection coefficients inside and outside the feedback ring are calculated. The bands of the linacs without and with feedback are measured. In order to achieve a desirable band, in front of the load (i.e. outside the feedback ring) a matching iris is added. After the linac with feedback has been matched the band is given. (4 refs.)

99784 CW side-coupled linac for the Los Alamos/NBS racetrack microtron. L.M.Young, J.M.Potter (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3508-10 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A 2.7-m side-coupled linac has been built as part of the 5-MeV injector for the CW room-temperature racetrack microtron (RTM) being constructed in collaboration with the National Bureau of Standards (NBS). The linac is designed to accelerate the electron beam from 1 to 5 MeV with an accelerating gradient of 1.5 MeV/m. Fabrication of the structure started October 4, 1982 and was completed February 28, 1983, when it was tested with a CW power level of 82 kW. The structure has an effective shunt impedance (ZT^2) of 82.5 MΩ/m. No change in field distribution was detected at any power level. The operating frequency is 2380 MHz. (4 refs.)

99785 High power integral RF linac cavities. D.Mitrovich, F.Felber, P.Wilson, R.Cooper (Western Res. Corp., San Diego, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3518-20 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Accelerating a long train of high current pulses requires a very large power flow from cavity to beam. Several advantages exist when this large RF power is supplied to the accelerating cavities at the same high rate at which the beam is extracting it. A particular approach to accomplishing this, the wake field transformer concept of Voss and Weiland, as applied to the parameter regime of interest is examined. Several high current, low energy (few MeV) beams injected off-axis into the cavity are decelerated by their own and

receding fields. The resulting RF energy in the proper mode accelerates a lower current, high energy beam on-axis. Mode generation by an idealized annular beam is calculated as a function of driving current pulse width, cavity length, and radius of the annulus. Optimal pulse width is about half the wavelength of the TM_{010} accelerating mode, and the efficiency maximized for annulus radius equal to about two-thirds the cavity radius. Analysis of the beam dynamics shows that an axial magnetic field of the order of 1 kG is adequate to guide the annular power beam. (7 refs.)

99786 RFQ linac structure developments at CRNL. R.M.Hutcheon, L.D.Hansborough, K.J.Hohban, S.O.Schriber (Chalk River Nuclear Labs., AECL, Chalk River, Ontario, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3521-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Modeling studies of RFQs for a 300 mA CW proton accelerator are continuing at CRNL. Initially, low power models of the four-vane structure with standard end terminations were extensively investigated. Later, results of simple RF dipole experiments led to studies of two new RFQ termination schemes, the double dipole (in which too opposing vanes were shorted at both ends) and the folded dipole (in which one set of opposing vanes was shorted at one end, and other vane set shorted at the other end). Various end tuner configurations were also tested, including radial end tuners and Bourdon tube mechanisms for remote positioning. Finally, a versatile low power RFQ model has been built to study RF properties with reproducible vane geometry. (4 refs.)

99787 The fermilab RFQ project. D.Neuffer, C.D.Curtis, F.R.Huson, Q.A.Kerns, A.Martinez, C.W.Owen, C.W.Schmidt, E.Treadwell, G.J.Villa (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3527-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A 200 MHz Radio Frequency Quadrupole (RFQ) Linac is being designed and constructed for the acceleration of H^- ions from 30 keV to 750 keV at a current of 30 mA. The RFQ is being developed as a possible placement for the Fermilab preaccelerator and as R and D project to investigate RFQ properties for future accelerators. The current status of the project is described. (7 refs.)

99788 A spiral-resonator radio-frequency quadrupole accelerator structure. R.H.Stokes, J.M.Potter, F.J.Humphry, P.L.Roybal (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3530-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A radio-frequency quadrupole (RFQ) structure operating at low frequency has been developed for possible use in accelerators for heavy ion fusion or Tokamak plasma heating. The structure uses a series of shunt spiral inductors placed periodically along the electrodes of an electric quadrupole to achieve resonance at the desired frequency. A 1.2-m-long model has been constructed for low-power testing. The model resonates near 12 MHz and has radial dimensions that are reduced by a factor of 15 compared to the commonly used four-vane resonator. (2 refs.)

99789 Beam dynamics and wave geometry in the LBL heavy ion RFQ. J.Staples (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3533-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The LBL Heavy ion RFQ accelerator, presently undergoing acceptance tests, extends the application of the RFQ principle to charge-to-mass ratios considerably less than one. In this design the aperture is very small compared to the operating wavelength, causing a large capacitive loading of the structure and also in a high sensitivity of the field configuration of the structure to vane alignment. A structure has been derived that eases the vane alignment procedure and reduces the sensitivity to vane misalignment. The selection of the vane cross section facilitates machining and eventual frequency trimming. (8 refs.)

99790 Status of the Frankfurt zero-mode proton RFQ. A.Schempp, P.Junior, H.Klein, M.Daehne, M.Ferch, K.Langbein, N.Zoubek (Inst. fur Angewandte Phys., Univ. Frankfurt/Main, Frankfurt/Main, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3536-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The O-mode RFQ consists of 4 trapezoidally modulated electrodes, manufactured on a lathe and periodically supported by radial stems. This resonator is excited in π-O-mode forming an RFQ field, which is highly stable against tolerances and dipole-modes. A compact proton accelerator (10-300 keV, 108 MHz) with high duty cycle has been built and RF properties and first beam measurements are presented. New sparking experiments and results of high power tests with a 18 MHz spiral-RFQ are discussed. (14 refs.)

99791 Integral radial stems on aluminium $\beta=1$ disk-and-washer structures. S.O.Schriber (Chalk River Nuclear Labs., AECL, Chalk River, Ontario, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3539-41 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Aluminum test cavities were manufactured with integral radial stems to support the washers of a $\beta=1$ 2500 MHz disk-and-washer structure. Difficulties in making stem joints were therefore eliminated. From one to four integral stems were studied. Measurements showed that four stem supports was best and that two stems mounted at 180° to each other created RF problems. The frequencies of higher order mode passbands can be shifted to result in a structure with good RF efficiency, coupling and quality factor for the $\pi/2$ operating mode. (11 refs.)

99792 Disk-and-washer linac structure with biperiodic T supports. Y.Iwashita (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3542-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The disk-and-washer (DAW) linac structure with particular biperiodic washer-support geometries promises to be an excellent structure for $B>0.5$ accelerator applications. Outstanding features of this structure include high efficiency, high stability, good vacuum properties, and ease of fabrication. (5 refs.)

99793 Additions and improvements to the RF cavity code SUPERFISH. S.O.Schriber, R.F.Holsinger (Chalk River Nuclear Labs., AECL, Chalk River, Ontario, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3545-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
SUPERFISH is a computer code that is used extensively to determine RF properties or RF strucures. The authors describe a new post processor for SUPERFISH that determines temperature distributions in the metal enabling high average power RF characteristics for various cooling configurations to be examined. Different materials can be incorporated for different parts of the cavity geometry. Sample results for geometries including drift tube linacs and coupled cavity linacs are presented. Other improvements to the code give electric fields at all vacuum mesh points, normalized RFQ geometry parameters, and transit time factors (T_0, T_1, T_2, S', $\tilde{S}$, $\bar{S}$, S_0 and S_0) associated with off-axis electric fields for MAPRO beam dynamics codes. (7 refs.)

99794 A highly efficient interdigital-H-type resonator for molecular ions. T.Weis, H.Klein, A.Schempp (Inst. fur Angewandte Phys., Univ. Frankfurt/Main, Frankfurt/Main, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3548-50 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
For accelerating molecule ions with low charge to mass ratio highly efficient resonators are needed to keep the accelerator length short and to decrease power consumption. Therefore the authors used a modified interdigital-H-type structure (TE_{111} excitation) to build a high power prototype for CO^+ molecules. They measured a surprisingly high bare shuntimpedance of 700 MΩ/m at 108.5 MHz. By using a proper design of drifttubes and stabilizing rods to fix the support stems, they obtained a nearly constant axial field distribution. The resonator will be used for postacceleration of CO^+ molecules—which are preaccelerated to 153 keV/N by a CN Van de Graaff—up to 224 keV/N requiring less than 15 kW RF power, corresponding to a total cavity voltage of 3 MV and a resonator length of about 1 m. (14 refs.)

99795 Voltage breakdown in S-band linear accelerator cavities. E.Tanabe (Radiation Div., Varian Associates Inc., Palo Alto, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3551-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Voltage breakdown is one of the major limiting factors in the design of a high accelerating gradient linear accelerator structure. A multiple-use cavity test system was developed to establish the criteria for voltage breakdown in S-band pulsed electron linear accelerator cavities, in terms of cavity geometry, accelerating gradient, RF pulse shape and repetition rate, surface finish, temperature and external magnetic field. The experimental set-up and test procedure, as well as the experimental results, are presented. (3 refs.)

99796 Radio-frequency quadrupole vane-tip geometries. K.R.Crandall, R.S.Mills, T.P.Wangler (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3554-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Radio-frequency quadrupole (RFQ) linacs are becoming widely accepted in the accelerator community. They have the remarkable capability of simultaneously bunching low-energy ion beams and accelerating them to energies at which conventional accelerators can be used, accomplishing this with high-transmission efficiencies and low-emittance growths. The electric fields, used for radial focusing, bunching, and accelerating, are determined by the geometry of the vane tips. The authors review the vane-tip geometry based on the 'ideal' two-term potential function and briefly describe a method for calculating the electric field components in an RFQ cell with arbitrary vane-tip geometry. They describe five basic geometries and use the prototype RFQ design for the Fusion Materials Irradiation Test (FMIT) accelerator as an example to compare the characteristics of the various geometries. (5 refs.)

99797 100% duty factor RFQ linac systems at CRNL. R.M.Hutcheon, J.C.Brown, L.D.Hansborough, S.O.Schriber, R.B.Turner (Chalk River Nuclear Labs., AECL, Chalk River, Ontario, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3557-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
An RFQ linac operating at 100% duty factor (CW) and high currents is required for an accelerator breeder. Two high power structures are being built as part of the RFQ development program. First, a copper 270 MHz sparker cavity with RFQ geometry is being tested to determine CW field breakdown levels and conditioning characteristics. The design and status of the 'sparker' are presented. Secondly, a 270 MHz CW RFQ linac (RFQ1) is being designed to accelerate a nominal 75 mA from 50 to 600 keV, to study beam quality and stability as well as resonator field tuning and leveling requirements under conditions of high beam loss at high average power. The combination of CW operation and restricted space at the entrance require new approaches in end terminations and tuners. The status of RFQ1 is presented and design innovations outlined. (7 refs.)

99798 Design of RFQ vane tip to minimize sparking problems. B.G.Chidley, G.E.McMicheal, G.E.Lee-Whiting (Chalk River Nuclear Labs., Chalk River, Ontario, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3560-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Transverse and longitudinal focusing in radio-frequency quadrupole (RFQ) accelerators depends on V/R_0 (the vane voltage divided by the mean radial aperture). For maximum current carrying capacity, one generally designs for maximum V/R_0, which is limited by the peak surface electric field E_S $(=\kappa(V/R_0))$ that can be sustained without sparking. The value of the enhancement factor κ depends on the pole geometry and can be minimized by choosing an appropriate pole shape. A computer program POTRFQ will be described which derives the field potential $\phi(r,\theta,z)$ and the vane tip contour, for a range of input parameters. The effects on the beam dynamics of the higher multipole components resulting from the modified pole shapes will also be presented. (2 refs.)

99799 Study of peak power doublers with spherical resonators. A.Fiebig, R.Hohbach (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3563-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Based on the work done at SLAC by Z.D. Farkas et al. (1974) SLED, it was investigated whether a similar arrangement can be used for the LEP Injector Linac (LIL) in order to save high power klystrons by feeding, for a part of the accelerator, twice the number of accelerating sections from one klystron (LIPS=LEP Injector Power Saver). It seemed interesting to make use of the high quality factor of spherical resonators ($2...2.5\times10^5$) as compared to 10^5 of the cylindrical resonators used for SLED. The advantages (high Q) and

disadvantages of spherical resonators (high number of competing resonant modes, problems of orientation, coupling) are discussed. Results of measurements with low power (c.w. and pulses) on single resonators and a complete model, and with high power on a prototype are presented. (4 refs.)

99800 The launching of a 3-MeV proton RFQ linac. I.M.Kapchinskij, V.A.Andreev, V.S.Artemov, V.I.Bobylev, I.V.Chuvilo, E.N.Daniltsev, V.I.Edemskij, L.V.Kartsev, A.M.Kozodaev, A.A.Kolomiets, V.S.Kosiak, R.P.Kuibida, V.V.Kushin, N.V.Lazarev, Ju.B.Stasevitch, S.B.Ugarov, R.M.Vengrov (Inst. for Theoretical & Experimental Phys., Moscow, USSR).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3579-81 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A 3 MeV RFQ linac has been constructed in the ITEP. Values of the linac design parameters attained in practice as well as some preliminary experimental results obtained at the machine launching with output current rising up to 100 mA are reported. (22 refs.)

99801 Operating characteristics of a 2.0-MeV RFQ. F.O.Purser, E.A.Wadlinger, O.R.Sander, J.M.Potter, K.R.Crandall (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3582-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A second radio-frequency quadrupole (RFQ) accelerator has been designed, constructed and operated at Los Alamos National Laboratory. The accelerator's design parameters represent a major extension from the original Los Alamos RFQ, with the new accelerator being 2.5 times as long, having three times the output energy, and with 2.5 times the current limit. The new accelerator's operating characteristics were studied for 3 months before disassembly to incorporate design modifications. Results are discussed. (6 refs.)

99802 Mechanical features of the ATS RFQ linear accelerator. N.G.Wilson, T.D.Hayward, G.W.Lind (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3585-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A radio-frequency quadrupole (RFQ) linear accelerator has been constructed and placed in operation on the accelerator test stand (ATS). This accelerator uses an evacuated RF manifold to distribute RF excitation from the 425-MHz RF power supply to the slot-coupled, RFQ vane-cavity, resonator assembly. Measurements made on the accelerator as assembled have demonstrated >8000 vane-cavity Q at the quadrupole's ~423.400-MHz accelerating-mode frequency. Operating manifold vacuum of 3-6×10^{-8} torr has been observed after RF conditioning; conditioning required 150 h for stable high-power RF operation. Experience to date has indicated the desirability of modifying the vane RF-contact seat configuration to improve assembly and alignment procedures, improving vane-machining processes to increase vane straightness, installing periodic vane-shorting rings to minimize the effect of dipole modes in the quadrupole accelerating structure, and modifying the waveguide-coupling slot in the manifold to improve forward RF power flow. (2 refs.)

99803 Higher modes in the coupling cells of coaxial and annular-ring coupled linac structures. R.A.Hoffswell, R.M.Laszewski (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3588-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Dipole- and quadrupole-like modes in the coupling cells of coaxial and annular-ring coupled structures have been examined up to a frequency of 4 GHz. The quadrupole mode frequencies appear to lie high enough above the frequency of the accelerating mode to make coupling between the two unlikely. In the annular-ring case, however, a dipole mode was found very near the accelerating mode frequency. Evidence is presented which suggests that some power may couple between these two modes in a real cavity. (4 refs.)

99804 Heat transfer, thermal stress analysis and the dynamic behaviour of high power RF structures. J.McKeown, J.-P.Labrie (Chalk River Nuclear Labs., AECL, Chalk River, Ontario, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3593-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A general purpose finite element computer code called MARC is used to calculate the temperature distribution and dimensional changes in linear accelerator RF structures. Both steady state and transient behaviour are examined with the computer model. Combining results from MARC with the cavity evaluation computer code SUPERFISH, the static and dynamic behaviour of a structure under power is investigated. Structure cooling is studied to minimize loss in shunt impedance and frequency shifts during high power operation. Results are compared with an experimental test carried out on a CW 805 MHz on-axis coupled structure at an energy gradient of 1.8 MeV/m. The model has also been used to compare the performance of on-axis and coaxial structures and has guided the mechanical design of structures suitable for average gradients in excess of 2.0 MeV/m at 2.45 GHz. (11 refs.)

99805 The 500-MeV, $2^1/_2$% duty factor linear electron accelerator (MEA). P.J.T.Bruinsma, F.B.Kroes, L.H.Kuijer, J.G.Noomen, J.B.Spelt, A.G.C.Vogel (Nat. Inst. for Nuclear & High-Energy Phys., Amsterdam, Netherlands).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3599-601 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Although the intermediate energy electron accelerator in Amsterdam has not reached completely its design specifications, since early 1981 a fully grown scientific program has developed using beams with an energy ranging from 20 to 120 meV in the 140 MeV substation and from 70 to 400 MeV in the high energy stations for electron scattering and physics with pion and muon beams. A brief description of the MIT-type accelerator and its performance is given with emphasis on typical features of the machine. Some examples are given of recently obtained scientific data from which it can be derived that the quality of the beam is in full accordance with the high performance level of the scientific equipment, involving a complex beam transport system and a pair of spectrometers for high resolution (1×10^{-4}) work. (6 refs.)

99806 Assembly and installation of the 2-MeV FMIT accelerator. D.Liska, R.Michelotti (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3620-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The front end of the 35-MeV Fusion Materials Irradiation Test (FMIT) Facility accelerator is being assembled and installed at Los Alamos. The machine ultimately will produce a 500-kW continuous duty beam at 5 MeV, although only the first 2-MeV will be installed this year. The 2-MeV system will include the most powerful radio frequency quadrupole (RFQ) in existence. The assembly and installation of the hardware are described, along with the unique problems arising from the large size and high power of the components involved. (no refs.)

99807 Long-pulse induction acceleration of heavy ions. A.Faltens, M.Firth, D.Keefe, S.S.Rosenblum (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3669-71 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A long-pulse induction acceleration unit has been installed in the high-current Cs^+ beam line at LBL and has accelerated heavy ions. A maximum energy gain of 250 keV for 1.5 μS is possible. The unit comprises 12 independent modules which may be used to synthesize a variety of waveforms by varying the triggering times of the low voltage trigger generators. (6 refs.)

99808 A high-energy, laser accelerator for electrons using the inverse Cherenkov effect. J.R.Fontana (Electrical & Computer Engng. Dept., Univ. of California, Santa Barbara, CA, USA), R.H.Pantell.
J. Appl. Phys. (USA), vol.54, no.8, p.4285-8 (Aug. 1983).
A laser method for accelerating electrons is described, based on the inverse Cherenkov effect in a gas. The laser fields are in the form of a cylindrical cone of plane waves on whose axis travel the electrons, with the cone angle and the gas refraction index such that each electron sees constant fields in time. Expressions are obtained relating the overall energy transfer to total laser power and wavelength, and to gas index and interaction length. With laser powers now available, energy increments of tens of GeV are possible. For comparative purposes, a related alternative scheme involving electrons in vacuum and evanescent fields is also analyzed. It is found that the method applies particularly well to adding energy to the electron bunches produced by large microwave accelerators, as collision effects are less troublesome at high injection energies. (14 refs.)

99809 Design, fabrication and performance of the dipole and quadrupole magnets for the RIKEN heavy-ion linear accelerator. M.Hemmi, Y.Miyazawa, T.Inoue, M.Odera.
Rep. Inst. Phys. & Chem. Res. (Japan), vol.59, no.3, p.79-111 (1983). In Japanese.
The RIKEN heavy-ion linear accelerator (RILAC) consists of a 500 kV injector and six Wideroe type high frequency accelerating structures. It can accelerate wide range of heavy-ions having different mass to charge ratios by use of variable frequency scheme. In order to focus and guide those heavy-ions, the magnet system must satisfy several requirements. The maximum magnetic rigidity of the ions is 500 kG.cm in the beam line between the injector and the first resonator and 3000 kG.cm after acceleration by the six cavities. The authors give descriptions of the design, technology of fabrication and specifications of the dipoles and quadrupoles of the magnet system with many relevant figures and drawings. (4 refs.)

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9.20 CYCLIC ACCELERATORS AND STORAGE ACILITIES

or plasma accelerators, see 52.75)

9810 The CERN PS complex as an antiproton source.
EE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2039-41 (Aug. 1983). 983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
ur years after the start of the pp̄ project, the PS-complex has become an fective p̄ source. The process of p̄ accumulation and transfer is recalled and e 'modes' in which the machines operate are described. The performance hieved has permitted extended physics runs in which considerable operanal experience has been gained. (10 refs.)

9811 Antiprotons in the ISR. P.J.Bryant (LEP Div., CERN, Geneva, vitzerland).
EE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2047-9 (Aug. 1983). 983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
brief account is given of the events leading up to antiprotons in the Intercting Storage Rings (ISR) followed by a synopsis of the characteristics and rameters of the physics runs made to date. Experience gained with critical erations, such as transfer line steering, injection optimization, stacking and ase displacement acceleration is reviewed. Special reference is made to the rious machine improvements, namely the vertical transverse stochastic coolg for proton beams of up to 12 A, the transverse and longitudinal stochastic oling for the antiprotons, the new antiproton beam position monitoring stem in the transfer lines and ring and the use of two high-luminosity sertions. (16 refs.)

9812 Research efforts on increase of IHEP proton synchrotron intensity. u.M.Ado, E.A.Myae, A.A.Naumov, V.A.Teplyakov, E.F.Troyanov.
EE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2053-5 (Aug. 1983). 983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
e intensity of 5.6×10^{12} ppp attained at the IHEP accelerator with proton jection energy of 100 MeV is close to the incoherent Coulomb limit. The nstruction of a new 1.5 GeV injection system (fast cycling booster) to crease the accelerated beam intensity is near completion. A number of the ain ring systems have been modified with the goal to get ready for the oster operation. (9 refs.)

99813 The IUCF cooler—a storage ring with electron cooling for internal target experiments. R.E.Pollock (Dept. of Phys., Indiana Univ., Bloomington, IN, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2056-60 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A project to construct a ring to store beams of light ions with magnetic rigidities up to 3.6 T-m is under way at the Indiana University Cyclotron Facility. Beams from the cyclotron will fill the ring, be adjusted in energy, then cooled by electron immersion while impinging on thin targets within the ring for nuclear interaction experiments. The motivation is to explore the potential for improved resolution and reduced background of the cold storage technique. The status of the project and of selected subsystem designs is presented. (11 refs.)

99814 Initial operation of the MSU superconducting cyclotron. M.L.Mallory (Cyclotron Lab., Michigan State Univ., East Lansing, MI, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2061-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
On August 31, 1982, the first beam was extracted from the Michigan State University superconducting K500 cyclotron. Shortly thereafter the first experiment was performed with a 35 MeV/n carbon beam. The known operating characteristics of the K500 cyclotron are reported. Some of the technological innovations of the machine are described. Progress on the next phase of the project, the K800, is discussed. (8 refs.)

99815 A 100-MeV injector race-track microtron for the MAX storage-ring/pulse-stretcher. M.Eriksson (Max-Lab, Univ. of Lund, Lund, Sweden).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2070-1 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A 100 MeV pulsed race-track microtron (RTM) has been in operation at the University of Lund since 1979. The RTM will now be used as an injector for a storage-ring/pulse-stretcher currently being built. The RTM with its injection, acceleration and extraction systems are described and the beam characteristics are discussed. (6 refs.)

99816 A low cost heavy ion accelerator for 10 to 40 MeV/a. M.Lieuvin (Inst. des Sci. Nucleaires, Grenoble, France).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2072-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
SARA 'Systeme Accelerateur Rhone-Alpes' is a two stage accelerator now running at the Grenoble Institut des Sciences Nucleaires (ISN). It is a heavy ion accelerator giving beams from Li to Ar at a maximum energy of 40 MeV/amu. (4 refs.)

99817 Coupled operation experience at the Holifield heavy ion research facility. R.S.Lord, J.B.Ball, E.D.Hudson, P.K.Kloeppel, C.A.Ludemann, J.A.Martin, S.W.Mosko, N.F.Ziegler (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2077-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The 25 URC Pelletron tandem/electrostatic accelerator and the Oak Ridge Isochronous Cyclotron (ORIC) comprise the accelerators of the Holifield Heavy Ion Research Facility (HHIRF). The two machines may be operated individually or coupled, with ORIC serving as an energy booster for the tandem. In the coupled mode, the ion beam enters the cyclotron through the dee stem and is directed by the inflection magnet so that it is tangent to an orbit suitable for acceleration at a higher charge state. A thin carbon foil, placed at the point of tangency, strips the ions so that a substantial fraction are in the desired higher charge state. This fraction of the beam is then accelerated and extracted in the normal fashion. Full energy performance (25 MeV/A oxygen) was demonstrated during first coupled-operation in January 1981. Routine coupled operation for experiments commenced in July 1982. (8 refs.)

99818 Beam stacking experiments at TARN. T.Katayama, K.Chida, T.Hattori, S.Kadota, A.Mizobuchi, T.Murakami, T.Nakanishi, A.Noda, M.Takanaka, N.Tokuda, S.Yamada, Y.Yonehara, M.Yoshizawa, S.Watanabe, Y.Hirao (Inst. for Nuclear Study, Univ. of Tokyo, Tokyo, Japan).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2080-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
TARN is a low energy ion storage ring aimed at the beam accumulation both in the longitudinal and transverse phase spaces from the injector cyclotron. Up to now, proton, H_2^+, α and $^3He^+$ beams have been stored and the close agreements are shown between the theoretical and experimental results on the beam dynamics. Twenty turn beam are injected in the betatron phase space area of 87 πmm.mrad by the multiturn injection method and 15 pulses are RF stacked in the momentum space $\Delta p/p$ of 2.2%. Overall stacking number is then attained at around 300 turns. RF stacking is performed with the repetition rate of 30 Hz and it requires ~0.5 second to fill the whole phase spaces with beam. The e-folding life time of 7 MeV proton is 400 s at the vacuum pressure of 1×10^{-10} Torr, whereas that of $^3He^+$ is 60 ms at 1×10^{-8} Torr of ^4He target. Collision strengths of charge exchange atomic reaction have been measured. (9 refs.)

99819 ASTOR, concept of a combined acceleration and storage ring for the production of intense pulsed or continuous beams of neutrinos, pions, muons, kaons and neutrons. W.Joho (Swiss Inst. for Nuclear Res., Villigen, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2083-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A new concept for a high intensity accelerator for 2 GeV protons using the continuous 590 MeV beam from the present ring cyclotron has been worked out at SIN. To suppress the cosmic background in neutrino experiments are pulsed beam with high peak current and low duty cycle is required. Using the so called phase expansion effect, the acceleration and storage effect are combined in a single isochronous cyclotron ASTOR. With the help of several RF cavities, positioned at different radii it is possible to operate ASTOR either in a pulsed mode at 1500 Hz or in a continuous mode. The anticipated beam powers are 0.8 MW and 4 MW respectively. The ASTOR concept is also applicable in a possible kaon factory design, acting as an interface between the SIN ring cyclotron and a 50 Hz synchrotron for 15 to 20 GeV protons. (9 refs.)

99820 The proposed university of Manitoba polarised and unpolarised light ion facility. S.Oh, F.Konopasek, V.Derenchuk, I.Gusdal, A.McIlwain, R.Pogson, J.S.C.McKee (Cyclotron Lab., Univ. of Manitoba, Winipeg, Manitoba, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2089-91 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A variable energy cyclotron with six separated sectors is proposed for the acceleration of polarised and unpolarised light positive (p,d, $^{3}He^{++}$, ^{4}He, $^{6}Li^{+++}$, $^{7}Li^{+++}$ etc.) and light negative (H^- and D^-) charge state ions. H^- and D^- beams can be accelerated and extracted by stripping foils and in this case the lower limit of the energy range will be reduced, (to 10 MeV for H^-). Cost consideration is a very important factor. Because of this, it is proposed to inject the beam from an external ion source at low energy (~200 keV), rather than incorporate a pre-accelerator. The acceleration of H^- and D^- particle entails losses through collisional electron detachment and electromagnetic stripping inside the cyclotron. The loss from the former is expected to be ~10% for D^- (at 10^{-7} Torr) while the loss from the latter is estimated to be ~0.04% for H^-. (4 refs.)

99821 Progress towards higher intensities and improved beam stability at TRIUMF. P.W.Schmor, R.Baartman, J.W.Carey, D.Dohan, G.Dutto, G.H.Mackenzie (TRIUMF, Vancouver, BC, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2092-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The TRIUMF accelerator routinely delivers up to 120 μA of 500 MeV protons. For tests, 150 μA have been extracted in a CW mode, 225 μA equivalent in a 10% duty-cycle pulsed mode. Longitudinal space-charge effects are observed at these higher currents. A lead target, used as a beam dump and thermal neutron source, is being upgraded to allow extracted currents up to 375 μA CW. The reliability and performance of the cyclotron has significantly increased as the result of several recent developments. Improvements to the main magnet power supply (18000 A) have resulted in a magnetic field stability better than ±0.8 ppm for periods of 2 h. The effect on beam phase, instability and separated turn operation is presented. A Lamb-shift polarized H^- source provides up to 300 nA extracted. An ECR proton source has been tested as a replacement for the duoplasmatron on the polarized source. A gain in current of order 5 is expected. To satisfy the long-term needs, work has begun on developing an intense optically pumped, polarized source with the aim of increasing the current by a factor of 100. (8 refs.)

99822 Status report on GANIL.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2102-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The first beam (Ar^{+4}) from SSCl was obtained in June 82. A full energy Ar^{+16} beam at ~44 MeV/A was accelerated in SSC2 in November and delivered to physicists in January 83. Till now, nine experiments have been performed. (6 refs.)

99823 Modifications to the injection system of the K800 superconducting cyclotron. F.Marti, D.Johnson, H.G.Blosser, B.Milton (Cyclotron Lab., Michigan State Univ., East Lansing, MI, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2105-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The original design of the K800 cyclotron called for a pole tip geometry with a double spiral. After studying the feasibility of designing a stripping mechanism that would fit inside one of the dees, it was decided to use the simpler single spiral pole tips. In this paper the authors describe the calculations made to study the injection orbits. (2 refs.)

99824 Design status of the Munich cyclotron SuSe. U.Trinks, H.Daniel, G.Graw, G.Hinderer, E.Huenges, P.Kienle, H.J.Korner, H.Morinaga, F.Nolden, E.Nolte, H.J.Scheerer, U.Schneider, W.Schott, S.Skorka, W.Wilhelm, H.G.Willers, E.Zech (Phys. Dept., Tech. Univ. Munchen, Garching, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2108-10 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
At the Munich Accelerator Laboratory the design study for the superconducting sector cyclotron SuSe with the existing 13 MV-tandem as injector is in a final state. SuSe will accelerate protons and heavy ions to maximum energies of 500 MeV respectively 300 MeV/u (for Q/A=0.5) with excellent beam properties. Some new technical developments were needed. A prototype of a superconducting sector coil is under test. Several models for the RF-cavities were built. At present a 1:1 prototype power model is under construction. A superconducting channelmagnet without stray fields for injection is developed. (6 refs.)

99825 Injection from the K500 superconducting cyclotron into the 88″ cyclotron at Texas A&M. B.Laune, D.P.May, R.C.Rogers, W.C.Chapman, W.J.Walterscheid, G.Derrig, Y.L.Tsien, P.Smelser, D.H.Youngblood (Cyclotron Inst., Texas A&M Univ., College Station, TX, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2111-13 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The construction of a superconducting cyclotron of the MSU design (K=500, K_f=160) is under way at Texas A&M. It will be used both alone and as an injector for the existing 88″ (K147) cyclotron. A beam optics study has been carried out for injection of K550 cyclotron heavy-ion beams into the K147 cyclotron. This study traces a variety of beams from extraction at the K500 cyclotron until focused and dispersion matched into the proper orbit of the K147 cyclotron. The line is configured to decouple the parameters of each cyclotron by first bringing the momentum dispersion to zero and then producing a double waist which serves as the apparent source for the second cyclotron. Beam line optics for standalone operation of the K500 cyclotron, which provides for use of the present experimental facilities, have also been studied. Construction of the K500 cyclotron is proceeding approximately on schedule with operation expected in 1985. (8 refs.)

99826 Preliminary design of the NRL modified betatron. J.Golden, J.Pasour, D.E.Pershing, K.Smith, F.Mako, S.Slinker, F.Mora, N.Orrick, R.Altes, A.Fliflet, P.Champney, C.A.Kapetanakos (Naval Res. Lab., Washington, DC, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2114-16 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The principal subsystems of the NRL Modified betatron accelerator (MBA) have been designed. These subsystems include the air-core magnets, the mechanical structure, the vacuum system, the injector accelerator, and the pulse power capacitor banks. The MBA concept uses an applied toroidal magnetic field B_θ (2-5 kG) to improve the stability and confinement of a multikiloamp e-beam. Trapping of an injected beam will results from varying the B_z by a few Gauss during the first poloidal bounce period. Externally driven coils will compensate the diffusion of the self magnetic field to maintain equilibrium. (9 refs.)

99827 Conceptual design of a 1.1-GeV 500-μA fast cycling proton synchrotron. Y.Cho, E.Crosbie, T.Khoe, R.Kustom, R.Martin, J.Norem, W.Praeg, K.Thompson, G.Wustefeld (Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2117-19 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A very high intensity proton synchrotron system which could be used for a pulsed spallation neutron source and low energy neutrino and meson physics facility is designed. The synchrotron would accelerate 200 MeV protons to 1.1 GeV with a repetition rate of 50 pulses per sec. The number of protons per pulse is 6.3×10^{13}, resulting in an average proton current of 500 μA. Special features of the conceptual design include H^- charge exchange injection, a guide field flat-bottom of 1.5 msec to facilitate low-loss injection and capture, 15 msec acceleration period, and 3.5 msec for reset of the guide field. A separated function lattice consists of normal cells, dispersion suppressor cells, and matching cells. It provides sufficient straight section length to accommodate a fairly long RF system. A low impedance RF system (cathode-follower) is considered in order to overcome strong beam loading effects in the cavities. Rapid bunch shaping is employed at the end of acceleration to produce pulses of 200 nsec duration for possible neutrino experiments. The transverse acceptances used in the design are: $\epsilon_H=500\ \pi$ mm mr and $\epsilon_V=300\ \pi$ mm mr. (7 refs.)

99828 A variable transition energy lattice for SIS 12/18. B.Franczak, K.Blasche (GSI, Darmstadt, Germany), K.H.Reich.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2120-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
GSI plans to build a heavy ion synchrotron, SIS 12/18, as an extension to its UNILAC facility. This linear accelerator, in operation since 1976, accelerates heavy ions up to 20 MeV/u. SIS 12/18 will extend this range up to 1 GeV/u for the heaviest ions like uranium ($q/A\approx0.3$), and even up to 2 GeV/u for light ions with a specific charge $q/A=0.5$. Acceleration of intense proton beams to 4.5 GeV ($\gamma=5.8$) is being discussed as an option, for instance to produce exotic radionuclides, or for experiments comparing proton interactions with those of ions. In normal operation of magnetic rigidity of 12 Tm can be reached in a fast cycle (dB/dt=10 T/s, 3 cycle/s). For high energy operation up to 18 Tm, the power supplies are connected for giving a peak current of 3500 A at a reduced cycle rate (dB/dt=4 T/s, 1 cycle/s). (5 refs.)

99829 Measuring and manipulating an accumulated stack of antiprotons in the CERN antiproton accumulator. R.Johnson, S.van der Meer, F.Pedersen (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2123-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The antiproton stack is observed through Schottky scans, both longitudinal and transverse. A particular feature is the wide dynamic range needed for observing both the dense core and the freshly-deposited tail. Separating batches of antiprotons from the stack is a highly automated process including the measurement of the momentum distribution and the generation of a suitable RF function to remove a slice of the desired density. Multiple slices may be removed successively and a process for locally flattening the distribution to obtain equal batch intensities is used. When successive batches are unstacked and ejected, the process may have to be aborted if the particles do not arrive correctly at the user. A 'restack' facility is provided to return any antiprotons to the stack that have been unstacked but not ejected. A missing-bucket scheme for unstacking low-intensity batches for LEAR is also described. (2 refs.)

99830 Status of the Milan superconducting cyclotron project. E.Acerbi, F.Aghion, F.Alessandria, G.Baccaglioni, G.Bellomo, C.Birattari, J.Camon, C.De Martinis, E.Fabrici, D.Giove, W.Giussani, G.Gualeni, P.Michelato, L.Milinkovic, C.Pagani, E.Panzeri, F.Resmini, L.Rossi, A.Salomone, L.Serafini, G.Varisco, V.Venturini (Univ. of Milan, Milan, Italy).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2126-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Presents an updated status report on the superconducting cyclotron, under construction at the University of Milan during the past two years. The cyclotron is designed for a K=800 and a K_{FOC}=200, thus yielding maximum energies of 100 MeV/n for fully stripped light ions and 20 MeV/n for uranium ions. The pole radius is 90 cm with three sectors having an average spiral constant of 1/45.7 rad/cm. The average magnetic field will span between 22 and 48 kgauss, with a corresponding RF frequency range between 15 and 48 MHz. The anticipated peak dee voltage is 100 kV, with harmonic operation from h=1 to h=4. The operating modes of the machine include: (i) use of an internal PIG source; (ii) injection from a 16 MV Tandem; (iii) axial injection from an external ion source. (8 refs.)

99831 Lattice for a 1.1-GeV 500-μA fast cycling proton synchrotron. Y.Cho (Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2129-30 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A very high intensity proton synchrotron lattice has been designed for a spallation neutron source system. The synchrotron is to accelerate a beam of 6.25×10^{13} protons from 200 MeV to 1100 MeV in 15 msec. The proposed lattice is in modular form of storage ring type consisting of normal cells, dispersion suppressor cells and matching and straight section cells. Due to the fast repetition rate, the maximum required energy gains per turn is approximately 100 KeV, and this in turn needs approximately 20 meters or more of straight sections for the acceleration cavities. The lattice proposed consists of four sectors, and each sector is made up by thre e FODO normal cells, four dispersion suppressor cells, and four matching and straight section cells. Then the total of 44 cells with approximately 90°/cell phase advance would make the natural tune of the machine to near 11. However, a working point consideration prefers $\nu_x=10.3$ and $\nu_y=11.3$. (1 ref.)

99832 The JINR phasotron: status and progress. V.P.Dzhelepov, V.P.Dmitrievsky, L.M.Onishchenko (Joint Inst. for Nuclear Res., Dubna, USSR).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2134-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The synchrocyclotron of the Laboratory of Nuclear Problems (JINR) for 680 MeV protons has been operational for 30 years. Since 1979 it has been under conversion. The conversion is aimed at making a phasotron with spatial variation of the magnetic field using the building and the magnetic core of the former accelerator. According to the conversion plan the whole accelerator equipment, including the electromagnetic windings, pole tips, the accelerator

chamber, the dee with the resonance line, rotating capacitor, RF generator, ion source, beam extraction system and auxiliary equipment will be replaced. Up to date all the accelerator units have been assembled; the magnetic field which ensures the proton acceleration up to the extraction radius has been formed; the vacuum system has been adjusted and high vacuum is achieved in the accelerator chamber. (no refs.)

99833 The control system for LEP. M.C.Crowley-Milling (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2142-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
There are three main ways in which the requirements for the LEP control system differ from systems that have been built in the past. These are the great distances involved with a ring 27 km in circumference, the introduction of microprocessors into the equipment itself and the long timescale at a time when progress in electronics is rapid, with the cost of hardware falling every year, without any corresponding fall in the cost of specialized software. In view of the latter, there are many detailed decisions that cannot be taken at the moment, but the basic principles have been laid down, and a number of developments and investigations have been started. The paper firstly discusses the effects of the introduction of microprocessors, followed by the basic principles of the LEP control system and a description of the work in progress. (11 refs.)

99834 A broadband accelerator control network. J.Skelly, T.Clifford, R.Frankel (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2155-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A broadband data communications network has been implemented at BNL for control of the alternating gradient synchrotron (AGS) proton accelerator, using commercial CATV hardware, dual coaxial cables as the communications medium, and spanning 2.0 km. A 4 MHz bandwidth digital control channel using CSMA-CA protocol is provided for digital data transmission, with 8 access nodes available over the length of the RELWAY. Each node consists of an RF modem and a microprocessor-based store-and-forward message handler which interfaces the RELWAY to a branch line implemented in GPIB. A gateway to the RELWAY control channel for the (preexisting) AGS computerized accelerator operating system has been constructed using an LSI-11/23 microprocessor as a device in a GPIB branch line. A multilayer communications protocol has been defined for the digital control channel, based on the ISO Open Systems Interconnect layered model, and a RELWAY Device Language defined as the required universal language for device control on this channel. (2 refs.)

99835 Properties and possible use of beam-beam synchrotron radiation. M.Bassetti, J.Bosser, M.Gygi-Hanney, A.Hofmann, E.Keil (CERN, Geneva, Switzerland), R.Coisson.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2182-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
In large electron-positron colliding beam facilities the fields created by one beam in the crossing point are quite large and cause the particles in the other beam to radiate synchrotron radiation. The total power emitted in the form of this beam-beam synchrotron radiation is calculated for beams with a bi-Gaussian cross-section colliding head-on, and its dependence on beam separation is estimated. The radiation emitted in the forward direction is quite hard and has a complicated spectrum. However the radiation emitted at angles much larger than both $1/\gamma$ and the deflecting angle, is softer and has the properties of 'short magnet' radiation. Its spectrum observed at a fixed angle is directly given by the Fourier transform of the longitudinal dependence of the deflection field. The polarization has a simple azimuthal dependence. This radiation can be used for beam diagnostics. (17 refs.)

99836 The control system for the dedicated synchrotron radiation storage ring BESSY. G.von Egan-Krieger, W.-D.Klotz, R.Maier (Berliner Elektronenspeicherring GmbH, Berlin, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2273-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
BESSY is a 800 MeV electron-storage ring dedicated to research with synchrotron radiation in the VUV and soft X-ray region. The storage ring is fed by a 800 MeV separated function synchrotron with a classical 20 MeV microtron as preinjector. The machines are remotely controlled by four minicomputers which are linked by a local network. The computers are connected to a commercially available electronic interface system. (3 refs.)

99837 A multiprocessor bus architecture for the LEP control system. J.Altaber, R.Rausch (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2281-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The architecture and the system aspects of the multimaster bus used for the construction of the process computer assemblies and the message handling assemblies of the LEP control system are presented. This bus architecture provides a fully distributed reservation mechanism and a protected access of the peripherals to prevent processor interferences. To achieve this, a channel concept is proposed, using a system bus for communication between processors and with their peripherals. The architecture is microprocessor independent, provides dynamic bus allocation amongst several microcomputers, offers processor position independence and has a multimaster bus extension to several crates with a homogeneous addressing. A global system concept, called E3S, has been developed including the definition of software primitives. The bus access software is organised in a layered structure matching the module functionality. (7 refs.)

99838 New methods to correct on-line the closed orbit of a synchrotron accelerator with variable focusing configuration. L.Burnod, E.D'Amico (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2284-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A high energy proton synchrotron, operating as an accelerator for fixed target physics has often a very simple and periodic structure at least at the design stage. For instance the CERN SPS working in this mode has 108 identical FODO sections. For a given plane, horizontal or vertical, beam position detectors (BP), all identical, and closed orbit correction dipoles (COD), also identical, can be located near the quadrupoles where the betatronic amplitude (β) and the phase advance (μ) are constant from one element to the next. The closed orbit correction (only needed at low energy) is then straightforward using the simple beam bump method on three adjacent CODs. Transforming such an accelerator into a proton-antiproton (pp) collider significantly alters its periodicity. To increase the luminosity, low beta configurations are inserted at the crossing points, changing β and μ around the ring and modifying the physical layout of BP and COD. New types of BP are required locally to detect p and p and well as new types of COD to correct the closed orbit at any energy inside the insertions. Furthermore the working points and the low beta configurations can change from one experiment to the other. (4 refs.)

99839 Replacing mini-computers by multi-microprocessors for the LEP control system. J.Altaber, M.C.Crowley-Milling, P.G.Innocenti, R.Rausch (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2287-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The control system for the CERN SPS machine has pioneered a control strategy which has expanded the usual central control methodology not only spatially among computers but also organisationally among people. Each fragment resulting from this 'controlled explosion' is a mini-computer containing a message exchange package which loosely couples the fragments, a multitasking monitor and an interpreter. A small number of professional programmers have constructed a system which numerous engineers and technicians have been employing both for the day-to-day operation of the machine and for developing experimental multi-computer control procedures. The same strategy will be used for the LEP machine but a further expansion will be implemented breaking down the mini-computer, basic construction block of the SPS control system, into clusters of loosely coupled micro-computer based units. Apart from the availability of the technology, this expansion is feasible because of the underlying constructional principles of the SPS system which will be transported intact to the LEP system. The paper will describe the problem of organising the clusters analogue to a mini-computer running tasks interacting with real-time events; it will be shown that simple hardware and software solutions exist for the problems that arise, and in addition it is possible to organize a uniform data flow through the system. (6 refs.)

99840 Computer control of RF-manipulations in the CERN Antiproton Accumulator. R.Johnson, S.van der Meer, F.Pedersen, G.Shering (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2290-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The Antiproton Accumulator uses a conventional RF system for bunched beam manipulations within the ring. These require precise control of the bucket size, the synchronous phase angle, and the radial position across the width of the vacuum chamber, over which the magnetic properties of the ring vary significantly. Several different manipulations are required, often in close succession, so a fast, reliable, and accurate method of switching between them is required. This has led to an unconventional, computerised, beam control system. For a desired set of beam manipulations, the computer calculates the needed voltage and frequency as functions of time, using a mathematical model of the beam and lattice. These are then loaded into function generators which subsequently operate independently of the computer. (5 refs.)

99841 The CERN SPS low beta insertion control system. H.K.Kuhn, A.Hilaire (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2293-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Within the context of the CERN SPS p$\bar{p}$ colliding beam experiments there are 2×15 power supplies which have to provide the currents necessary to produce the two low beta insertions. Their control system is described for both the hardware and the software parts. The references use a combination of an 18 bit DAC and an integrator to produce a relatively smooth drive signal to the current controlled power supplies. (no refs.)

99842 Accelerator controls at DESY. (Machine Control Group, DESY, Hamburg, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2299-301 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Six e^+e^- accelerators are working at DESY. All of them are operated from one central control room via the new common control system. The report describes some design aspects, system structure, first experience, and the control room. (4 refs.)

99843 The Proton Storage Ring control system. P.Clout, S.Bair, A.Conley, R.Ford, M.Fuka, N.Greene (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2305-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
When designing a control system for a new facility, one is faced with a bewildering array of electronic devices to use in the solution. There is, of course, no single correct solution because the constraints are laboratory and project dependent. The major constraint applicable to the hardware choice for the Proton Storage Ring (PSR) control system was the limited manpower available for the design, development, and documentation of custom hardware. As a result, wherever possible, commercial components have been used that are based on recognized standards. The array of choice on the hardware side contrasts markedly with the absence of suitable commercial software products, and it is unfortunate that here there seems to be little prospect of change. The analysis of the overall system that follows leads to a suitable hardware choice and a description of the software's structure. (4 refs.)

99844 A high performance control system for a heavy ion medical accelerator. H.D.Lancaster, S.B.Magyary, R.C.Sah (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2311-13 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A high performance control system is being designed as part of a heavy ion medical accelerator. The accelerator will be a synchrotron dedicated to clinical and other biomedical uses of heavy ions, and it will deliver fully stripped ions at energies up to 800 MeV/nucleon. A key element in the design of an accelerator which will operate in a hospital environment is to provide a high performance control system. This control system will provide accelerator modeling to facilitate changes in operating mode, provide automatic beam tuning to simplify accelerator operations, and provide diagnostics to enhance reliability. The control system being designed utilizes many microcomputers operating in parallel to collect and transmit data; complex numerical computations are performed by a powerful minicomputer. (3 refs.)

99845 Synchrotron radiation lead shielding of the vacuum chambers for LEP. G.Chapman, O.Grobner, G.Linser, T.Perry, G.Schmidlin (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2340-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The high linear power density and the energetic photon spectrum in LEP impose a complete radiation shield around the vacuum chamber. The absorp-

tion and scattering of the photons in the vacuum chamber has been studied with the use of the Monte Carlo shower program EGS in view of defining the lead shielding required for acceptable dose levels. To avoid the excessive production of ozone or of corrosive products in the air surrounding the vacuum chamber it is proposed to apply the lead shield directly onto the aluminium profile. In this way the cooling circuits of the vacuum chamber can cool the lead shield which will later be necessary at increased LEP energies. Different methods of bonding the lead to the aluminium have been studied and have resulted in a cladding process using a tin-lead solder joint. This method has been applied to aluminium tubes of up to 12 m length and to full size prototype vacuum chambers. (8 refs.)

99846 **Determination of the sextupole components for the superconducting low-β_v insertion of the CERN intersecting storage rings.** A.Verdier (LEP Div., CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2424-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Sextupole components were introduced in the quadrupoles of the superconducting insertion of the ISR in order to maintain the momentum acceptance of the machine in spite of the large β_h modulation resulting from the horizontal betatron mismatch and to a lesser extent to correct the variation of β^*_v with momentum. The matching of the off-momentum closed orbit at the top of the stack was the procedure which made it possible. This matching is practically eqivalent to a correction of the second order chromatic aberration since all the off-momentum closed orbits are almost matched one it is performed. With the tune values used in the ISR for stacking and physics running, withdrawing the insertion sextupoles would provoke a loss of luminosity of the order of 5% which is modest but logical. Indeed the sextupoles have to compensate at the most a decrease of about 2% of the quadrupole strength. (6 refs.)

99847 **Searches for 'Arnold diffusion' and 'chaotic' motion in the beam-beam interaction.** D.Neuffer, A.Riddiford, A.G.Ruggiero (Fermilab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2427-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The results of long time computer simulation searches for 'Arnold diffusion' in beam-beam interactions at $\bar{p}p$ collider parameters are presented. No evidence of significant diffusion is found, consistent with beam storage for many days without 'blow-up'. 'Chaotic' motion is observed in 2-D simulations at $\bar{p}p$ parameters by use of reversability tests, and Lyapunov exponents for the chaotic motion are measured. This motion appears at the intersections of low-order resonances. Chaotic motion in 1-D simulations and in simulations with tune modulation can also occur. The conditions for the appearance of chaotic motion are explored as well as its relationship with 'beam blow-up'. (6 refs.)

99848 **Perturbation of radial oscillations in superconducting cyclotrons due to asymmetric dee voltages or phases.** M.M.Gordon (Cyclotron Lab., Michigan State Univ., East Lansing, MI, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2439-41 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Like many other cyclotrons, the new superconducting cyclotrons frequently operate with ν_r close to unity, and must actually accelerate the beam through the $\nu_r=1$ resonance in the central region and again just prior to extraction. The spiral shaped dees in these machines are designed to operate the equal voltages and prescribed relative phases, and deviations from these values significantly perturb the radial oscillations. An analysis of these effects, including those produced by the spiral electric gaps, is outlined and the results compared with those from a magnetic field bump. Possible applications to the control of orbit centering are discussed and illustrated with data from detailed orbit computations. (1 ref.)

99849 **Second order effects of a sextupolar field on betatron oscillations in a storage ring.** A.Jejcic (Lab. de l'Accelerateur Lineaire, Orsay, France).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2445-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Calculations concerning the betatron oscillations in a storage ring lattice comprising a lumped element sextupole field are presented. The method used is based on the second order approximation of the averaging method. The existence of singular points inside the region of the phase space defined by the separatrix is assumed. Formulas are given permitting the calculations of the size of the corresponding intersecting invariant curves and a simple expression is deduced for the betatron tune shift. The results are compared to those obtained by a tracking program. A good agreement between them is noticed. (3 refs.)

99850 **A dispersion-free long straight section for a fixed-field alternating-gradient synchrotron.** P.F.Meads,Jr..
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2448-50 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The FFAG synchrotron is generally designed to be 'scaling' in order to assure that resonances are not crossed. In compact designs, where the spiral angle and radial gradient are very high, it is necessary to depart from pure scaling by inserting radial cuts in order that there be room for RF cavities, etc. It is shown that a doubly symmetric set of six gradient magnets will provide an insertion that matches the structure for all momenta, providing in addition a long drift space that is free of dispersion. With the space thus provided for RF cavities, very high repetition rates are possible. Such a ring also provides an attractive means of accumulating equilibrium distributions of feeble heavy ion beams by placing a stripping foil in the dispersion-free section. (6 refs.)

99851 **On improving the chromatic effects of storage rings with antisymmetric insertions.** J.Claus, M.Cornacchia, E.Courant, F.Dell, G.Parzen (Brookhaven Nat. Lab., Upton, NY, USA), A.Garren.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2451-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
High luminosity storage rings require good chromatic behavior for beams with large momentum spreads. This requires that the effects of half-integer structure resonances for off-momentum particles be minimized. The authors show that a lattice with antisymmetric insertions can be so designed that the driving term for the half-integer structure resonance is suppressed by cancellation of successive pairs of high-beta multiplets. Hence, even though the periodicity is half that of a lattice with symmetric insertions, the chromatic properties are similar. (1 ref.)

99852 **Coupling and decoupling in storage rings.** S.Peggs (European Organisation for Nuclear Res., Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2460-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The accidental or intentional introduction of solenoids and skew quadrupoles into a storage ring couples the transverse motion, unless the lattice is trimmed. Coupling can cause, for example, irreversible emittance blow up at injection (protons), resonance excitation, flat beam blow up in collision (electrons), and can destructively modify the beam-beam equations of motion. Apart from these effects themselves, not many diagnostics are available to guide compensation attempts. After developing a matrix description of coupling the paper analyses the compensation of a lattice insertion, and goes on to show how random errors can be handled close to a coupling resonance. The global decoupling of random errors in the SPS, achieved by the observation of eigenfrequencies on a spectrum analyser, is described. Rough estimates show that global compensation usually makes further (local) compensation unnecessary. (3 refs.)

99853 **Simulation of the beam-beam effect during injection, accumulation and acceleration in LEP.** S.Myers (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2466-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The beam-beam program is used to simulate noncollision conditions for LEP. These results are used to facilitate the choice between horizontal and vertical separations at the interaction points and to quantify the required amount of separations. It is shown that in certain cases the residual beam-beam kicks during injection with separated beams can cause severe 'blow-up' in the transverse beam emittance and thereby lead to a reduction in the apparent injection efficiency. Results are also shown for transient effects which occur while the beams are brought into collision. (11 refs.)

99854 **Studies of the chromatic properties and dynamic aperture of the BNL colliding beam accelerators.** G.F.Dell (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2469-71 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The PATRICIA particle tracking program has been used to study chromatic effects in the Brookhaven CBA (colliding beam accelerator). The short term behavior of particles in the CBA has been followed for particle histories of 300 turns. Contributions from magnet multipoles characteristic of superconducting magnets and closed orbit errors have been included in determining the dynamic aperture of the CBA for on and off momentum particles. The width of the third integer stopband produced by the temperture dependence of magnetization induced sextupoles in the CBA cable dipoles is evaluated for helium distribution systems having periodicity of one and six. The stopband width at a tune of 68/3 is naturally zero for the system having a periodicity of six and is $\sim 10^{-4}$ for the system having a periodicity of one. Results from theory are compared with results obtained with PATRICIA; the results agree within a factor of slightly more than two. (8 refs.)

99855 **Dipole shuffling in the Fermilab Energy Saver.** L.P.Michelotti, S.Ohnuma (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2472-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Permuting the magnets in an accelerator can modulate the adverse effects of field errors on particle orbits; imperfections in magnetic fields can be made to cancel one another by paying some attention to their arrangement. In particular, careful ordering gives a certain measure of control over resonances excited by field nonlinearities. Such considerations were used in assigning superconducting dipoles to the Fermilab Saver. The authors call this activity by the suggestive name 'shuffling'. The lowest order effect of field errors is closed orbit distortion caused by variations in dipole strength. To reduce it, a strategy may be developed based on either measured values of $\int B dl$ or the NMR magnetic field measurements. They found, however, that placing the magnets randomly did not degrade the orbit enough to warrant this, especially since the improvement eventually would have been nullified by misaligned quadrupoles. The closed orbit therefore was not included explicitly in their shuffling program, but they substantiated, after the fact, the argument for ignoring it. (3 refs.)

99856 **Generalization for the Hofmann-Zoter combined-function formulation for application to 50×50 GeV e^+e^- storage rings.** L.E.Sakazaki, R.M.Talman (Newman Lab. of Nuclear Studies, Cornell Univ., Ithaca, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2475-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Though all existing strong-focusing electron storage rings have separated-function lattices, the combined-function lattice would reduce energy loss to synchrotron radiation. Robinson (1958) and Hofmann and Zotter (1977) have shown how to overcome the anti-damping that was once thought to rule out this possibility. Their formulation is generalized to achieve a more realistic machine design having FODO cells to incorporate the inevitable straight sections between magnets and to allow for any subsequent insertion of nonlinear elements. An analysis is performed to estimate the energy savings for a 50×50 GeV e^+e^- facility using combined-function magnets. (5 refs.)

99857 **Computer modeling of internal targets in electron storage rings.** R.P.Maloney, R.C.York, J.S.McCarthy, B.E.Norum (Dept. of Phys., Univ. of Virginia, Charlottesville, VA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2484-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The effect of thin (1-50 $\mu g/cm^2$) internal targets on beam quality in electron storage rings is evaluated. The internal target is modeled assuming that scattering is the result of elastic collisions between the beam electrons and the target nuclei. A screened Coulomb potential is used and single and plural scattering mechanisms are included. A storage ring particle tracking code, DIMAT, was modified to include the internal target model and used to obtain the results discussed. Beam particle loss distributions and bean envelope 'growth times' are given are discussed in light of damping mechanisms inherent in electron storage ring designs. (6 refs.)

99858 **Storage ring filling via direct production of electron and positrons by high energy protons.** S.Conetti (Inst. of Particle Phys., McGill Univ., Montreal, Canada), A.G.Ruggiero.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2693-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
In the context of the proposals to build an electron proton colliding facility at Fermilab, the authors present a new scheme for the electron ring injector,

ased on the production of high energy electrons or positrons by a suitably repared 100 GeV high intensity proton beam. With this scheme one can chieve electron ring filling times of a few minutes, while avoiding the instabilities associated with low energy injection 83/0800-2693$01.00. (10 refs.)

9859 The beam bunching system for the Chalk River superconducting yclotron. E.A.Heighway, C.B.Bigham, J.E.McGregor (Chalk River Nuclear abs., Atomic Energy of Canada Ltd., Chalk River, Ontario, Canada).
EEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2809-11 (Aug. 1983). 1983 Particle Accelerator Conference. Accelerator Engineering and Technolgy, Santa Fe, NM, USA, 21-23 March 1983).
he bunching system for the tandem accelerator-superconducting cyclotron is f the buncher-rebuncher type. It consists of a low energy gridded buncher efore the tandem that produces a time focus at the tandem stripper, comined with a high energy buncher between the tandem and the cyclotron to orrect for debunching of the beam produced by energy straggling in the tripper. To meet the cyclotron design energy resolution of 5:10^4 the bunch ength produced at the cyclotron has to be less than three degrees in RF hase. (11 refs.)

9860 Injection and extraction for use. G.Hinderer, F.Hinterberger, .Kienle, W.Schott, U.Trinks, W.Wilhelm, E.Zech (Phys. Dept., Tech. Univ. unchen, Garching, Germany).
EEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2809-14 (Aug. 1983). 1983 Particle Accelerator Conference. Accelerator Engineering and Technolgy, Santa Fe, NM, USA, 21-23 March 1983).
he injection onto the first cyclotron orbit differs essentially from injection chemes for normal conducting sector cyclotrons because of two reasons: 1) he central region is occupied by the RF-cavities; 2) the stray field between he sectors is strongly nonscaling with the mean field level. An appropriate njection and extraction system was developed using a series of superconducting channel magnets which cause practically no field perturbation outside and roduce field levels of several Tesla inside. The injection path is below the nedian plane in the region of the circulating orbits. The accelerated beam vill be extracted with an electrostatic septum (10 MWm). Single turn extraction is achieved primarily by the acceleration voltage of 2 MV/turn, giving a urn-separation of 2.5 mm for 300 MeV/u and Q/A=0.5. The separation nay be increased by coherent betatron-oscillations. (6 refs.)

99861 Antiproton yield optimization in the CERN Antiproton Accumulator. C.D.Johnson (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2821-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The setting-up and optimisation of antiprotons injected into the Antiproton Accumulator was initially based upon the measurement of circulating antiprotons by integration of their Schottky signals. This has now been supplemented by amplitude distribution measurements using an internal target. Also, the more readily detectable pions, muons and electrons, injected along with the antiprotons, give information on machine aperture and orbits, which can serve as a monitor of injection conditions during antiproton stacking. (6 refs.)

99862 Pulsed beam chopper for the PSR at LAMPF. J.S.Lunsford, R.A.Hardekopf (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2830-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A traveling-wave beam chopper has been designed to provide properly structured negative-ion beam to the Proton Storage Ring (PSR) and other LAMPF users. The chopper must provide a 20-mrad kick with pulse rise time <5 ns for the 750-keV H^- ions in the injector transport line. Variable pulse lengths from 15 ns to 750 μs at repetition rates up to 16.7 MHz must be generated in synchronization with the PSR circulation frequency. Parameter studies led to an optimized design combining good deflection efficiency and bandwidth with minimum deleterious effects from plate-to-plate coupling. Both positive and negative 600-V pulses, with lengths up to 1 ms and maximum 10% duty factor, can be generated to drive the deflectors. (4 refs.)

99863 A three-dimensional field program. M.H.Foss (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2856-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The high-energy microtrons studied at Argonne National Laboratory (ANL) require complicated magnetic field shapes. A three-dimensional infinite-permeability magnetic field program was written to show that poles and coils can be devised to produce these fields. The program is in Hewlett-Packard 9845B BASIC, which limits the active mesh to about 30000 points. In some problems the number of useful points can be greatly increased by placing virtual pionts one plane beyond the active mesh. The program has four parts: (1) prepare the problem description file, (2) load the starting mesh, (3) relax the mesh, and (4) output results. Preliminary results indicate that the magnet edge can be quite 'hard' and suggest that the required field shapes can be produced. (1 ref.)

99864 Prototype sector magnets for the GeV electron microtron (GEM). R.B.Wehrle, J.H.Norem, W.F.Praeg, R.H.Swanstrom, K.M.Thompson (Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2859-61 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Three prototypes of the sector magnents for GeV Electron Microtron accelerators have been designed. The first is a full scale, 168 ton prototype for one-half of a 2 GeV Double Sided Microtron (DSM) sector magnet. The successful fabrication and testing of the pole pieces for this prototype has demonstrated that their required close tolerances for flatness and parallelism can be met. The second magnet is an approximate two-thirds scale model of one step at the low energy end of the hexatron sector magnet designed for the 4 GeV Electron Microtron (GEM). The measured fields demonstrate that the field falls off faster than an 'Enge-short-tail' and error fields are at low levels and are controllable. A third prototype magnet exactly duplicates the full scale geometry of the first three full orbits of the GEM sector magnet from entrance to exit points. (6 refs.)

99865 Energy Saver partial ring power tests. G.Tool, R.Flora, P.Martin, D.Wolff (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2889-91 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
As installation of the Energy Saver progresses, completed sections of the ring are operated to test subsystems and their interactions. The authors describe the power and quench protection tests in the 1/8 ring operation (3/4 of A sector) completed in June 1982, and in the more recent 1/3 ring operation of E and F sectors. (4 refs.)

99866 Operation of the Tevatron satellite refrigerators for 0.75- and 2.0-kilometer-long magnet strings. C.H.Rode, R.A.Andrews, R.Ferry, J.Gannon, J.Makara, M.Martin, D.Mizicko, J.Misek, T.Peterson, J.Theilacker (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2892-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
In January 1982, the authors started a five-month-long run of three satellite refrigerators, each attached to 250 meters of magnets. Two additional satellite refrigerators were operated, one as a liquefier, and the other to cool B12 Magnet Test Facility. They were all powered by the first two of the compressor buildings, located 1.0 kilometer apart, each housing four, two-stage screw compressors. During most of this period the Central Helium Liquefier was operating, providing supercritical helium. In November 1982 the authors commissioned eight additional refrigerators, each with its 250 meters of magnets, as well as two additional compressor buildings. In February 1983 an additional four refrigerators with magnets were started up. The remainder of the project is being started up this spring (1983). (5 refs.)

99867 Performance of the new cryogenic vacuum system at the Bevatron. R.T.Avery, T.F.Henderson, K.D.Kennedy, J.R.Meneghetti, J.R.Alonso (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2895-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A cryogenically cooled liner has been installed within the Bevatron to achieve 10^{-10} Torr vacuum. Features and performance of this liner are described, including achieved pressures, residual gas composition, cryo heat loads, leak rates through moving and static seals, and cool-down and warm-up times. (2 refs.)

99868 Oxygen deficiency hazard induced by helium release in accelerator tunnel. D.P.Brown, J.H.Sondericker (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2898-900 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Tests to investigate oxygen deficiency levels due to release of helium into the CBA tunnel are described. Results of the tests indicate that the helium stratifies and spreads quickly in the horizontal plane. This demonstrates that adequate warning of possible asphyxiation hazards can be achieved. When oxygen deficiency monitors are located at ceiling level they may be spaced at intervals of 60 m or more and still achieve acceptable results. (no refs.)

99869 Helium refrigeration system for BNL Colliding Beam Accelerator. D.P.Brown, Y.Farah, R.J.Gibbs, A.P.Schlafke, W.J.Schneider, J.H.Sondericker, K.C.Wu (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2901-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A Helium Refrigeration System which will supply the cooling required for the Colliding Beam Accelerator at Brookhaven National Laboratory is under construction. Testing of the compressor system is scheduled for late 1983 and will be followed by refrigerator acceptance tests in 1984. The refrigerator has a design capacity of 24.8 kW at a temperature level near 4K while simultaneously producing 55 kW for heat shield loads at 55K. When completed, the helium refrigerator will be the world's largest. Twenty-five oil-injected screw compressors with an installed total of 23250 horsepower will supply the gas required. One of the unique features of the cycle is the application of three centrifugal compressors used at liquid helium temperature to produce the low temperatures (2.5K) and high flow rates (4154 g/s) required for this service. (no refs.)

99870 Performance of the NBS-LANL RTM injection line vacuum system. R.I.Cutler (NBS, Washington, DC, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2904-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A 1000 l/sec cryopump is used to provide the hydrocarbon-free vacuum required for the 100 keV electron beam transport line of the NBS-LANL Racetrack Microtron. The beam line is 3.5 cm in diameter and 4 m long. To overcome the low vacuum conductance of the beam line, it is pumped every 1/2 meter by a 15 cm diameter vacuum manifold which is connected to the cryopump. A single cryopump is used rather than several ion pumps to reduce costs and to provide easier starting. An oil-free roughing pump and sorption pump are used in the initial pumpdown. The vacuum system is all metal sealed. Vacuums of 3×10^{-6} Pa are reached in 8 hours from atmospheric pressure without baking out the system, and ultimate vacuums of 5×10^{-7} Pa are achieved. (3 refs.)

99871 Construction of vacuum system for TRISTAN accumulation ring. H.Ishimaru, T.Momose, K.Narushima, H.Mizuno, H.Watanabe, T.Kubo, H.Yamaguchi, M.Kobayashi, G.Horikoshi (Nat. Lab. for High Energy Phys., Ibaraki, Japan).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2906-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
An all aluminum-alloy vacuum system for the TRISTAN accumulation ring (2.5-8 GeV) is now under construction. Aluminum and aluminum alloys are preferred materials for ultrahigh vacuum systems of large electron storage rings because of their good thermal conductivity, extremely low outgassing rate and low residual radioactivity. The bakeout temperature of an aluminum alloy system is generally limited to approximately 150°C by the decrease in mechanical strength with temperature. If ordinary stainless steel components are mixed in an otherwise aluminum alloy system, effective bakeout of the stainless steel is often impossible because of the temperature limitations due to aluminum. Then the ultimate pressure is often limited by outgassing of the stainless steel components. Ordinary stainless steel components and stainless steel-aluminum transitions have been eliminated as much as possible from the TRISTAN design. Suitable aluminum alloy vacuum chambers, elliptical bellows, fittings, flange/gasket/bolt, nut and washer combinations, feedthroughs, gauges, optical windows, sputter ion pumps, turbomolecular pumps, valves and related aluminum alloy vacuum components have been developed. (6 refs.)

99872 The GANIL vacuum system—results. G.Rommel.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2914 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
GANIL is a heavy ion accelerator located in Caen near the sea in France. This accelerator consists mainly of two big separated sector cyclotrons. As GANIL must accelerate all ion spaces, problems of vacuum are particular. The author gives results from the vacuum of SSC1 which has been running since June 1982. (3 refs.)

99873 CBA main magnet power supply ripple reduction. G.Bagley, R.J.Edwards (Brookhaven Nat. Lab., Upton, Ny, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2923-5 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

The preliminary results of a development program to minimize beam perturbation resulting from ripple current generated by the CBA Main Magnet Power Supply are presented. The assessment of the magnitude and causes of the ripple generated led to a modification of the SCR Gate Driver and the addition of a bandpass amplifier correction loop which gave significant improvement. A description of the changes made and the results obtained are included. A second design approach was developed in which the timing of the SCR gate pulses is directly determined by a VCO. The results reported with this VCO Loop indicate superior performance, particularly at frequencies below 60 Hz. A shunt transistor regulator design is proposed to minimize higher SCR switching frequency harmonics. (8 refs.)

99874 Software system for the operation of the TRISTAN-AR power supply. K.Endo, T.Kubo, A.Kabe, H.Fukuma (Nat. Lab. for High Energy Phys., Ibaraki, Japan), K.Arimoto, H.Aoki, H.Yamamoto.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2926-8 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

Many power supplies ranging from 1 KVA to 4 MVA are controlled remotely through the serial CAMAC data way. The programs for their operation have been combined to form a software system which includes functions such as current monitoring, interlock and status surveillance, current pattern data generation, current fine adjustment, data transfer and so on. (3 refs.)

99875 Digital simulation for TRISTAN AR magnet power supply and control system. T.Kubo, H.Fukuma, A.Kabe, K.Endo (Nat. Lab. for High Energy Phys., Ibaraki, Japan).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2929-31 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

The TRISTAN AR Magnet Power Supply is the system for exciting the magnets to accelerate the electron and positron beam from 2.5 GeV to 8 GeV. To estimate its performance the digital simulation was performed using DDS (Digital Dynamics Simulator). The simulation method and the result are described. (9 refs.)

99876 Improved control system of the thyristor flicker suppressor for the KEK 12-GeV PS. S.Matsumoto, H.Baba, H.Sato, T.Sueno, K.Mikawa (Nat. Lab. for High Energy Phys., Ibaraki, Japan).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2932-4 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

Thyristor control system of the 20 MVar flicker suppressor has been improved essentially. The previous feed forward (FF) loop with each single phase reactive current detector of the MR magnet power supply was exchanged to the present by both FF- and NFB-loops. The FF-loops consist of a three phase reactive power detector of the MPS and a forcing pattern generator on the fast but steady line voltage flicker, sag and surge. The NFB-loops control by the slow parts of the flicker and the unbalanced line voltages. These detectors of the reactive power, the voltage flicker and the unbalance have been developed. Sampled voltage flicker data with 12 bit ADC are processed by Z-80A microcomputer system and the forcing pattern is generated by the system through 12 bit DAC into the loop. A typical voltage flicker including sag and surge has been reduced within ±1.5%, about 1/3 compared to the previous, at 66 kV primary line. (3 refs.)

99877 Regulator to control current sharing among parallel-connected power transistors. F.D.Wells, E.F.Higgins, M.E.Mauro (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2935-7 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

A current regulator is described that controls the peak current of a power transistor driving an inductive load, such as magnet coils. Presently, the current pulse has a 0.1- to 1-ms adjustable duration with duty cycle to 5%. Ultimately, the pulse length must by ~7 ms with 50% duty cycle. The peak current nominally is 200 A, as set by a reference pulse. Several transistors, each controlled by an individual regulator, are connected in parallel to provide the total peak load current. The regulators compensate for differences between the power transistors and assure equal current sharing among the collectors. The regulator comprises an 8-bit multiplying digital-to-analog (D/A) converter that drives the base of the power transistor, an 8-bit up-down counter, an analog differencing circuit, and a comparator. For control purposes, a current-sensing resistor in the transistor's collector produces the second input to the differencing circuit. Regulation is accomplished over a collector current range of 200±50 A per stage. (2 refs.)

99878 Present status of SOR. S.Asaoka, T.Igarashi, G.Isoyama, A.Mikuni, Y.Miyahara, H.Nishimura (Synchrotron Radiation Lab., Univ. of Tokyo, Tokyo, Japan).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2944-6 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

Recent progress and investigations of an electron storage ring, SOR, are presented. Stored current and beam life time increased considerably. Injection efficiency and the life time were studied critically. Especially the life time was found to depend on the pressure of the ring and effective momentum aperture related to betatron resonance as well as the Touschek effect. (no refs.)

99879 Permanent magnet storage rings for microlithography and FEL sources. J.Le Duff (Lab. de l'Accelerateur Lineaire, Univ. de Paris-Sud, Orsay, France), Y.Petroff.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3060-2 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

Permanent magnet technology is rapidly improving and it seems possible now to design and build dedicated electron storage rings for peculiar applications such as microlithography and free electron laser. A low capital cost as well as a low operational cost (no power supplies) may lead to industrial solutions. The authors describe two possible design studies for machines at energies of 240 and 500 MeV with some indications on an efficient injector. (9 refs.)

99880 Status of BESSY, an 800-MeV storage ring dedicated to synchrotron radiation. G.Egan-Krieger, D.Einfeld, H.-G.Hoberg, W.-D.Klotz, H.Lehr, R.Maier, M.Martin, G.Milhaupt, R.Richter, L.Schulz, E.Weihreter (Berliner Elektronenspeicherring-Gesellschaft fur Synchrotronstrahlung mbH, Berlin, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3094-6 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

BESSY is a national dedicated source for synchrotron radiation situated in Berlin (West). This facility includes a 800 MeV electron storage ring, a 800 MeV separated function injector-synchrotron and a 20 MeV preinjector-microtron. The critical wavelength of BESSY was chosen to be $\lambda_c=2$ nm. This corresponds to a maximum field strength of 1.5 T in the bending magnets at 800 MeV and a bending radius of 1.78 m. By this choice of the spectral range BESSY meets the demands of X-ray lithography and complements the hard X-ray laboratory HASYLAB at DESY (Hamburg). Together with the HASYLAB facility both laboratories are thought as national centers for research with synchrotron radiation. BESSY covers the spectral range in the infrared, VUV and soft X-ray region up to 5 keV photon energies. (4 refs.)

99881 Performance of the 800-MeV injector for the BESSY storage ring. G.von Egan-Krieger, D.Einfeld, W.-D.Klotz, H.Lehr, R.Maier, G.Mulhaupt, R.Richter, E.Weihreter (Berliner Elektronenspeicherring-Gesellschaft fur Synchrotronstrahlung mbH, Berlin, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3103-5 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

The injector for the BESSY storage ring is an 800 MeV synchrotron with a 20 MeV microtron as preinjector mainly manufactured by Scanditronix AB. The synchrotron was designed as a separated function machine. The bending magnets, the focusing and the defocusing quadrupoles are powered by three independent White-circuits. These circuits are phase-locked to each other via a microprocessor. The repetition rate of the synchrotron is 10 c/sec. The max. extracted current measured at 570 MeV was 12 mA/50 ns. The emittance was $\epsilon_x=1.6\times10^{-6}$ πm rad, $\epsilon_Y=0.25\times10^{-6}$ πm rad. The energy was changed to 776 MeV in August 1982. The extracted current was 7 mA/50 ns. (no refs.)

99882 Status of the National Synchrotron Light Source. J.N.Galayda (Nat. Synchrotron Light Source, Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3109-11 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

The status and performance of the NSLS 700 MeV ring and 2.5 GeV ring is described. Emphasis is placed on properties of the stored beam pertinent to synchrotron radiation production, the factors determining these properties, and efforts to improve performance of the rings. (11 refs.)

99883 Photon factory: status of storage ring. (KEK, Nat. Lab. for High Energy Phys., Ibaraki, Japan).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3130-2 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

The 2.5 GeV electron storage ring of the photon factory is a dedicated synchrotron radiation source. The first beam was stored at the design energy on March 11, 1982. Experiments with synchrotron radiation was started in June. During this year, efforts have been devoted to investigation of the properties of the storage ring. Then, the stored beam currents were increased and the beam lifetime was improved. In February 1983, a superconducting vertical wiggler of 5 Tesla and a permanent magnet undulator have successfully come into operation. The spectra of emitted radiation were measured. (4 refs.)

99884 A 600-MeV ETL electron storage ring. T.Tomimasu, T.Noguchi, S.Sugiyama, T.Yamazaki, T.Mikado, M.Chiwaki (Electrotech. Lab., Ibaraki, Japan).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3133-5 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

A 600-MeV electron storage ring has been constructed in only ten months at a cost of 200 million yen at the Electrotechnical Laboratory (ETL) in Tsukuba. The 500-MeV high efficiency-high current electron linac being operated for high energy-dosimetric experiments serves as an injector. The ring consists of eight bending magnets (r=2m) and four triplets of quadrupole magnet. The circumference is 31.45 m and λ_p is 22 Å. The lattice order is 0/2 $B_dQ_fQ_dQ_fB_d$ 0/2. The harmonic number is 17. The maximum stored current is 160 mA and 1/e lifetime is 1.5 hours at present. The radiation is used for calibrating photometry and soft X-ray standards, photoelectric analysis of electronic materials, and LSI lithography. (7 refs.)

99885 A proposed lattice modification to the Daresbury SRS. G.Saxon (Sci. Engng. Res. Council, Daresbury Lab., Daresbury, England).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3136-8 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

The Synchrotron Radiation Source (SRS) at Daresbury was the world's first purpose built X-ray source dedicated to synchrotron radiation experiments. Since the SRS was designed much further work has been carried out on the optimisation of radiation sources, and this has led to the realisation of the importance of source brightness. Accordingly a proposal has been made to upgrade the SRS by increasing the periodicity through the addition of further quadrupoles, in order to reduce the emittance of the stored electron beam by an order of magnitude. The practical implications of this change are discussed. (9 refs.)

99886 The stellatron—a strong-focusing, high-current betatron. C.W.Roberson (Office of Naval Res., Arlington, VA, USA), A.Mondelli, D.Chernin.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3162-4 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

By adding both a toroidal magnetic field and a strong focusing field to a betatron, the authors achieve high current capability together with the required energy mismatch tolerance. The resulting configuration is a combination of stellarator and betatron (stellatron). The authors consider the behavior of a stellatron, which provides quadrupole focusing and is analogous to an alternate-gradient strong focusing system in a toroidal field. (9 refs.)

99887 Successful betatron acceleration of kiloampere electron rings in RECE-Christa. D.Taggart, M.R.Parker, H.Hopman, H.H.Fleischmann (School of Appl. Engng. Phys., Cornell Univ., Ithaca, NY, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3165-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

The authors describe first experiments in which the strong electron rings normally trapped in the RECE-Christa device are accelerated in a plasma-betatron-like arrangement. Using a cold, collisional background plasma (T_e=1-2 eV, $n_p=10^{11}$-10^{12} cm^{-3}) generated by the ring in a gas fill of 50-200mTorr H_2, electron rings with currents of up to 2 kA were accelerated from about 1 MeV to 2.5-3 MeV. It appears that this method may be useful in significantly extending the parameter range of betatrons, in particular its ring current into the 10 kA range. (12 refs.)

99888 Intense beam recirculation. J.G.Siambis (Lockheed Palo Alto Res. Lab., Palo Alto, CA, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3195-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

The concept of racetrack-modified betatron recirculator-accelerator is introduced in order to recirculate intense-current electron beams under the same accelerating cavities several times (<10) before extraction. Design criteria are obtained and the parameter space of operation is given. (11 refs.)

99889 Intense ion ring acceleration in a flux compressing liner. R.J.Faehl, G.Gisler (Los Alamos Nat. Lab., Los Alamos, NM, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3201-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

Circular accelerators based upon increasing magnetic flux comprise one of the oldest classes of machines, the Betatron being a prime example. The authors have found that intense, charged neutralized ion rings can be accelerated to interesting energies by imploding a conducting liner on the field/ring configuration. Because the ring radius is not fixed, they find that the energy scaling varies from linear in the field ($p_\theta{}^2 \propto B_z$) at low energies to square root scaling ($\gamma \propto B_z{}^{1/2}$) at relativistic energies. Simple modeling has confirmed many of the characteristics they have seen in $2^1/_2$-D fully electromagnetic particle simulations. (10 refs.)

99890 A high-current racetrack induction accelerator. A.Mondelli (Sci. Applications Inc., McLean, VA, USA), C.W.Roberson.

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3212-14 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

The energy and system scaling laws of the racetrack induction accelerator (RIA) are determined and its operating principles are discussed. This device is a cyclic accelerator that is capable of multi-kiloamp operation. Long pulse induction linac technology is used to obtain short acceleration times. The RIA circulates a high current beam through a linear induction module. The voltage gain relation is $V=V_M T_M/\tau$, where V_M is the voltage gain per pass, T_M is the module pulse duration and τ is the transit time of the beam around the accelerator. (5 refs.)

99891 Effect of synchrotron radiation in the proposed 4-GeV Argonne microtron. E.A.Crosbie (Phys. Div., Argonne Nat. Lab., Argonne, IL, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3218-20 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

Synchrotron radiation in the sector magnets of the 4 GeV microtron designed at the Argonne National Laboratory produces a small but noticeable distortion of the closed orbits of the system and a very significant growth of the horizontal and longitudinal phase space emittances. Because of the small apertures in the three 25 meter linacs, it is important that the expected growth of the beam be calculated as accurately as possible. A computer program has been written which follows the motions of individual electrons in the four dimensional horizontal and longitudinal phase space as they are accelerated in the system. As the electrons go through the sector magnets, they emit quanta at random with randomly chosen energies. The final results show 63% emittance (area/π) values of 0.15 mm mrad and 630 keV degrees for the horizontal and longitudinal phase spaces respectively. The 99% values are about 4.6 times larger. (4 refs.)

99892 Transverse beam containment in the ANL 4-GeV microtron. E.Colton (Phys. Div., Argonne Nat. Lab., Argonne, IL, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3221-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

Optical systems have been designed to contain the electrons during the acceleration form 0.185-4.0 GeV. These systems are located in the dispersive straight sections and maintain a matched dispersion free beam with $\beta^*=15.0$ m in the linac centers, and transverse beam waists in the centers of the dispersive straight sections. A thin-lens code has been developed to design the multi-energy system. Three version of the focusing systems have been evolved: (i) two quadrupole triplets for $E \leq 1.62$ GeV; (ii) a single triplet for $1.655 \leq E$ 2.215 GeV; and (iii) a pentaquad system for $E \geq 2.250$ GeV. For case (i) the author steps the exit edges for the 60° bending magnets so as to simulate a zero degree edge—this reduces vertical defocusing effects to an acceptable value. At the higher energies the exit edge angles are $-60°$. The entrance angles are 15° on the linac sides of the dipoles. Energy behavior of the Twiss parameters and quadrupole strengths are presented. (4 refs.)

99893 Conceptual design for a CW 1-GeV double-sided microtron. K.Hayakawa, K.Tsukada, K.Sato, T.Tanaka (Atomic Energy Res. Inst., Nihon Univ., Tokyo, Japan).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3224-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

The design study of a double-sided microtron is presented. An idea and the results of beam optics of the first turn orbit in sector magnets and quadrupole magnets are described. (1 ref.)

99894 Analytical study of the generation and control of orbit errors in the ANL 4-GeV CW electron microtron design. R.L.Kustom (Phys. Div., Argonne Nat. Lab., Argonne, IL, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3229-31 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

The 4 GeV CW electron microtron (GEM) design has 3 linac sections and 3 dispersive straight sections. Six 60° sector bending magnets separate the linac and dispersion straight sections. A magnetic optical system has been designed within the dispersive straight sections to contain the beam during the 36 or 37 return passes through the linacs. A major concern is the effect of small alignment or field errors on the equilibrium or desired orbit with a relatively strong focusing system. The results of an analytical study which shows the effect of small random errors on the orbit are presented. A study was also undertaken on the control of the orbit position by making error measurements in one dispersive section and making an angular adjustment with a small dipole in the preceding dispersive section. The analysis indicates that the orbit position can be adequately and easily controlled in the presence of random alignment and field errors. (2 refs.)

99895 150-MeV pulse stretcher of Tohoku University. T.Tamae, M.Sugawara, O.Konno, T.Sasanuma, M.Muto, K.Yoshida, M.Hirooka, Y.Shibazaki, K.Yamada, T.Terasawa, M.Urasawa, T.Ichinohe, S.Takahashi (Lab. of Nuclear Sci., Tohoku Univ., Sendai, Japan), H.Miyase, Y.Kawazoe, S.Yamamoto, Y.Torizuka.

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3235-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

The paper describes the Tohoku University 150 MeV pulse stretcher and the results of the test operation. The ring stores a pulsed electron beam from the electron linac and converts it into a continuous one. The test operation has proved that it works successfully. Broadening of the extracted beam in the vertical direction due to a coupling resonance was observed in the early operation. This problem was resolved by readjustment of the tune. And an extracted beam of 1 μA has been obtained with a duty factor of 80%. The energy spread of the extracted beam was measured to be 0.2%. (1 ref.)

99896 Relativistic collective effect accelerator to reach ultrahigh energies. F.Winterberg (Desert Res. Inst., Univ. of Nevada System, Reno, NV, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3238-40 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

A collective circular particle accelerator is proposed, with the potential to reach ultrahigh particle energies, including large luminosities. In the accelerator an electron cloud is produced within a large toroidal magnetic solenoid by inductive charge injection through the action of a travelling magnetic wave running around the torus. At the same time, the travelling magnetic wave accelerators the electron cloud to relativistic energies. By continuous inductive charge injection the cloud can be relativistically densified and the cloud thus densified becomes the source of ultrastrong electric and magnetic fields, many times stronger than is possible using only externally applied fields. These large fields can then be used to keep ions in a circular orbit, and an accelerator with a circumference of 10 km could accelerate protons up to 10^3 TeV with luminosities up to 10^{33} cm^{-2} sec^{-1}. (6 refs.)

99897 Nuclotron status report. A.M.Baldin, S.A.Averichev, Yu.D.Beznogikh, A.M.Doniagin, E.I.Djachkov, I.B.Issinsky, A.I.Govorov, A.D.Kovalenko, G.G.Khodzhibagijan, L.G.Makarov, A.I.Mikhailov, V.A.Mikhailov, A.I.Pikin, I.N.Semeniushkin, A.A.Smirnov, I.A.Shelaev, B.V.Vasilishin, M.A.Vojevodin, A.G.Zel'dovich, L.P.Zinoviev (JINR, Dubna, USSR), A.A.Vasiliev.

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3247-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

The outline of an accelerator of relativistic nuclei at an energy of 6 GeV/u is presented. The parameters of the accelerator and the characteristics of superconducting magnets with iron-shape magnetic field employed in it are given. (8 refs.)

99898 Overview of CW electron accelerator proposals. B.E.Norum (Dept. of Phys., Univ. of Virginia, Charlottesville, VA, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3250-1 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

Electron beams in the MeV to GeV energy range have been used for nuclear studies for the last thirty years. Existing and proposed high duty factor electron accelerators can be grouped into three categories. First, there are those involving a pulsed accelerator plus a pulse stretcher ring. In these machines short (on the order of 1 μsec) high current pulses are injected into pseudo-storage rings at repetition rates of 100 to 1000 Hz. The second category contains machines based on the microtron concept. The basic microtron consists of a short CW linac located between two 180° dipole magnets. The beam is passed through the linac several times, each time returning to the head of the linac by a trajectory of steadily increasing diameter. The third category (recirculated linac) could be considered as another variation of the microtron. It consists of machines wherein the beam is recirculated several times through a longer CW linac than is used in the microtron. (no refs.)

99899 ELSA, a stretcher and post accelerator for the Bonn 2.5-GeV electron synchrotron. D.Husmann (Phys. Inst., Univ. Bonn, Bonn, Germany).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3252-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

ELSA (electron stretcher and accelerator) operates in two different modes. Up to the maximum energy of the synchrotron it works at a constant magnetic field. The electrons from the synchrotron which runs at 50 Hz repetition rate are injected, stored, and ejected at a constant rate. In this operation mode the macroscopic duty cycle is 95% at least. In the operation mode of post acceleration which is possible up to 3.5 GeV the duty cycle is reduced to 60%. The intensity in this operation mode is 5% of that in the stretcher mode. Higher intensities are available at lower duty cycle. ELSA mainly is dedicated to feed a tagged photon facility. (16 refs.)

99900 Multi-GeV electron linac-pulse stretcher design options. R.C.York, J.S.McCarthy, B.E.Norum (Dept. of Phys., Univ. of Virginia, Charlottesville, VA, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3257-61 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

The linac-pulse stretcher ring system is evaluated as a design for a high duty factor ($>90\%$), intense (240 μA), electron accelerator for operation in the 0.5 to multi-GeV (>4 GeV) region. Options within this system are discussed in light of their predicted initial and operational cost, flexibility, and reliability. The ramifications of the choice of a particular cavity type, accelerating gradient, repetition rate, beam pulse length, and number of beam recirculations for the linac design are discussed both with respect to the linac itself and to the pulse stretcher ring. The pulse stretcher ring concept is analysed in terms of injection schemes (single or multi-turn), extraction methods (half or third integer, chromatic or achromatic), and operation parameters (machine tune and chromaticity). (12 refs.)

99901 The Illinois cascade microtron a proposal for a high duty factor, intermediate energy electron accelerator. L.S.Cardman (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3267-73 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

The Nuclear Physics Laboratory at the University of Illinois currently operates a 6-traversal microtron using a superconducting linac, MUSL-2, which provides 100% duty factor electron beams with energies between 2 and 80 MeV. The author has submitted to the National Science Foundation a proposal to construct a 750 MeV cascade microtron capable of delivering 100% duty factor beams with currents of up to 100 μA. Subharmonic RF splitting of the output beam will provide up to three simultaneous beams for experiments, with independently controllable currents (summing to 100 μA). The proposal also includes two large building additions and the major new experimental equipment needed to exploit fully the research potential of this new accelerator. (19 refs.)

99902 Status report on the normal conducting CW racetrack microtron cascade 'MAMI'. H.Herminghaus, B.Dreher, H.Euteneuer, K.H.Kaiser (Inst. fur Kernphys., Univ. Mainz, Mainz, Germany), M.Kelliher, R.Klein, H.J.Kreidel, M.Loch, U.Ludwig-Mertin, K.Merle, H.Schoeler, R.Schulze, P.Semmel, G.Stephan.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3274-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The first two stages (175 MeV) of the three-stage CW microtron cascade MAMI have been completed. The report concentrates on the design of the 2nd stage which, so far, has not been described in detail elsewhere. First beam had been obtained in February 1983, best beam transmission obtained so far is in excess of 94%, maximum extractable energy achieved so far is 187 MeV. (20 refs.)

99903 The NBS proposal for a one GeV CW racetrack microtron facility. S.Penner (NBS, Washington, DC, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3279-85 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
As part of a joint accelerator research project with the Los Alamos National Laboratory, NBS is now building a 200 MeV, high current, CW racetrack microtron (RTM). This machine will be used to provide CW electron beams to nuclear physics experimenters, and also as the injector for a second stage RTM to boost the final energy to one GeV. A building addition of 35000 square feet will house the second stage RTM and new experimental facilities. Subharmonic RF beam splitting is planned to allow up to three simultaneous beams for experiments, with currents up to 100 μA each. In addition, low and high energy beams at low currents for tagged-bremsstrahlung experiments can be delivered at the same time. (12 refs.)

99904 GEM, ANL 4-GeV CW electron microtron design. R.L.Kustom (Phys. Div., Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3286-90 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A six-sided hexagonal microtron has been chosen as the accelerator to generate the beams required to pursue a national research program at a CW 4 GeV electron laboratory. The basic components of the accelerator include an electron gun, chopper-buncher, a 23 MeV linac injector, a 23-185 MeV racetrack microtron (RTM), an interstage phase space matching section, asubharmonic cavity, a 185-4000 MeV six-sided microtron (hexatron), extraction systems, and various transport lines. The electron energy at the output of the gun will be 100 keV. The beam will be chopped and prebunched at 100 keV. The hexatron will be built with three 35 MeV linacs and six 60° sector bending magnets. The beam optics in the hexatron will use a quadrupole system in the dispersive straight sections. Final extraction will be accomplished by an electrostatic septum followed by a magnetic septum. The extraction septa will be moved between the orbits to select the different energies for extraction. (10 refs.)

99905 The Montreal electron accelerator proposal. G.K.Bavaria, P.Depommier, P.Hinrichsen, H.Jeremie, L.Lessard, J.P.Martin (Lab. de Phys. Nucleaire, Univ. de Montreal, Montreal, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3291-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A 50 MeV CW RTM electron accelerator has been designed at the University of Montreal. The system consists of an electron gun, a chopper-buncher, a preaccelerator and the 50 MeV RTM. The installation is essentially the first phase of what is hoped will one day be a 1 GeV Canadian electron facility. A general outline of the system is presented. The main topics discussed are the various system components, the beam optics calculations and some of the experimental equipment to be used in the proposed nuclear physics research program. (18 refs.)

99906 ALS II: the Saclay proposal for a 2-GeV, CW electron facility. B.Aune, C.Grunberg, M.Jablonka, F.Koechlin, J.Magne, A.Mosnier, B.Phung, F.Netter (CENS, Gif-sur-Yvette, France).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3296-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The transformation of the Saclay electron linac facility (ALS) into a 2 GeV, 100 μA CW electron facility is described. Polarized electrons will be available in the whole energy range. In order to reach the required performances, the linac is rebuilt with new klystrons and with the addition of a partial recirculation. The 100% duty cycle is obtained with a stretcher ring. (9 refs.)

99907 Superconducting materials for particle accelerator magnets. D.C.Larbalestier (Appl. Superconductivity Center, Univ. of Wisconsin-Madison, Madison, WI, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3299-303 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The support given to the production of superconducting composites by the needs of particle accelerators has been continuous over about 15 years, and many decisive advances, such as the development of twisted filamentary composites, have been made with this support. At present, interest appears to be focused on two areas: 5 Tesla conductors for present day accelerators such as the Energy Doubler and Isabelle, and 10 Tesla conductors for future very high energy machines. The Fermilab production program for the Energy Doubler conductor has enabled the costs, reliability, and production aspects of 5 Tesla conductors to be extensively explored with conventional Nb 46.5 wt.%Ti. Applications at 8-10 Tesla will require Nb-Ti or Nb-Ti-Ta at sub-4.2K temperatures or Nb_3Sn. For both conductors there are present developments which appear capable of pushing current densities to higher values. (34 refs.)

99908 A cathode follower power amplifier. S.Giordano, M.Puglisi (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3408-10 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
In circular accelerators and particularly in storage rings it is essential that the total impedance, as seen by the beam, be kept below some critical values. A model of the accelerating system was built using a single ended cathode follower amplifier driving a ferrite loaded cavity. The system operated at 234.5 KHz with a peak output voltage of ±10 kV on the gap. The dynamic output impedance, as measured on the gap, was <15 ohms. (2 refs.)

99909 A linear and nonlinear analysis of high power RF amplifiers. M.Puglisi (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3411-13 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
After a survey of the state variable analysis method the final amplifier for the CBA is analyzed taking into account the real beam waveshape. An empirical method for checking the stability of a nonlinear system is also considered. (3 refs.)

99910 The RF power plant of the SPS. H.P.Kindermann, W.Herdrich, W.Sinclair (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3414-16 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983). (1 ref.)

99911 Determination of the RF leakage field in the vacuum tank of the TRIUMF cyclotron. R.Poirier, D.Dohan, G.Dutto, T.A.Enegren, K.Fong, V.Pacak (TRIUMF, Vancouver, BC, Canada), R.Hohbach.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3514-16 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
In the TRIUMF cyclotron the dees are partially defined by the two halves of the quasi-circular vacuum chamber, which completely contains the 1 MW resonating cavity. A stray electric field or 'RF leakage' exists inside the dees and has occasionally caused problems to probes or other tank equipment. In order to understand the nature of this field a precise 1:10 scale metal model of the entire tank and resonator system has been built and is being investigated. Various resonances have been identified: the push-pull mode at 226 MHz and the push-push mode at 233 MHz; cross modes along the dee gap resonate at 243 MHz and 253 MHz. In the quasi-circular tank region outside of the main resonating cavity the Tm_{310} and Tm_{410} modes are mainly responsible for the configuration of the leakage field since they are closer to the operating frequency. The measurements are in reasonable agreement with the results of numerical relaxation calculation and with measurements in the cyclotron tank. (5 refs.)

99912 A four gap synchrotron RF cavity. W.R.Smythe (Nuclear Phys. Lab., Univ. of Colorado, Boulder, CO, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3517 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A proposed four gap synchrotron cavity is described here. The drift tube (140° long) is rigidly supported by a reentrant conducting structure near each end. Each support structure provides two accelerating gaps. The potential across each gap is approximately the same as the potential between the drift tube and the vacuum tank wall in the central region. The reentrant feature has the effect of a two-turn center tapped transformer, which is achieved in the cavity by passing one current surface through another by means of spokes and holes.

99913 Experience with a 51-MHz, 200-KV, aluminum RF cavity. R.Boni, V.Chimenti, S.Fortebracci, F.Tazzioli, G.Turchetti.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3566-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A 51 MHz, 200 KV, aluminum cavity, in vacuum, has been built, tested and set in operation on the Frascati storage ring. Problems encountered in building, vacuum sealing and conditioning are illustrated. Behaviour on the accelerator is also mentioned. (4 refs.)

99914 Thermal analysis and loss in shunt impedance of the LEP accelerating cell. I.Wilson, H.Henke (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3590-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Basic formulae governing thermal flow in water-cooled solids are given. By calculating the heat dissipation at room temperature of the LEP accelerating cell with the program SUPERFISH and then using this as input to the thermal analysis program DOT, the surface temperatures and losses at full power have been estimated. Good agreement is obtained when these LEP results are scaled and compared with measurements made on similar accelerating structures in PEP and PETRA. The calculated decrease in shunt impedance of 4.2% with respect to the room temperature value has been substantiated by experimental measurements on a prototype LEP cavity. (8 refs.)

99915 Field properties for a 4-GeV microtron sector magnet. K.M.Thompson, M.H.Foss, R.J.Lari (Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3611-13 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The central magnetic field uniformity and field edge shapes have been investigated for a 609 metric ton sector magnet designed for the 4 GeV electron microtron (GEM) at Argonne National Laboratory. The effect of a Purcell-filter on the central field uniformity was studied using the 2D magnetostatic computer program, TRIM. The effects on the shape of the edge field were studied for various geometries of endguard, pole tip shim, shield plate, pole edge shape, and coil. Both 2D and 3D programs were used for these latter studies and all results showed that the proposed design would produce acceptable field qualities. (8 refs.)

99916 Nuclear physics research requirements for electron and heavy ion machines. E.Vogt (TRIUMF, Vancouver, BC, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3684-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
There has been a great deal of interest in a variety of new machines intended to probe atomic nuclei for hadronic and quark aspects which lie beyond the familiar shell model view of nuclei. The author gives the physics perspective within which the proposals for such machines have arisen and discusses the two classes of tools—high energy CW electron machines and relativistic heavy ion machines—which lie at opposite ends of the arsenal being gathered for the pursuit of QCD in nuclei. The electron machines present a reasoned analytic approach to the simplest systems and the heavy ion machines a major thrust for startling new physics in the quark-gluon sea. (13 refs.)

99917 From accelerators to storage rings to ?. W.K.H.Panofsky (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3689-93 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Gives a general but highly subjective overview of the expectation for accelerators and colliders for high energy physics. (no refs.)

99918 Construction of a system for transport and focusing of ion bunches by the CV-28 cyclotron of IEN/Rio. H.E.Wolf, J.Eichler, S.de Barros, L.F.V.Paiva (Dept. de Fisica Nuclear, Inst. de Fisica, Univ. Federal do Rio de Janeiro, Rio de Janeiro, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.4, p.639-62 (Dec. 1982). In Portuguese.
A detailed description of a system of magnetic lenses designed to transport the charged beam of the variable energy, model CV-28 cyclotron of the Instituto de Energia Nuclear is presented. The beam is transported from a switching magnet to a large experiment room. (1 ref.)

99919 Synchrotron radiation from the low-beta quadrupoles scattered back toward the short insertion of LEP. R.Del Fabbro.
Report INFN/AE-83/2, Ist. Naz. Fis. Nucl., Pisa, Italy (18 Feb. 1983), 15 pp.
By Monte Carlo calculation the synchrotron radiation produced by the LEP beam in the low-beta quadrupoles is evaluated. This radiation is simulated to scatter back along the beam pipe toward the short insertion of LEP in the mini-beta version. The back photon flux reaching the experimental insertion is calculated and the corresponding energy and delay time spectra are given as well as the azimuthal distribution. It results that the back-scattered radiation from the low-beta quadrupoles do not appear to be dangerous, mainly because the bulk of this radiation is delayed more than 200 nsec with respect to the crossing time. On the contrary the back radiation coming from the quadrupoles upstream the short insertion could be a more serious source of background. (6 refs.)

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29.25 PARTICLE SOURCES AND TARGETS, PREPARATION AND TECHNOLOGY

(see also 07.77 Particle production and handling; targets)

99920 A new system for astrophysical nuclear reaction studies with radioactive ion beams. R.C.Haight, G.J.Mathews, R.M.White, L.A.Aviles, S.E.Woodward (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.245-7 (1 July 1983).
A beam transport system has been constructed for the production and use of secondary beams of radioactive nuclides for astrophysical nuclear reaction studies. This system is based on six magnetic quadrupole lenses. Beams of ^{7}Be and ^{13}N have been produced in the energy range 15-30 MeV. The cross section of the ^{2}H(^{7}Be, ^{8}B)n reaction is measured to be 58 ± 11 mb at $E_{7\mathrm{Be}} = 16.9$ MeV. (9 refs.)

99921 Mass spectrometric study of the negatively-charged krypton and xenon monofluorides. E.Minehara, S.Abe (Div. of Phys., Tokai Res. Establ., JAERI, Ibaraki, Japan).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.533-7 (1 July 1983).
The negative ion formation of KrF_2 and XeF_2 was studied by using a Penning ion source with radial extraction, and the extraction of KrF^- and XeF^- from the ion source was confirmed by observing the mass spectra of KrF_2 and XeF_2 in the KrF and XeF mass regions, respectively. (7 refs.)

99922 Experiments on a medium charge state duopigatron. Zhou Zhiyi, Chen Miao, Xu Mingjuan, Zhang Shaorong, Sun Chunchang (Shanghai Inst. of Nuclear Res., Acad. Sinica, Shanghai, China).
Nucl. Tech. (China), no.2, p.6-9 (April 1983). In Chinese.
Duopigatron is a medium charge state heavy ion source. The principle, construction, test system and some experimental results are given. 1-5+ charge state argon ions and 1-3+ nitrogen ions can be observed in the ion mass spectrum. The effects of the magnetic field of the source, the gas pressure, the arc voltage and extraction voltage on the ion current and their charge state are measured and discussed. (5 refs.)

99923 The slowdownatron: A suggestion for increasing stopping rates by using shaped magnetic field and absorbers. M.K.Sundaresan, P.J.S.Watson (Dept. of Phys., Carleton Univ., Ottawa, Ontario, Canada).
Can. J. Phys. (Canada), vol.61, no.8, p.1184-91 (Aug. 1983).
The authors suggest the possibility of combining a momentum separator, consisting of a uniform magnetic field at right angles to a beam of particles, with a shaped absorber to obtain enhanced stopping rates. It is shown that by suitably shaping the magnetic field, one can obtain a form of linear focusing and derive the relevant equations for the magnetic field and absorber. Straggling is taken into account. The authors show that with certain (optimistic) assumptions the device could give three orders of magnitude improvement in stopping rates. Other problems are outlined, and finally they discuss what such a device could be used for. (7 refs.)

99924 Conceptual magnet design for an iron-free colliding beam accelerator. C.Taylor, R.B.Meuser (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2042-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Superconducting accelerator magnets usually have magnetic iron yokes to obtain maximum magnetic field and to limit stray field. However, the iron is expensive and heavy. The smaller size and weight of an iron-free magnet can result in lower magnet and refrigeration costs. However, in a colliding beam accelerator the stray field from one ring produces aberrations in the field in the other. A way to eliminate this mutual interference is to surround each magnet with a coil that exactly cancels the field from the other ring magnet. That is expensive in terms of superconductor requirements. However, the cancellation of the external dipole field component is unnecessary. Only a small amount of superconductor is required for cancellation of the higher-order field-aberration components. Parameters for the iron-free magnet concept are investigated, and a preliminary conceptual design for an accelerator is presented. (3 refs.)

99925 Possibility of accelerating the light nucleus by KEK proton synchrotron. M.Kondoh, K.Muto (Nat. Lab. for High Energy Phys., Ibaraki-ken, Japan).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2045-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
An accelerating method of the light nuclei with charge-mass ratio of 1/2 by use of the proton synchrotron system of KEK, is described. The description is mainly on the ring accelerator system and the ion source is excepted. As the velocities of the extracted nuclear beam from the linac and from the booster synchrotron are half the present protons in this method, wider range of accelerating frequency than the present one is necessary for the ordinary acceleration method in the main ring synchrotron. To avoid much modification in RF system coming from the extension of frequency range, a method called multi-stage acceleration is applied. (1 ref.)

99926 The lattice design of the LEP electron positron accumulator (EPA). J.P.Delahaye, A.Krusche (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2050-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
In large accelerators, the lattice cell is generally made as simple as possible. Special requirements are then fulfilled by appropriate insertions (dispersion suppressors, low β schemes, wigglers, etc.). In small machines, where space is limited, the lattice cell itself has to deal with all the machine constraints and requirements. The lattice design method developed consists of splitting the superperiod into specialized sections. Each section is built up to fulfil some of the basic requirements, then matched to the neighbouring sections. The best parameter values are deduced from systematic variation in the analytical expression of the corresponding beam transfer matrix. Applied to the LEP electron positron accumulator (EPA), this method was very efficient in optimizing a large number of constraints. (7 refs.)

99927 ASPUN, design for and Argonne super intense pulsed neutron source. T.K.Khoe, R.L.Kustom (Phys. Div., Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2086-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Argonne pioneered the pulsed spallation neutron source with the ZING-P and IPNS-I concepts. IPNS-I is now a reliable and actively used source for pulsed spallation neutrons. The accelerator is a 500 MeV, 8-9 μa, 30 Hz rapid cycling proton synchrotron. Other proton spallation sources are now in operation or in construction. These include KENS-I at the National Laboratory for High Energy Physics in Japan, the WNR/PSR at Los Alamos National Laboratory in the USA, and the SNS at the Rutherford Appleton Laboratory in England. Newer and bolder concepts are being developed for more intense pulsed spallation neutron sources. These include SNQ at the KFA Laboratory in Julich, Germany, ASTOR at the Swiss Institute for Nuclear Physics in Switzerland, and ASPUN, the Argonne concept. ASPUN is based on the Fixed-Field Alternating Gradient concept. The design goal is to provide a time-averaged beam of 3.5 ma at 1100 MeV on a spallation target in intense bursts, 100-200 nanoseconds long, at a repetition rate of no more than 60 to 85 Hz. (8 refs.)

99928 Performance of the intense pulsed neutron source accelerator system. C.Potts, F.Brumwell, A.Rauchas, V.Stripp, G.Volk (Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2131-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The intense pulsed neutron source (IPNS) facility has now been operating in a routine way for outside users since November 1, 1981. From that date through December 1982, the accelerator system was scheduled for neutron science for 4500 hours. During this time the accelerator achieved its short-term goals by delivering about 380,000,000 pulses of beam totaling over 6×10^{20} protons. The changes in equipment and operating practices that evolved during this period of intense running are described. The intensity related instability threshold was increased by a factor of two and the accelerator beam current has been ion source limited. Plans to increase the accelerator intensity are also described. Initial operating results with a new H^- ion source are discussed. (7 refs.)

99929 Remote handling and accelerators. M.T.Wilson (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2138-41 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The high-current levels of contemporary and proposed accelerator facilities induce radiation levels into components, requiring consideration to be given to maintenance techniques that reduce personnel exposure. Typical components involved include beamstops, targets, collimators, windows, and instrumentation that intercepts the direct beam. Also included are beam extraction, injection, splitting, and kicking regions, as well as purposeful spill areas where beam tails are trimmed and neutral particles are deposited. Scattered beam and secondary particles activate components all along a beamline such as vacuum pipes, magnets and shielding. Maintenance techniques vary from 'hands-on' to TV-viewed operation using state-of-the-art servomanipulators. Bottom- or side-entry casks are used with thimble-type target and diagnostic assemblies. Long-handled tools are operated from behind shadow shields. Swinging shield doors, unstacking block, and horizontally rolling shield roofs are all used to provide access. (22 refs.)

99930 Long distance wideband optical fibre links for accelerator synchronization. H.H.Beger, D.Boussard (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2152-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The proper performance of a large scale accelerator complex like the CERN network of machines, requires the transmission, over long distances, of precise timing pulses. In most cases the timing pulses are derived from a master clock, and therefore the ultimate time accuracy of the pulses is determined by the quality of the transmission of the clock frequency itself. A similar problem arises when several accelerating stations are distributed around a large accelerator, or when two machines need to be synchronized RF-wise. In all cases the transmission of a CW wave in the frequency range of several hundred MHz over distances up to several kilometres is the key to a proper synchronization. The classical solution, using coaxial cables, is getting more and more difficult and costly, as the frequency and the length of the link increase. In this context the use of optical fibres as transmission media offers an attractive alternative, and indeed a 4 km link was installed in 1978 between the CERN SPS and its injector for the purpose of synchronizing the two machines. The authors report the technical performance of this particular link in terms of frequency response, signal to noise ratio and long-term stability. (10 refs.)

99931 The slotted coax as a beam electrode. G.R.Lambertson, K.J.Kim, F.V.Voelker (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2158-60 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The slot coupled TEM line has been employed at CERN as a pick up electrode in the GHz range. It is a compact and broad band device, and will be quite attractive if the coupling efficiency is competitive with an array of quarter wave loops. The authors study various properties of such a structure. They have analyzed the slot-coupled TEM line using simplifying assumptions. The results are in rough agreement with the tests carried out with a 50-slot model coupler. The experiments are still in a preliminary stage, and a more thorough investigation is necessary to understand the limitations of the simple theory. (7 refs.)

99932 Single bunch profile measurement using synchrotron light from an undulator. J.Bosser, L.Burnod, R.Coisson, E.D'Amico, G.Ferioli, J.Mann, F.Meot (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2164-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
For protons with energies up to 400 GeV classical theory shows that the critical energy of the synchrotron radiation due to the constant field of the bending magnets is in the far infrared with a negligible part in the visible light spectrum. However it was shown that the magnetic field discontinuity at the edges of the bending magnets shifts the spectrum to the visible region where the normal light detectors can be used. For the use of the SPS as a proton-antiproton collider at 270 GeV with p bunches having 10^{10} to 10^{11} particles and $\bar{p}$ bunches having 10^9 to 10^{10} particles, it was necessary to enhance the synchrotron light by an undulator and to develop a more sensitive and gated detector to get p and $\bar{p}$ single bunch profiles. (10 refs.)

99933 Single pass antiproton beam diagnostics of the CERN PS accelerator complex. G.Cyvogt, B.Frammery, A.Krusche, R.Maccaferri, M.Ruette, G.C.Schneider, E.Schulte (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2167-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The beam characteristics of every $\bar{p}$ bunch in the transfer lines and the CPS can be acquired by various monitors during a single pass and the information stored. The signals emanate from high sensitivity transformers, pick-ups, secondary emission grids and TV screens. After fast analysis and treatment the beam intensity, trajectory (positions), shape, transverse and longitudinal distributions are displayed in analog and/or digital form. Multiple shot storage is provided for some of these parameters. The paper describes the monitors and the signal processing, gives the special features of the storage systems, and presents typical results. (6 refs.)

99934 Computer modeling of the klystron. P.J.Tallerico, B.E.Carlsten (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2170-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A self-consistent ring model of the klystron interaction is being developed for use as a design tool, with the initial goal of improving the LAMPF klystrons to conserve electrical energy. A mathematical model that includes large-signal effects, relativity, harmonic and fundamental cavities, extended cavity fields, and self-consistent calculations of the induced currents is being developed. The model is self-consistent because the gap fields are calculated interactively, because the currents that drive the cavities are not known until after the beam traverses the cavities. Several test cases have been run, and the basic theory and results to data are discussed. (5 refs.)

99935 Reducing ferrite tuner power loss by bias field rotation. W.R.Smythe (Nuclear Phys. Lab., Univ. of Colorado, Boulder, CO, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2173-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
It has been suggested that ferrite tuners for RF cavities with the magnetic bias field perpendicular to the RF magnetic field would have greatly reduced RF losses. A simple model proposed allows the calculation of tuning characteristics for a variety of bias schemes. The model shows that the perpendicular bias scheme requires very much larger bias levels than does the parallel bias scheme in order to achieve the same tuning range with a particular ferrite tuner. However, further investigation with the model has led to the discovery that the use of perpendicular bias at low frequency and parallel bias at high frequency requires only a modest increase in the bias field. In effect, the ferrite is kept highly magnetized, reducing ferrite losses, and is tuned primarily by rotating the bias field direction with respect to the RF field direction. The resulting reduction in dissipation can significantly reduce the amount of ferrite required per cavity. (3 refs.)

99936 Polarimeters for the AGS polarized proton beam. D.G.Crabb, B.Bonner, J.Buchanan, J.A.Bywater, P.R.Cameron, M.Fujisaki, M.E.Hejazifar, A.D.Krisch, S.L.Linn, A.Perlmutter, G.Phillips, L.G.Ratner, J.Rice, J.B.Roberts, K.M.Terwilliger (Dept. of Acceleration, Associated Univs. Inc., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2176-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The report describes the three polarimeters which will be used to measure the beam polarization at the AGS polarized beam facility. The beam polarization will be measured before injection into the AGS, during acceleration, and after extraction from the AGS. The 200 MeV polarimeter uses scintillation counter telescopes to measure the asymmetry in p-carbon inclusive scattering. The internal polarimeter can measure the beam polarization at up to five selected times during acceleration. A continuously spooled nylon filament is swung into the beam at the appropriate time and the asymmetry in pp elastic scattering measured by two scintillation counter telescopes. This is a relative polarimeter which can be calibrated by the absolute external polarimeter located in the 'D' extracted beam line. This polarimeter uses scintillation counters in two double-arm magnetic spectrometers to measure clearly the asymmetry in pp elastic scattering from a liquid hydrogen target. The specific features and operation of each polarimeter are discussed. (1 ref.)

99937 An ionization profile monitor for the Brookhaven AGS. H.Weisberg, E.Gill, P.Ingrassia, E.Rodger (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2179-81 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A non-destructive internal emittance device has been built for the AGS, with separate units to measure the horizontal and vertical profiles of the circulating beam. Positive ions from collisions of the beam with background gas are collected in a 3-kV/cm electric field onto a 64-channel parallel strip detector. Because positive ions rather than electrons are collected, profile broadening due to space charge is small. Tests indicate that a quantitative, reproducible and accurate measurement of beam size throughout the acceleration cycle is provided. (7 refs.)

99938 Continuous tune measurements using the Schottky detector. T.Linnecar, W.Scandale (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2185-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A continuous measurement of the betatron tune has been implemented in the SPS $p\bar{p}$ collider with hardware normally used for the detection of Schottky noise. Suitable values for the tunes and chromaticities are thus more easily achieved in a machine where the strong space charge effects of the two counter-rotating beams severely reduce the available space in the resonance diagram. The basic idea is to monitor the frequency of one of the betatron lines, f_β, together with the revolution frequency and to deduce the tune ν according to the formula $f_\beta=(n+\nu)f_{rev}$. The betatron lines which naturally appear as noise signals adding incoherently, are strongly enhanced by exciting the beam at the required frequency with a kicker. The whole system then forms a closed loop in which an oscillator excites the beam producing a coherent signal at the Schottky detector, this signal providing the reference to lock the oscillator frequency. The excitation, 50 W at 10.7 MHz causes particle loss (~3%/cycle) and emittance blow-up (~10%/cycle) restricting the use of the apparatus to setting-up periods. (1 ref.)

99939 A measurement of the transverse particle distribution in the presence of the beam-beam interaction. G.Decker, R.Talman (Lab. of Nuclear Studies, Cornell Univ., Ithaca, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2188-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The beam-beam interaction in e^+e^- storage rings causes significant beam size enhancement limiting the attainable luminosity. It is important to understand this effect, in particular the resulting particle distribution shape. Measurements at CESR have been made using an 'active' probe to obtain horizontal beam profiles and detailed information regarding the vertical distribution tail shape. An estimate of the effect of the probe on the beam is given and results are presented. (3 refs.)

99940 Beam diagnostic instrument at CESR. D.Rice, G.Aharonian, K.Adams, M.Billing, G.Decker, C.Dunnam, M.Giannella, G.Jackson, R.Littauer, B.McDaniel, D.Morse, S.Peck, L.Sakazaki, J.Seeman, R.Siemann, R.Talman (Cornell Univ., Ithaca, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2190-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Describes various beam diagnostic devices in use at CESR, an 8 GeV electron-positron storage ring operating primarily in the 4.7 to 5.5 GeV beam energy range. Getting the last 20% of performance depends to some extent on empirical tuning and appropriate presentation of various parameters is very important. Several devices are most useful in machine studies. The authors describe their operation. The individually regulated quadrupoles in CESR provide unique opportunities for lattice measurements and calibration of beam position monitors. (6 refs.)

99941 Fast lifetime measurements of stored e^+/e^- single bunches in PETRA and DORIS II utilizing the AC-signals of simple beam current transformers. W.Radloff, W.Kriens (DESY, Hamburg, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2193-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A monitor for fast lifetime measurements has been developed and successfully tested. The monitor pick-up consists of a standard broadband transformer device in a ring position with equidistant bunch spacing. It has an upper cut-off frequency of about 4 MHz which allows to measure simultaneously the lifetimes of up to 8 individual bunches in PETRA (2 in DORIS II). In the electronic section the AC-signals are separated, baseline-restored, stretched and finally digitized in a highly stable 15 bit AD-converter. The output data are fed then into a microprocessor that computes the average currents and their time derivatives. As a result lifetimes of up to 5×10^4 s can be measured in less than 2 seconds. Some measurements are reported. (6 refs.)

99942 Further development of instrumentation for the Tevatron beam dump. E.Harms, B.Hendricks, T.L.Williams (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2196-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Circuitry has been developed for remote monitoring of the Tevatron beam dump instrumentation package. This package includes an x-y beam position detector, calorimeters, and temperature sensing devices. Details of the electronics design as well as expected response to beam-on conditions are presented. (4 refs.)

99943 Applications of FASTBUS to beam diagnostics and experiment data systems. D.R.Machen (Sci. Systems Internat., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2328-30 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The author discusses the near-term use of FASTBUS in accelerator beam-diagnostics instrumentation systems, where an extra increment in system throughput and front-end processing speed can produce a greater understanding of the physical phenomena under study. The arguments and conclusions may be equally well applied to other similar data-handling problems requiring high bandwidth in the data system. (3 refs.)

99944 The Multiwire Secondary Emission Monitor and the emittance measurement of the AGS beam. W.T.Weng, I-H Chiang, G.A.Smith, A.Soukas (Accelerator Dept., Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2331-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A set of three stations of Multiwire Secondary Emission Monitor (MSEM) has been built and installed in the fast external beam line for the measurement of beam profiles. Each unit consists of two planes each with 30 nickel wires having a diameter of 5 mils. The signal is linear within the range of 10^{10} to 10^{13} incident protons on the wire and the resolution of the signal is well within a few percent. A least-square fitting routine has been used to extract the emittance and phase space parameters of the beam. The emittances obtained at various intensities will help one to understand the AGS acceleration process and to choose the optimal injection scheme for CBA. (4 refs.)

99945 On stochastic cooling of bunches in the colliding beam mode in high energy p-p storage rings. S.Chattopadhyay (SPS Div., CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2334-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Possible cooling rates for stochastic cooling of intense bunches of protons and antiprotons in the colliding beam mode in the Fermilab Tevatron and the CERN SPS $p\bar{p}$ colliders are estimated, based solely on the bandwidth of the cooling system and the phase-space structure of the bunches and found to be a few tens of hours for high frequency large bandwidth feedback systems typically in the 8-16 GHz range and higher. The feasibility of even such slow cooling schemes will depend on successful design of pick-ups, kickers and novel signal processing schemes in this high frequency regime, all of which demand detailed study. (4 refs.)

99946 A theoretical model and computer simulations to describe diffusion enhancement by the beam-beam interaction. D.Neuffer, A.Riddiford, A.Ruggiero (Fermilab, Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2430-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Several observers have speculated that the simultaneous presence of diffusion processes and the beam-beam interaction may lead to enhanced diffusion or beam loss greater than that present with either diffusion or the beam-beam interaction alone. To test those ideas the authors have developed analytical and numerical methods to estimate the magniutde and variation of this enhancement. They find substantial agreement between simulation results and theoretical model that describes diffusion enhancement caused by a major resonance located within the beam. They present results of beam-beam simulations with random diffusion which systematically cover fractional tunes between 0.0 and 0.5 and tune shifts between 0.0 and 0.10. Their theoretical model is tested systematically, and is found to provide an adequate approximate description of the phenomena. (8 refs.)

99947 Study of periodic tune modulation with the beam-beam effect. D.Neuffer, A.Riddiford, A.G.Ruggiero (Fermilab, Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2433-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Simulations of weak-strong $p\bar{p}$ collisions with a periodic tune modulation show the possibility of beam blowup at sufficiently strong modulation amplitudes. This beam blowup is associated with the appearance of nonrepeatable 'chaotic' trajectories and occurs when low order resonances are crossed by the modulation. The authors report results of an investigation of the dependence of this blowup upon the modulation frequency, with the modulation amplitude fixed. It is determine that a threshold frequency exists and modulations at frequencies greater than the threshold do not lead to beam blowup. (2 refs.)

99948 Analytic estimates for the dynamic aperture of nonlinear lattices. K.J.Adams (Lab. of Nuclear Studies, Cornell Univ., Ithaca, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2436-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
For an accelerator lattice containing non-linear elements, particle amplitudes outside a 'dynamic aperture' are unstable. An analytic procedure for estimating this aperture not depending on resonance assumptions is described. The amplitude x(N) aftr N iterations is expanded in powers of the initial amplitude x_0. Low order coefficients are obtained using the symbolic algebraic manipulation program REDUCE. For intermediate values of N (e.g. 100) these terms give an asymptotic description which, by particle tracking, is shown to be valid. This leads to an estimate of the dynamic aperture and to its possible enlargement. (2 refs.)

99949 MARYLIE: the Maryland Lie algebraic transport and tracking code. D.R.Douglas, A.J.Dragt (Univ. of Maryland, College Park, MD, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2442-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
MARYLIE is a FORTRAN-language beam transport and tracking code developed at the University of Maryland. It employs algorithms based on a Lie algebraic formalism for charged particle trajectory calculations, and is designed to compute transfer maps for and trace rays through single or multiple beam-line elements. This is done without the use of numerical integration or traditional matrix methods; all nonlinearities (including chromatic effects) through third (octupole) order are included. Thus, MARYLIE includes effects one order higher than those usually handled by existing matrix-based programs. (3 refs.)

99950 Investigation of stochastic beam growth with a nonlinear lens. M.Cornacchia, L.R.Evans, W.Kalbreier, H.K.Kuhn, S.Peggs (European Organisation for Nuclear Res., Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2454-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The problem of the onset of stochastic motion in a non-linear system is of considerable importance for the understanding of the long-time stability of beams in hadron storage rings in the presence of strong high-order nonlinear resonances. A nonlinear lens has been installed in the SPS in order to simulate resonances driven by the beam-beam effect or by magnetic field imperfections in superconducting storage rings. A criterion for the onset of stochastic motion is derived and compared with the results of computer simulations and of experiments performed on the machine. (4 refs.)

99951 Beam-beam synchrobetatron resonances. S.G.Pegs (European Organisation for Nuclear Res., Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2457-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Electron storage rings see dangerous beam-beam synchrobetatron sidebands which are almost invisible to single beams, for example the diagonal resonances $Q_z\text{-}Q_x=mQ_s$. Colliding protons and antiprotons in the SPS do not see diagonal sidebands, despite the absence of stabilisation by radiation damping. The report uses a strong-weak numerical simulation to show that an apparent tune modulation, induced by longitudinal collision point oscillations can cause synchrobetatron sidebands, to a distance of about $2Q_s$ from a beam-beam resonance. The concurrent analytic description illustrates several reasons why flat beams behave quite differently from round beams and why the SPS is so resonance free. Transverse electron trajectories can become stochastic beyond a critical longitudinal amplitude limit, making microbeta optics unstable. Round beam-beam sidebands are found to be stronger near $Q_z=2/3$ than near the diagonal. Chromaticity is more dangerous to the SPS as a source of (real) tune modulation, than the modulation due to collision point oscillations. (6 refs.)

99952 The lattice design and tolerance analysis of the CBA transport line. W.T.Weng (Accelerator Dept., Associated Univs. Inc., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2463-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The beam transport line from the AGS to CBA is 600 m long and consists of 70 bending magnets and 20 quadrupoles, as well as several special injection components. The beam has to bend 117 horizontally and drop 1.8 m in elevation. To insure that it has momentum acceptance of $\Delta P/P=\pm1\%$ and the transverse emittance dilution is within 30%, a detailed tolerance analysis has been carried out on the requirements of the AGS beam properties, magnetic field quality of the transport magnets, and misalignment errors. Field quality tolerances of $\Delta B_0/B<1\times10^{-3}$ for bending field, $\Delta G/G<5\times10^{-3}$ for gradient field and $\Delta B_2/B<2.5\times10^{-4}$ cm^{-2} for the sextupole components in the bending magnets are indicated. (4 refs.)

99953 The Fermilab Tevatron I debuncher ring. A.G.Ruggiero (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2478-80 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The Fermilab Tevatron I project includes two rings. One is an accumulator ring where subsequent pulses of antiprotons are accumulated by stochastic momentum stacking and the other is the debuncher ring. The author describes the design of the debuncher. The lattice of the debuncher has been designed with tree goals. First, the ring must fit closely around the accumulator.

Second, the lattice must be able to satisfy the primary function of the ring, which is bunch rotation and debunching of an antiprotoon beam before it is transferred to the accumulator. Finally, fast betatron stochastic cooling in two seconds must be included to keep the accumulator aperture as small as possible. (6 refs.)

99954 Errors in radio-frequency quadrupole structures. W.P.Lysenko (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2481-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Performance degradation caused by certain radiofrequency quadrupole (RFQ) machine errors was studied using an efficient 3-D particle tracing simulation code for a high-brightness example. Matched beams, for which no emittance growth occurs, exist for periodic structures and were used as input beams for particle tracing in the presence of errors. The author considered both slowly varying and fast (random) errors that destroy periodicity. Random dipole errors cause emittance growth because of the mismatches they introduce and also result in a motion of the beam centroid that causes a reduction in acceptance. Because of the way RQFs are manufactured, the random error amplitudes can be kept below harmful levels. More important are the slow errors, which are harmful because they reduce acceptance even though they maintain a match. Slow dipole errors steer the beam toward the wall, and voltage deficiencies cause instabilities in the longitudinal direction resulting in particles not being accelerated to full energy. (5 refs.)

99955 TBCI and URMEL—new computer codes for wake field and cavity mode calculations. T.Weiland (DESY, Hamburg, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2489-91 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Wake force computation are most important for any study of instabilities in high current accelerators and storage rings. These forces are generated by intense bunches of charged particles passing cylindrically symmetric structures on or off axis. The adequate method for computing such forces is the time domain approach. The computer Code TBCI computes for relativistic as well as for nonrelativistic bunches of arbitrary shape longitudinal and transverse wake forces up to the octupole component. TBCI is not limited to cavity-like objects and thus applicable to bellows, beam pipes with varying cross sections and any other nonresonant structures. For the accelerating cavities one also needs to know the resonant modes and frequencies for the study of instabilities and mode couplers. The complementary code named URMEL computes these fields for any aximuthal dependence of the fields in ascending order. The mathematical procedure being used is very safe and does not miss modes. Both codes together represent a unique tool for accelerator design. (25 refs.)

99956 Longitudinal instabilities with a non-harmonic RF potential. S.Erinsky, J.M.Wang (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2492-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The authors consider the longitudinal instabilities of a bunched beam subject to a nonharmonic RF potential. Assuming the unperturbed bunch to be described by a Maxwell-Boltzmann distribution, their treatment is based upon the linearized Vlasov equation. The formalism developed is exact and, in particular, correctly describes the effect of the dependence on amplitude of the synchrotron oscillation frequency. They discuss the fast blowup limit, and extend Wang and Pellegrini's (1980) treatment of the microwave instability to include the case of a non-Gaussian bunch. Next, within the short bunch approximation, they derive the dispersion relation describing the Landau damping of the coupled bunch modes, resulting from the use of a Landau cavity. (8 refs.)

99957 Longitudinal instabilities of long Gaussian bunches. S.Krinsky, J.M.Wang (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2495-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The authors present an overview of the longitudinal instabilities of Gaussian bunches subject to a harmonic RF potential. Their emphasis is on the behavior of long bunches having lengths greater than the wavelength of the perturbing electromagnetic fields. They exhibit the crossover between the dominance of the synchrotron modes and the coating-beam-like distortions of the bunch distribution, which occurs as the real or imaginary part of the coherent oscillation frequency becomes large compared to the synchrotron oscillation frequency. For a narrow band impedance the growth rate of the coasting-beam-like modes is determined by the average beam current, and for a broad band impedance the growth rate is determined by the peak current. They discuss the transition between these two regimes by considering the growth rate as a function of the bandwidth of the impedance. (4 refs.)

99958 A common transverse feedback damper for two beams during a stacking cycle. J.M.Wang (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2498-500 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
During the stacking cycle at a proton storage ring, it often occurs that coasting and bunched beams coexist, rotating in the same direction. The problem of the two beams oscillating coherently with each other is formulated and discussed. The author demonstrates that when the tune distribution is dominated by the sextupole contribution, one common transverse dipole feedback system is enough to damp both the coasting beam and the bunched beam instabilities. (9 refs.)

99959 Threshold behavior for longitudinal stability of induction linac bunches. J.Bisognano, I.Haber, L.Smith (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2501-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The induction linac bunches of heavy ion fusion scenarios are strongly influenced by the longitudinal space charge impedance. This is in distinct contrast to relativistic bunches in storage rings where most of the data on stability have been obtained. Simulation results reveal that when space charge effects are large, the stability requirement of small growth rate relative to the synchrotron frequency for relativistic bunches is replaced by the relaxed condition of small growth rate relative to the frequency spacing of the space charge wave modes on the bunch. Dispersive effects from finite pipe size tend to make the lower frequencies less susceptible to instability than higher frequencies. Since induction modules have a high resistive component only for the lowest bunch modes, stability is better than would occur for a broadband impedance of comparable magnitude. These results indicate that long term longitudinal bunch stability is realizable for induction linac drivers for heavy ion fusion. (5 refs.)

99960 Stabilization of longitudinal modes in a high current betatron. E.P.Lee, A.Faltens, L.J.Laslett, L.Smith (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2904-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The momentum spread required to stabilize longitudinal modes in a proposed high current betatron is computed. (5 refs.)

99961 Beam breakup (BBU) instability experiments on the Experimental Test Accelerator (ETA) and predictions for the Advanced Test Accelerator (ATA). G.J.Caporaso, A.G.Cole, K.W.Struve (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2507-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
In linear accelerators the maximum achievable beam current is often limited by the beam breakup instability. This instability arises from the interaction of a transversely displaced beam with the dipole modes of the accelerating cavities. The modes of interest, the TM_{1n0} modes, have non-zero transverse magnetic fields at the center of the cavity. This oscillating field imparts a time varying transverse impulse to the beam as it passes through the accelerating gap. Of the various modes possible only the TM_{130} mode has been observed on the Experimental Test Accelerator and it is expected to surface on the Advanced Test Accelerator. (4 refs.)

99962 A simple method for damping transverse motion of a high intensity electron beam. D.S.Prono, G.J.Caporaso, J.C.Clark, E.J.Lauer, K.W.Struve (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2510-12 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Describes a simple electrostatic focusing method which efficiently damps transverse motion of a high intensity (both high current and high particle energy) electron beam. The principle is to create an electrostatic central force anharmonic potential field which phase mix damps transverse beam motion into increased beam emittance. The nonlinear electrostatic field is created by a very resistive wire (L/R time ~ 2 ns) strung axially down the accelerator vacuum pipe. Positive image charge equal to $\sim 1/2$ the negative beam charge is induced onto the wire. Since the beam self fields cancel to within $1/\gamma^2$, the resultant wire electric field dominates. Experimental results showing the guiding, focusing and damping of transverse motion are presented. (5 refs.)

99963 Beam breakup instability in RF linacs. F.S.Felber, D.Mitrovich, R.K.Cooper, P.B.Wilson (Western Res. Corp., San Diego, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2513-15 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Analytic and numerical calculations of the beam breakup instability in RF linac cavities are presented. Analytic calculations for single bunch beam breakup in pillbox cavities show that beam deflection x scales with initial deflections x_0, charge per bunch Q, accelerating gradient E_a, accelerator length z, and cavity wavelength λ as $x = x_0[1 + (Qz/\Sigma_0 E_a(0.4\lambda)^3)]$. This scaling is generalized to include the effects of periodic focusing on transverse emittance growth. Numerical simulations of multibunch beam breakup show growth of beam deflection amplitude from wake fields generated by preceding bunches. Wake field calculations using a transverse beam cavity interaction code are presented. (3 refs.)

99964 Comparison of delta function and Gaussian wakes for longitudinal tracking. D.Brandt (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2516-18 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The longitudinal motion of bunched beams in large storage rings has been simulated in synchrotron phase space, including the effects of wake-fields excited by the bunches themselves in the RF cavities. Using the delta-function wake-potential of the cavities requires a great deal of computing time and, in addition, the results depend on the number of superparticles considered. The computing time can be strongly reduced by using tables of wake potentials of a fixed bunch shape. The author investigates the case where the distribution is assumed to be Gaussian. The validity and limitations of this model as function of the beam intensity are analysed by evaluation of higher moments of the distribution (variance, skewness, kurtosis). This shows that the assumption of the shape remaining Gaussian is insufficient and yields misleading results when the beam current is too high. This phenomenon appears to be related to the manifestation of turbulence in the beam. (6 refs.)

99965 Limitations of bunch-current in LEP by transverse mode-coupling. B.Zotter (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2519-21 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The most severe limitation of beam-current in LEP will be a fast transverse instability of single bunches, which can be explained as coupling of transverse modes. These predictions are verified with experimental data from several operating machines. The dependence of the threshold on beam and machine parameters is investigated in order to optimize the performance of LEP. (5 refs.)

99966 Transverse instabilities in the Daresbury SRS. A.Jackson, N.Marks, M.W.Poole, G.Saxon, V.P.Suller, R.P.Walker (SERC, Daresbury Lab., Daresbury, Warrington, England).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2522-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Transverse instabilities can limit the achievable beam current in the SRS storage ring both in the single bunch mode and in the multibunch mode. It is shown that these instabilities originate in higher order modes in the accelerating cavities. The threshold of these instabilities can be greatly increased by the use of octupole fields. (5 refs.)

99967 The experimental study of a higher harmonic RF system in PETRA. R.D.Kohaupt (DESY, Hamburg, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2525-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
At the natural bunchlength the single bunch currents in PETRA are limited by satellite resonances and a new vertical instability, which causes a vertical blow-up of a particle bunch if the single bunch current reaches the threshold value of that instability. The 'PETRA instability' was explained in terms of head-tail mode coupling and according to this model the vertical blow-up was cured by bunchlengthening changing the longitudinal damping partition. The disadvantage of this kind of bunchlengthening is the increase of energy spread leading to a reduction of quantum life time during energy ramping. The satellite resonances are avoided by a careful steering of the longitudinal and

transverse tunes. A more effective method of bunchlengthening is the use of a higher harmonic RF system. Such a system was installed in PETRA. With the higher harmonic RF system the threshold current of the vertical 'PETRA instability' could be increased from 3 mA (natural bunchlength) to 15 mA (withhigher harmonic RF system). Besides bunchlengthening the higher harmonic system leads to a considerable reduction of satellite effects in the range of normal PETRA tunes. (4 refs.)

99968 Analytic and numerical studies of the modified betatron. T.P.Hughes, M.M.Campbell, B.B.Godfrey (Mission Res. Corp., Albuquerque, NM, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2528-30 (Aug. 1983).

(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

The modified betatron concept has been proposed as a means of accelerating high current (kilo amp) electron beams to high energy. This device employs a toroidal magnetic field to overcome the space-charge limit on the current in a conventional betatron at low energy. The authors look at the injection, equilibrium and stability of the modified betatron. The main emphasis is on stability. An analytic dispersion relation is derived using a cold-fluid model of the beam. The results are compared to three-dimensional simulations performed with the electromagnetic PIC code IVORY. The nonlinear development of the negative mass instability is followed in the simulations. (12 refs.)

99969 Beam breakup instabilities in high current electron beam racetrack induction accelerators. B.B.Godfrey, T.P.Hughes (Mission Res. Corp., Albuquerque, NM, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2531-3 (Aug. 1983).

(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

Beam breakup and negative mass instability growth rates for a 1 kA, 40 MeV electron beam racetrack induction accelerator are computed. The device is taken to have four acceleration gaps, each with 0.2 MeV applied voltage and 15 ohm transverse impedence; the guide field is 2 kg. The authors find that the total amplification of the beam breakup mode is limited to five e-foldings provided that the cavity mode quality factor Q is 6. Thus, the negative mass instability, which grows several times faster, is the dominant consideration. However, they also find that the energy range over which the negative mass instability occurs can be narrowed substantially by reducing the guide field strength after the beam has been accelerated to about 12 MeV. This approach, coupled with beam thermal effects, not considered here, probably is sufficient to limit negative mass growth to acceptable levels in the racetrack accelerator. (11 refs.)

99970 A probability function to fit radial distributions in PARMILA simulation beams. G.P.Boicourt (Los Alamos Nat. Lab., Los Alamos, NM, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2534-6 (Aug. 1983).

(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

Proton or deuteron beams in linear accelerators have halos much too large to be described by the normal distribution. When the beam core is fitted to a normal distribution, the actual amount of beam past a given number of standard deviations is orders of magnitude above the normal distribution prediction. Knowing the distribution obeyed by beams would be helpful in evaluating beam spill using computer codes. Toward this end, a probability distribution has been found that fits PARMILA-generated radial beam distributions. The fitting distribution is a mixture of two generalized gamma distributions and fits both the beam core and the tail reasonably well. Its predictions in the halo region are substantially larger than normal distribution predictions. The distribution is described, examples of fits are given, and the ability to fit the tail is discussed. (3 refs.)

99971 Progress of experiment to study the limitations to beam transport in a periodic solenoid focusing channel. J.D.Lawson (Rutherford Appleton Lab., Chilton, England), E.Chojnacki, P.Loschialpo, W.Namkung, C.R.Prior, T.C.Randle, D.H.Reading, M.Reiser.

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2537-9 (Aug. 1983).

(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

An account is given of work carried out in preparation for an experiment on the transport of a high current electron beam through an array of solenoid lenses. The performance of grids for emittance enhancement, and measurements of beam profile and emittance are described. The effects of aberrations and nonlinearities are discussed. (6 refs.)

99972 The space charge computer program SCHAR. R.J.Hayden, M.J.Jakobson (Dept. of Phys. & Astron., Univ. of Montana, Missoula, MT, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2540-2 (Aug. 1983).

(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

The space charge computer program, SCHAR, uses macrofilaments or macroparticles to model the effects of space charge in ion transport. The authors have attempted to verify predictions of SCHAR by reproducing measurements made on the LAMPF H^+ injector line. For beams with appreciable space charge, when SCHAR is run with the KV distribution utilized by TRACE, SCHAR agrees with TRACE. When the H^+ line measured beam profile is taken as the input to SCHAR, it reproduces the waist locations and beam emittance for the remainder of the transport line, something TRACE has failed to do. Various types of input beams, including KV and observed, may be utilized with the program. Beam transport elements incorporated are drifts, quadrupoles, solenoids, bend magnets (with pole face rotations) and RF bunchers. (no refs.)

99973 Studies of heavy ion beam transport in a magnetic quadrupole channel. J.Klabunde, M.Reiser, A.Schonlein, P.Spadtke, J.Struckmeier (GSI, Darmstadt, Germany).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2543-5 (Aug. 1983).

(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

In connection with the West German Heavy Ion Fusion Program the first stage (six periods) of a magnetic quadrupole channel (FODO type) to study the transport of intense ion beams was built at GSI. Different ion beams can be used and the variation of the brightness of these beams (hence of the tune depression σ/σ_0) is sufficiently large that regions of theoretically predicted instabilities can be covered. The initial studies are being carried out with a high-brightness beam of 190 keV Ar^+ ions and currents of a few mA. Since the pulse length is >0.5 ms and the pressure is between 10^{-6} and 10^{-7} torr partial space charge neutralization occurs. Clearing electrodes can be used to remove the electrons from the beam. Results of theoretical studies, measurements of charge neutralization effects and first results of transport experiments are reported. (9 refs.)

99974 Theoretical study of high-current beams in storage rings. I.Hofmann, I.Bozsik, A.Jahnke (Max-Planck-Inst. fur Plasmaphys., Garching, Germany).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2546-8 (Aug. 1983).

(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

In storage rings with a high current of heavy ions, as considered for drivers in inertial fusion, control of the resistive microwave instability and bunch compression against strong space charge have been identified as key questions. It is shown here that onset of the longitudinal microwave instability can be suppressed or at least delayed by Landau damping, if some fraction of the total beam intensity is used toform a stabilizing tail of the distribution function. The linearized theory dispersion relation is analyzed and computer simulation examples are given to demonstrate the nonlinear features. As an alternative method the stabilizing effect of finite bunch length is investigated numerically and a stability criterion is proposed on the basis of a broad-band resonator model centered at the cut-off frequency. Finally, it is shown by means of computer simulation that 30-fold bunch compression in a storage ring is possible practically without losses using only two RF harmonics. (7 refs.)

99975 A quadrupole beam transport experiment for heavy ions under extreme space charge conditions. W.Chupp, A.Faltens, E.C.Hartwig, D.Keefe, C.H.Kim, L.J.Laslett, R.Nemetz, C.Pike, S.S.Rosenblum, J.Shiloh, L.Smith, M.Tiefenback, D.Vanecek (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2549-51 (Aug. 1983).

(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

A Cs ion-beam transport experiment is in progress to study beam behavior under extreme space charge conditions. A five-lens section matches the beam into a periodic electrostatic quadrupole FODO channel and its behavior is found to agree with predictions. With the available parameters (≤ 200 keV, ≤ 20 mA, $\pi\epsilon_n \geq 10^{-7}\ \pi$ rad-m, up to 41 periods) the transverse (betatron) oscillation frequency (ν) can be depressed down to one-tenth of its zero current value (ν_0), where $\nu^2 = \nu_0^2 - \omega_p^2/2$, and ω_p is the beam plasma frequency. The current can be controlled by adjustment of the gun and the emittance can be controlled independently by means of a set of charged grids. (11 refs.)

99976 Application of dynamically consistent closures to hydrodynamic models of beams. J.W.-K.Mark, H.L.Buchanan, S.S.Yu (Lawrence Livermore Nat. Lab., Livermore, CA, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2552-4 (Aug. 1983).

(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

For applications to phenomena such as pinched beams in ion beam fusion or beams in dominant axial magnetic fields (ion sources, plasma lens etc.), in accelerators, dynamically consistent closure of hydrodynamical models is discussed within adiabatic assumptions mathematically analogous to that of Chew, Goldberger, and Low (1955) for magneto-hydrodynamics and that of Berman and Mark (1979) for galactic dynamics. Numerical comparison with particle codes is discussed for pinched beams. (8 refs.)

99977 Transport in rectangular quadrupole channels. E.Meier (Accelerator Dept., Brookhaven Nat. Lab., Upton, NY, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2555-7 (Aug. 1983).

(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

Multiple electrostatic quadrupole arrays can be produced in many different geometries. However, the fabrication process can be considerably simplified if the poles are rectangular. This is especially true for millimeter sized channels. The author presents the results of a series of measurements comparing the space charge limits in cylindrical and rectangular quadrupole channels. (no refs.)

99978 Space charge limits in ESQ transport systems. A.W.Maschke, J.Brodowski, E.Meier (Accelerator Dept., Brookhaven Nat. Lab., Assoc. Universities Inc., Upton, NY, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2558-9 (Aug. 1983).

(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

Describes the results obtained in a series of experiments done with a variety of different electrostatic quadrupole configurations, using a precision optical bench system. (1 ref.)

99979 Emittance growth of high current beams in transport lines. K.Bongardt (Kernforschungszentrum Karlsruhe, Univ. Karlsruhe, Karlsruhe, Germany).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2560-2 (Aug. 1983).

(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

The RMS emittance increase of high current beams in transport lines, caused by nonlinear space charge forces, can be understood as the development of the initial particle distribution to an equilibrium one. For a small beam radius, one gets less RMS emittance increase and the equilibrium distribution is reached earlier than for a large beam radius. The beam can now be transported over a long distance without further RMS emittance growth in all 3 directions. These results are incorporated in the design of a funneling section for the high current linear accelerator of the HIBALL concept. (9 refs.)

99980 Collective beam instabilities caused by RF cavities in TRISTAN. T.Suzuki, Y.Chin, K.Satoh, K.Takata, K.Yokoya (Nat. Lab. for High Energy Phys., Ibaraki-ken, Japan).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2563-5 (Aug. 1983).

(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

The works done at KEK to study the collective beam instabilities caused by the RF cavities in TRISTAN are summarised. The works include the higher-order mode loss, the longitudinal and transverse coupled-bunch instabilities and the single bunch fast instabilities for longitudinal and transverse motions. A design aim of 4 mA/bunch and two bunches per beam can be achieved when feedback systems for longitudinal and transverse dipole oscillations are used. The other cures such as the higher-harmonic cavities, the wigglers, the couplers and the change of radiation damping partition numbers are also desirable. (30 refs.)

99981 Transverse mode coupling in a bunched beam. Y.Chin, K.Satoh (Nat. Lab. for High Energy Phys., Ibaraki-ken, Japan).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2566-8 (Aug. 1983).

(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

Derives a formalism of the mode-coupling theory for a Gaussian bunch, starting from Sacherer's integral equation. The problem is reduced to solving the determinant equation for eigenfrequencies of coherent oscillations. Eigenfunctions are expressed as superposition of the linearly independent functions where higher radial modes and azimuthal modes are combined and rearranged into 'hybrid modes'. The theory is applied to explanation of the fast instability observed in PEP and to a preliminary estimate of the threshold current in the TRISTAN electron-positron storage ring. The transverse broad-band impedances of RF cavities in PEP and TRISTAN are calculated with the program code TBCI and characterized by a single low-Q resonator impedance. A satisfactory agreement with PEP experimental result is obtained. (11 refs.)

99982 Vertical instability in KEK booster. M.Suetake (Nat. Lab. for High Energy Phys., Ibaraki-ken, Japan), T.Kasuga, T.Kawakubo, I.Sakai, H.Someya, S.Takeda.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2569-70 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
In the KEK Booster Synchrotron, from one msec after injection to extraction timing, beam intensity is stable, though it is reduced to about one half during one msec after injection. An instability of the vertical direction is one of the candidates of the beam loss. The e-folding time of the instability is less than 0.1 msec, and it strongly depends on the beam intensity and the horizontal beam position. The author found that: (a) the instability occurred at 30 MHz and its bandwidth (FWHM) was 15 MHz, (b) the broad band coupling impedance resulted from several narrow band resonators, (c) these resonators were ferrite core bump magnets and kicker magnets. (no refs.)

99983 Beam shape distortion caused by transverse wake fields. A.W.Chao, S.Kheifets (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2571-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
As a particle bunch in a storage ring passes through a region with a transverse impedance, it generates a transverse wake electromagnetic field that is proportional to the transverse displacement of the bunch in the region. The field acts back on the bunch, causing various effects (such as instabilities) in the motion of the bunch. The authors study one of such effects in which a transverse impedance causes the beam to be distorted in its shape. Observed at a fixed location in the storage ring, this distortion does not change from turn to turn; rather, the distortion is static in time. To describe the distortion, the bunch is considered to be divided longitudinally into many slices and the centers of charge of the slices are connected into a curve. In the absence of transverse impedance, this curve is a straight line parallel to the direction of motion of the bunch. Perturbed by the transverse wake field, the curve becomes distorted. (8 refs.)

99984 The resistive longitudinal instability threshold in finite charged beams. A.Sternlieb (Soreq Nuclear Res. Center, Yavneh, Israel).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2573-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Heavy ion beams are considered as possible drivers in an inertial confinement fusion scheme. The high required intensities introduce space-charge effects. It has been shown analytically that a finite cold beam is longitudinally stable when a small resistive term is present. This is confirmed by simulations which show that for resistivities causing less than one e-folding of a perturbation over the bunch length, the beam is stable (unlike coasting beam), probably due to end reflections. However, for resistivities causing more than three e-foldings, the beam is unstable (emittance deteriorated exponentially). The author discusses the implication of this instability threshold for a few cases: (a) a full-scale driver model; (b) a multiple-beam driver; (c) single beam transport experiment—SBTE (LBL); (d) slow e-beam experiment (Maryland). (10 refs.)

99985 Choice of focusing strength and aperture for high energy synchrotrons and colliders. L.C.Teng (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2576-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
At low energies and low intensities the considerations in the choice of the focusing strength (betatron tune ν) for a synchrotron are the beam size and the orbit distortion due to field errors which, together, generate a geometrical requirement on the size of the beam pipe and the good field aperture. Indeed, the strong focusing principle was invented to reduce the necessary magnet aperture, thereby the cost of the magnets. The closed orbit distortion increases with ν and has been cited as the factor counteracting the desire to reduce the beam size indefinitely by going to arbitrarily strong focusing. At high energies and intensities and with modern technology this is no longer true. The beam size is generally negligibly small and the orbit distortion can be corrected to arbitrary desired accuracy. Studies of field errors and orbit distortions are now used for sizing the correction magnet system rather than the aperture. Other types of geometrical demands on the aperture arise from beam manipulations such as stacking and resonant extraction. These requirements tend to be local and can usually be satisfied by local lattice insertions (high-or low-β, high- or zero-dispersion etc.). (4 refs.)

99986 A 9.1-T iron-free Nb-Ti dipole magnet with pancake windings. W.Gilbert, S.Caspi, W.Hassenzahl, R.Meuser, C.Peters, J.Rechen, R.Schafer, C.Taylor, R.Wolgast (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2578-80 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
An eight-pancake Nb-Ti dipole magnet, with bent up ends, called D-10B has been built and tested. This magnet is a Nb-Ti version of a Nb_3Sn magnet designed to produce a 10-tesla dipole field in a 40 mm diameter aperture. The pancake design is used for the heavy 12000 ampere Nb_3Sn cable because of the mechanical difficulty in winding such a heavy cable into the conventional nested cylindrical shell configuration with a 2″ inner winding diameter. The Nb-Ti version operates at 1.8K, in He II, has superconducting cable half as thick as the Nb_3Sn cable, and operates at half the operating current: 6000 A rather than 12000 A at 10 tesla. Both magnets are approximately one meter long. (5 refs.)

99987 Wigglers for control of beam characteristics in LEP. J.M.Jowett, T.M.Taylor (LEP Div., CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2581-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Eight three-block dipole wigglers will be used in LEP to maximize luminosity and control other beam parameters such as emittance, damping rates at injection, energy spread and polarization. The excitation law for constant emittance (chosen, for example, to fill the dynamic aperture) and damping partition numbers is given. In contrast to conventional wigglers where orbit perturbation is avoided by means of a series of equal fields of alternate polarity, the LEP wigglers will use unequal fields and pole lengths. This allows one to retain a high potential asymptotic polarisation level together with an increased polarisation rate. The choice of the degree of field asymmetry is imposed by limitations on the transverse dimensions of the magnets and field levels, by polarisation requirements and by cost. A practical design of the proposed wiggler is presented. (3 refs.)

99988 Stochastic cooling in the CERN ISR during pp̄ colliding beam physics. E.Peschardt, M.Studer (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2584-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
When the ISR is used as a pp̄ collider a high-intensity proton beam in R1 collides with a low-intensity antiproton beam in R2 for periods of up to two weeks. The luminosity lifetime is increased with a vertical stochastic cooling system in R1 designed for currents up to 10 A with a total bandwidth of 3.3 GHz. Cooling rates up to 0.7%/h have been obtained. The R2 antiprotons are cooled vertically with a 100-600 MHz system which decreases the initial beam height by up to a factor 7 and increases the luminosity by a factor 1.3-1.4. A momentum cooling system in R2 (frequency range: 55-155 MHz) creates empty space within the p̄ stacking aperture. This allows several stacks from the antiproton accumulator (AA) to be stored in the ISR. With this system which uses the Palmer method it has been proved experimentally that momentum cooling and horizontal betatron cooling are obtained simultaneously if the betatron phase between pick-up and exciter is an odd number of half-betatron wavelengths. The cooling rate of the momentum cooling system which is power limited is typically 4%/h at 26 GeV/c. (6 refs.)

99989 Recent experience with antiproton cooling. G.Carron, R.Johnson, S.van der Meer, C.Taylor, L.Thorndahl (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2587-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Improvement of transverse stochastic cooling in cases where the pick-up-to-kicker distance is not optimal may be obtained by using a transmission-line filter that causes opposite phase shift at alternating Schottky sidebands. Improvement of the horizontal stack-core cooling in the antiproton accumulator by using a pick-up at a zero dispersion location is planned; the filter technique will make this possible. The improvement of the signal-to-noise ratio in the 250-500 MHz stack tail termination resistors is discussed, as well as some problems caused by undesired modes perturbing the pick-up response. (no refs.)

99990 Stability and signal suppression of Schottky signals from stochastically cooled beams. W.P.Kells (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2590-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Several treatments of stochastic cooling now exist which go far beyond the original conceptual picture of 'removing fluctuations from the Schott noise'. The trend has been to replace this original statistical picture with ensemble evolution equations amenable to continuum treatment. High performance P̄ accumulation systems, both designed and contemplated, attempt operation at the limits of system feedback gain, as dictated by instability thresholds and 'signal suppression' [SS] degradation. The many admitted as well as implicit assumptions and approximations associated with the current models are most questionable near the high gain limit. The author highlights a few of these assumptions by pointing out inconsistencies they lead to. In particular, a fundamental difference between transverse (including 'Palmer') cooling and filter cooling is revealed. (9 refs.)

99991 Fast betatron cooling in the debuncher ring for the Fermilab Tevatron I project. B.Autin (CERN, Geneva, Switzerland), J.Marriner, A.Ruggiero, K.Takayama.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2593-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Originally, the only function of the Fermilab antiproton debuncher was to compress the momentum spread of the injected antiproton beam using a bunch rotation technique. This operation is actually very fast and almost all the time between two injections can be used to cool the beam transverse emittance. The cooling is based on the stochastic method and designed to reduce the initial emittance of 20^{π} mm-mrad by an order of magnitude in two seconds. To achieve this performance, the betatron cooling is handicapped by the low value of η, the dispersion in revolution frequency with the particle momentum; η has indeed to be maintained small in order to keep the radio frequency voltage required for the bunch rotation within a reasonable limit; moreover, the momentum spread is small (0.2%), therefore a very broad bandwidth (2-4 GHz) is required to have an efficient sampling of the beam. Betatron cooling of low intensity beams (10^8 particles) is usually limited by the thermal noise since the signal is naturally weak; here it has taken advantage of the ample space left between the areas of the ring to dispose a great number of pick-up electrodes; furthermore, a low noise temperature of the pick-up and of the preamplifier is obtained using cryogenic techniques. (3 refs.)

99992 Signal suppression analysis for the momentum stochastic cooling with a multiple system. A.G.Ruggiero (Fermilab, Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2596-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The Tevatron I project at Fermilab depends very crucially on the momentum stochastic cooling to collect and store antiprotons produced by injecting protons on a target. The author analyses the closed loop system for momentum stochastic cooling. In the closed loop configuration the electronic feedback depends not only on the electronic component characteristics but also on the beam intensity and energy distribution. (5 refs.)

99993 Momentum precooling in the debuncher ring for the Fermilab Tevatron-I project. A.G.Ruggiero (Fermi Nat. Accelerator Lab., Batavia, IL, USA), J.Simpson.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2599-600 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The design of the antiproton source for the Fermilab Tevatron-I project (TeV-I) incorporates two separate rings. The accumulator ring uses a stochastic cooling/stacking system to accumulate sufficient number of antiprotons for use in the Tevatron collider. The debuncher ring rotates buckets and debunches antiproton pulses from the production target. This requires, in the debuncher, a choice of lattice transition energy very near the beam energy, resulting in very narrow spread in the circulation frequency. If the energy spread could be further reduced in the debuncher before the beam is transferred to the accumulator, operational improvements would result in: 1) the reduction of stochastic cooling power in the accumulator; 2) the acceptance of

a larger momentum bite of antiprotons in the debuncher (thus more antiprotons); 3) the reduction of momentum aperture in the accumulator. (2 refs.)

99994 Effects of RF stacking on cooling tail in the Fermilab antiproton accumulator. A.Ando, K.Takayama (Fermilab, Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2601-3 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A scheme has been recently proposed to produce a high-intensity antiproton beam in a stochastic cooling accumulator. According to this scheme, the coasting beam of $\bar{p}$'s extracted from the debuncher ring will occupy the injection orbit of the accumulator ring with a total momentum spread of about 0.2%. This beam is to be bunched adiabatically. Then the buckets are transformed to moving (decelerating) buckets, slowly enough to obtain as large a capture efficiency as possible. The amount of deceleration depends on the physical distance which must be cleared by the bunch. After deceleration is completed, the RF is turned off slowly to allow the beam to debunch adiabatically. The beam is now ready for stochastic cooling. The debunched beam is soon moved down in the stream by the tail cooling system in order to make room for the next stacked beam. (3 refs.)

99995 Synchrotron oscillations with very small η. A.Ando, K.Takayama (Fermilab, Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2604-6 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Synchrotron oscillations with very small η $(\gamma_T^{-2}-\gamma_0^{-2})$ cannot be regarded as ordinary pendulum oscillations because the nonlinearity resulting from higher-order kinematic terms becomes sufficiently significant so as to lead to modification of the standard bucket. The dynamics is important in momentum debunching with RF rotation. For instance, the dynamics has significant meaning in momentum debunching with RF rotation in the debuncher ring for the Fermilab TeV-I project. RF rotation is used for quick reduction of large momentum spread to a small one. This large momentum spread demands that the debuncher should have a very small $\eta \simeq 0.002$, because of engineering limitations of possible RF voltage. The above kinematic nonlinearity may eventually lead to undesirable diffusion in a debunched beam. The authors discuss how the nonlinearity is suppressed by adjusting the path length of an offmomentum particle with the help of sextupole correction magnets. (5 refs.)

99996 The moment approach to charged particle beam dynamics. P.J.Channell (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2607-9 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The author derives the hierarchy of moment equations that describes the dynamics of charged particle beams in linear accelerators and can truncate the hierarchy at any level either by discarding higher moments or by a cumulant expansion discarding only correlation functions. A procedure for relating the density expansion linearly to the moments to any order is developed. The relation of space-charge fields to the density has been derived; and an accurate, systematic, and computationally convenient expansion of the resultant integrals has been developed. (no refs.)

99997 Sequential bunch extraction in the Los Alamos PSR. T.F.Wang, R.K.Cooper, L.Smith (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2610-12 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
In the short-bunch, high-frequency operating mode of the future proton storage ring (PSR) at LAMPF, the extraction scheme will take out one bunch at a time. Because the ring only stores six bunches at most and because the bunching system is heavily beam loaded, each extraction can cause a substantial change in the average beam current and hence affects significantly the total bunching voltage as well as the phase synchronization between those remaining bunches and the voltage waveform. A time-dependent cavity-tuning scheme has been considered to retain the proper bunching voltage and phase relation. This work examines the stability of the phase synchronization, in the transient stage of extraction and cavity tuning. An equivalent circuit model is adopted, and the coupled nonlinear differential equations are solved numerically. It is found that the relative phase will remain stable and that the voltage variation is tolerable under the PSR proposed operating conditions. A comparison between the numerical and analytical solutions confirms the numerical results. (5 refs.)

99998 Electron beam dynamics in the CERN PS. Y.Baconnier, R.Cappi, R.Garoby, W.Hardt, K.Hubner, J.H.B.Madsen, J.P.Riunaud (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2613-15 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The 28 GeV proton synchrotron (PS) forms part of the chain of LEP injectors with the role to accelerate positrons and electrons from 0.6 GeV, the operating energy of the Electron/Positron Accumulator (EPA), to 3.5 GeV, the positron/electron injection energy of CERN's 400 GeV proton synchrotron (SPS) which then accelerates the particles to 20 GeV. The PS used as an electron synchrotron has to supply the SPS with 8 bunches at an intensity of $N_b=8\times10^9$ particles per bunch. Bunch length and energy spread must be chosen carefully to avoid transverse and longitudinal single-bunch instabilities (turbulence) associated with high peak currents in the SPS. Analysis of the beam dynamics in the combined function lattice of the PS shows that this requirement can be fulfilled if the damping-partition numbers are changed. A Robinson Wiggler is proposed for this purpose and a new additional RF system is needed to produce the required bunch dimensions in longitudinal phase space. (9 refs.)

99999 Computer simulation of multiple-beam final focusing systems for heavy ion fusion. I.Haber (Naval Res. Lab., Washington, DC, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2616-17 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Heavy ion fusion ignition systems which employ multiple beams to achieve the required ignition energies on a target offer a number of advantages over systems with a small number of beams. In addition to the higher phase space densities which can be transported, the use of multiple lenses reduces the chromatic and geometric aberrations in the final focusing system. Computer simulations are described here which show that, at least for a modest number of beams, the transverse space charge interaction between adjacent beams does not appear to cause significant final spot aberrations for parameters consistent with pellet ignition requirements. (3 refs.)

100000 The Wire Transport Code. G.J.Caporaso, A.G.Cole (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2618-20 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The Wire Transport Code was developed to study the dynamics of relativistic electron beam propagation in a transport tube in which a wire conditioning zone is present. In order for the beam to propagate successfully in the transport section it must be matched onto the wire by focusing elements. The beam must then be controlled by strong lenses as it exits the wire zone. The wire transport code was developed to model this process in substantial detail. It is able to treat axially symmetric problems as well as those in which the beam is transversely displaced from the axis of the transport tube. The focusing effects of foils and various beamline lenses are included in the calculations. (5 refs.)

100001 Reduction of effective emittance by stacking beamlets in phase space. M.R.Shubaly (Atomic Energy of Canada Ltd., Res. Co., Chalk River, Ontario, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2621-3 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Multiple aperture extraction systems are commonly used to produce high current ion beams. One disadvantage of such systems is the dilution of the beam brightness by the grids. Typically, for the seven beamlets from a hexagonal array with a central aperture, the beamlets occupy only one-quarter of the area of the ellipse enclosing them. Beamlet steering by aperture displacement is commonly used in neutral beam injectors to reduce the size of the beam. For realistic beams, typical of high current-density extraction systems, beamlets can be stacked in phase space to reduce the effective emittance of the beam. This paper presents the concept of the technique and the experimental verification. In initial tests, the emittance of a 150 mA hydrogen beam from three in-line apertures was halved using the technique. The reduction was not from reduction in the source size as this decreased less than eight percent. (1 ref.)

100002 Magnetic field and beam dynamics calculations for SuSe. W.Schott, G.Hinderer, P.Kienle, U.Trinks, W.Wilhelm, E.Zech (Phys. Dept., Tech. Univ. Munchen, Munich, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2624-6 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The SuSe magnet system is designed using the program GFUN3D. A small version of this program was connected to a general fit program by means of which the current in the main and trim coils was determined for a given isochronous mean field $\underline{B}(r)$. For beam dynamics calculations with the code GOC accurate fields $(\Delta B/B \lesssim 1\%)$ were used which were obtained by means of the program GFUN400 where the unique part of the magnet iron is subdivided into 400 elements at maximum. Several coil systems have been investigated. In an alternative design all coils have straight sections which are easier to manufacture than coils with negative curvature. The main coils have a largest radial extension of 3.08 m. There are 22 correcting coils inside each main coil. (6 refs.)

100003 RF exercises associated with acceleration of intense antiproton bunches at Fermilab. J.E.Griffin, J.A.MacLachlan, Z.B.Qian (Fermilab, Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2627-9 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Antiprotons for the Fermilab $\bar{p}p$ colliding beam project (Tevatron I) will be extracted from an 8 GeV accumulation ring in a few (1 to 3) bunches of $\sim 10^{11}$, a single bunch at a time. To preserve the stack as a source of subsequent bunches, each bunch will be removed from the dense core of the stack with an isolated bucket at harmonic number h=2. The longitudinal emittance of the bunches will be in range 1.5 to 2. eVs, roughly five times what the main ring usually accelerates with the installed 53 MHz RF system. Therefore, the bunch is to be narrowed on the accumulator extraction orbit to match a 2.5 MHz bucket in the main ring. By raising the 2.5 MHz voltage (harmonic number h=53), the bunch will be further narrowed in the main ring to span seven buckets of the principal system (h=1113). The bunch will then be captured adiabatically from the h=53 bucket into seven adjacent h=1113 buckets for acceleration to a 150 GeV flattop. At this energy the 2.5 MHz and 53 MHz systems will be used jointly to coalesce the seven bunches into a single h=1113 bucket for injection into the energy doubler. This paper describes unstacking in the accumulator, the adiabatic capture into seven bunches in the main ring, and the coalescing of the seven back into one bunch at 150 GeV. The expected performance of the whole sequence has been established by detailed particle tracking simulation. (8 refs.)

100004 Time and momentum exchange for production and collection of intense antiproton beams at Fermilab. J.Griffin, J.MacLachlan, A.G.Ruggiero, K.Takayama (Fermilab, Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2630-2 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Antiprotons for the Fermilab $\bar{p}p$ colliding beam project are accumulated by RF stacking of successive 8 GeV antiproton batches in a storage ring using stochastic cooling to reduce both transverse and longitudinal emittance. The rate of accumulation is increased 15-fold by interchange of bunch length and momentum spread of the antiproton bunches in a special purpose debuncher ring. Tightly bunched antiprotons are produced at the target by 120 GeV protons from the main ring. From 2.5×10^{12} protons every 2 seconds the debuncher receives 7×10^7 antiprotons, within a momentum bite $\Delta p/p=3\%$. These antiprotons are injected into mismatched stationary RF buckets in the debuncher so that synchrotron oscillation produces bunch rotation. After 90° of rotation followed by adiabatic debunching, the narrow time spread has been converted into a momentum spread $\Delta p/p=0.2\%$. The authors describe the RF technique used to shorten the bunches of the primary proton beam in the main ring and report test results. They describe the complementary procedures to be used in the debuncher and demonstrate the expected reduction of the momentum spread by particle tracking simulation. (11 refs.)

100005 A single bunch system for the Daresbury SRS. E.A.Hughes, T.Ring, B.Taylor (Sci. Engng. Res. Council, Daresbury Lab., Daresbury, Warrington, England).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2633-5 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Although the Daresbury Synchrotron Radiation Source normally operates at high current in the multibunch mode, some experimental users require only a few well separated bunches. A two stage RF chopper system produces a single 1 ns bunch from the SRS linear accelerator. A versatile timing system for synchronising the linear accelerator, booster synchrotron and storage ring,

which permits the single bunch to be loaded into any specified storage ring bucket, is described. Techniques of setting up and monitoring are discussed and illustrated by details of operational performance. (2 refs.)

100006 Electron cooling and accumulation of 200-MeV protons at Fermilab. T.Ellison, W.Kells, V.Kerner, F.Mills, R.Peters, T.Rathbun, D.Young (Fermi Nat. Accelerator Lab., Batavia, IL, USA), P.M.McIntyre.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2636-8 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Experimental measurements have been made of the cooling of 200-MeV protons by an electron beam of 1 to 3 A and an energy of 110 keV. These experiments are an extension of earlier measurements on the cooling of 115-MeV protons and were performed in the Fermilab experimental proton storage ring. At 200 MeV the proton beam lifetime in the storage ring is extended from 10 to 4000 sec with electron cooling. The cooling times with an electron beam current of 1 A were approximately 2 sec for momentum and 5 to 10 sec for transverse cooling of the proton beam. For proton intensities of approximately 2×10^6 particles, the six-dimensional phase-space density of the proton beam was increased by a factor of 2×10^5. These results and data on equilibrium proton distributions and frictional forces are in reasonable agreement with the theoretical predictions. In addition, the accumulation of successive 'hot' batches of protons into a cold core, i.e. stacking, has been demonstrated. (12 refs.)

100007 Design considerations on peak electrical fields and maximum beam currents for heavy ion RFQ linacs. P.Junior, H.Deitinghoff, K.D.Halfmann, W.Neumann, N.Zoubek (Inst. fur Angewandte Phys., Univ. Frankfurt/Main, Frankfurt/Main, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2639-41 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Aperture and frequency determine voltage limits with respect to sparking. For a corresponding application of Kilpatrick's criterion exact knowledge of peak electrical fields in the RFQ is required. Results of calculations for Bi^{2+} fusion injectors considered are presented. As a general result maximum beam current turns out approximately proportional to electrode voltage. Some notes on the influence of space charge models are reported. (14 refs.)

100008 Non-linear beam-beam effects in present and future storage rings; generalized Birkhoff method on conservative mappings. M.Pusterla (Istituto di Fisica, Univ. e Istituto Nazionale di Fisica Nucleare, Padova, Italy), G.Servizi, G.Turchetti.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2642-5 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A relevant application of the recent developments of nonlinear dynamical theories lies in providing the description and the consequent calculation of the interactions among charged particles that either belong to a given beam or to different beams in collision with each other in storage rings. The author considers the case of weak-strong beam-beam interactions for proton machines, which are dynamical conservative systems. The motion of a test-particle around its main reference orbit is analysed by a conservative mapping that follows from periodical kicks, due to the forces of the beam-beam collisions, that solicitate the otherwise regular betatron oscillations. Finally the effective spin polarisation of the beams after long performance in the presence of depolarising forces is considered. (6 refs.)

100009 Vlasov theory of signal suppression for bunched beams interacting with a stochastic cooling feedback loop. S.Chattopadhyay (SPS Div., CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2646-8 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The author develops a self-consistent Vlasov theoretic description of the dynamic distortion of incoherent Schottky signals from a bunched beam undergoing stochastic cooling, arising from beam feedback. In the situation of non-overlapping syncrotron bands, explicit expressions for the signal suppression factors are derived and evaluated numerically for a prototype high-energy storage ring. (3 refs.)

100010 Theory of bunched beam stochastic cooling. S.Chattopadhyay (SPS Div., CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2649-51 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A theoretical description of the time-evolution of a bunched beam subjected to stochastic cooling is provided. (5 refs.)

100011 A formulation of transversely coupled betatron stochastic cooling of coasting beams. S.Chattopadhyay (SPS Div., CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2652-4 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A formulation of stochastic cooling with coupled degrees of freedom, with emphasis on the tensorial signal suppression phenomenon for transversely coupled betatron stochastic cooling of coasting beams, is provided. The relevant expressions for the damping and diffusion coefficients and the elements of the signal suppression tensor are given in terms of the general cooling interaction harmonics. The formulation is necessarily abstract in order to provide a general framework of quantitative analysis and demands exact knowledge of the nature of the coupling interaction for it to be useful in any particular case. (3 refs.)

100012 Longitudinal phase space matching between microtrons at 185 MeV. H.Takeda (Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2655-7 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Electrons are accelerated to 185 MeV by a microtron. Then, they are injected into another microtron to boost the net energy up to a few GeV. Between the two microtrons both longitudinal and transverse phase space matching are required. The author considers a longitudinal phase ellipse matching which utilizes triple left-right-left sector dipoles to induce a negative phase angle shear. This is accomplished because a high energy particle travels a shorter distance through the dipole system than a low energy particle. (1 ref.)

100013 A review of the beam breakup problem in linacs. W.J.Gallagher (Boeing Aerospace Co., Seattle, WA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2658-60 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Beam breakup, or pulse shortening, may be described as a progressive shortening of the output beam pulse compared to the injected pulse length with increasing beam current, the pulse length reduction occurring from the later end of the pulse. The author reviews this effect in linacs. (21 refs.)

100014 Potential of a 3-dimensional halo charge distribution. K.Takayama (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2661-2 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A simple method for obtaining the expression of the electrical potential for a 3-dimensional non-uniform charge distribution is given. It is shown how the method can be used to obtain the expression for a 3-dimensional halo distribution. (3 refs.)

100015 Bunch lengthening in SOR. S.Asaoka, G.Isoyama, A.Mikuni, Y.Miyahara, H.Nishimura (Synchrotron Radiation Lab., Univ. of Tokyo, Tokyo, Japan).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2663-5 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Bunch lengthening in SOR, a 400 MeV electron storage ring dedicated for synchrotron radiation experiments, was found to be induced by a longitudinal coupled bunch instability. The bunch length which increases as a 1/5.8 power of the beam current, can be explained by the balance between the growth of the instability and Landau damping due to the spread of synchrotron frequency, and by introducing a weak frequency dependence of coupling impedance. In connection with this phenomenon, slow fluctuation of synchrotron radiation was found to come from a detailed unbalance of the equilibrium electron distribution on the longitudinal phase space. The Touschek life time of the expanded beam and Landau cavity to suppress the instability are described. (10 refs.)

100016 A first order space charge option for TRANSOPTR. M.S.de Jong, E.A.Heighway (Atomic Energy of Canada Ltd., Res. Co., Chalk River Nuclear Labs., Chalk River, Ontario, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2666-8 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
TRANSOPTR, a beam transport design code, incorporates automatic optimization of a beam transport system under general constraints. This optimization can be performed for either first order (with or without space charge effects) or second order calculations. Space charge effects are calculated in the x-y plane for continuous beams or in x-y-z space for bunched beams using a new approach. The method integrates a set of differential equations describing the evolution of the σ beam matrix along the main trajectory where the σ matrix represents the beam ellipsoid in phase space. A spatially uniform charge density approximation is used and emittance growth is assumed to be negligible. Changes in the optimum beam transport conditions of a system caused by space charge effects can be readily evaluated with this code. Some applications of the code are given. (7 refs.)

100017 A canonical integration technique. R.D.Ruth (Lawrence Berkeley Lab., Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2669-71 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The class of differential equations of interest here is that in which the equations are derivable from a Hamiltonian using Hamilton's equations. The exact solution of such a system of differential equations leads to a symplectic map from the initial conditions to the present state of the system. A characteristic feature of all explicit high order $(n>2)$ integration methods, however, is that they are not exactly symplectic, which would make the system artificially damped. The author develops an explicit third order symplectic map (i.e. a third order integration step that preserves exactly the canonical character of the equations of motion) and indicates the method for higher order maps. For a typical numerical integration, this method can be used to eliminate the noncanonical effects while providing the accuracy corresponding to a third order integration step. (4 refs.)

100018 The status of electron cooling at Novosibirsk (theory and experiment). Ya.S.Derbenev, N.S.Dikansky, V.I.Kudelainen, V.A.Lebedev, I.N.Meshkov, B.B.Parkhomchuk, D.V.Pestrikov, A.N.Skrinsky, B.N.Sukhina.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2672-5 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The recent developments on electron cooling at the Nuclear Physics Institute, Novosibirsk are given. Problems of getting an electron beam with low effective temperature, suitable for fast electron cooling, are discussed. (7 refs.)

100019 An optimization technique for computing chromatic corrections in heavy ion focussing systems. J.S.Steinhoff (Res. Dept., Grumman Aerospace Corp., Bethpage, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2677-9 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
An optimization algorithm is described for computing field strengths for a set of corrective sextupole magnets in a heavy ion focussing system. Initial results are presented which show that, in some cases, the beam transmission through a 1 mm pellet can be increased from an uncorrected value of about 60% to over 90%. The method should be useful for systems where, due to constraints or the presence of a number of abberations, no straight-forward theory exists for directly computing the field strengths. (7 refs.)

100020 Initial operation of ECR ion sources with CYCLONE. Y.Jongen, G.Ryckewaert (Lab. du Cyclotron, Louvain-la-Neuve, Belgium).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2685-9 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Two heavy ion sources, using the electron cyclotron resonance have been realized in Louvain-la-Neuve. They use a superconducting magnetic structure to confine the plasma. The operational characteristics are explained and present results are shown. Produced beams include fully stripped N, C and O, Ne^{9+} and Ar^{16+}. The source has been used as injector for CYCLONE and was found stable, reliable and easy to operate. (10 refs.)

100021 Polarization preservation in the AGS. L.G.Ratner (Accelerator Dept., Assoc. Universities Inc., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2690-2 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The successful operation of a high energy polarized beam at the Argonne Zero Gradient Synchrotron with the concommitant development of depolarizing resonance correction techniques has led to the commissioning of such a beam at the Brookhaven alternating gradient synchrotron (AGS). The author presents a detailed description of how it is planned to preserve the polarization during acceleration, and presents the 'game plan' for tuning through

some 50 resonances and reaching the goal of a 26 GeV polarized proton beam with greater than 60% polarization. (6 refs.)

100022 Operational characteristics of a radial extraction ion source with an injected electron beam. M.Abdelaziz, M.Abdelbaki, S.Zakhary (Nuclear Res. Center, Egyptian Atomic Energy Authority, Egypt).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2699-701 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
An RF ion source of the radial extraction type is modified by introducing an electron gun to supply electrons which interact radially with the source's plasma, thereby increasing ionizing density. A tungsten filament is used with an accelerating electrode, under the influence of axial magnetic field. Two plasma tubes have been tested with the same tube length (12 cm) and diameters 4 and 5 cm respectively. Glass-coated tungsten wires are immersed in the plasma as electrical probes. Two extraction electrodes of apertures 4 and 8 mm are used. The extraction characteristics indicate 15% increase in the extraction ion beam. (8 refs.)

100023 Dual arc chamber heavy ion source. E.D.Hudson (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2702-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A dual-arc-chamber heavy-ion source has been installed on ORIC. This source has exhibited a substantial improvement in performance for beams below mass 20. A 42 μA beam of $^{16}O^{5+}$ was extracted from ORIC using the dual-arc-chamber source and a 2.5 μA beam of $^{20}Ne^{5+}$ was obtained 1.5 minutes after turning on the arc voltage. (5 refs.)

100024 A cusped field H^- ion source for LAMPF. R.L.York, R.R.Stevens,Jr. (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2705-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The addition of the proton storage ring to LAMPF requires the development of a more intense H^- ion source. The goals of this development program are to produce a beam of sufficient quality to match the acceptance of the accelerator and sufficient intensity, quality, and duty factor to satisfy the operation of PSR as well as existing LAMPF requirements. The ion source concept which is best suited to these requirements is the multi-cusp negative ion source being developed at LBL by Ehlers and Leung (1980). This source has been shown to produce high quality beams of moderate current density (20 mA/cm^2). However, to produce an accelerator quality H^- ion source, additional development is required in the area of high-voltage extraction of high-brightness beams. (4 refs.)

100025 Status of the AGS polarized negative ion source. J.Alessi, A.Kponou (Accelerator Dept., Brookhaven Nat. Lab., Assoc. Universities Inc., Upton, NY, USA), R.Raymond, T.Sluyters.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2708-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Development of an intense polarized H^- source for the AGS continues at Brookhaven National Laboratory. Initial tests with about one milliampere, 40 keV pulsed neutral cesium beam, colliding with more than two milliampere polarized hydrogen atoms, produced about one-half microampere polarized negative ions, extracted at 20 keV. A new pulsed cesium source with an anticipated output of 5-15 mA and an improved neutralizer are under construction. (4 refs.)

100026 Polarization measurements at PETRA. D.P.Barber, H.D.Bremer, J.Kewisch, H.C.Lewin, T.Limberg, H.Mais, G.Ripken, R.Rossmanith, R.Schmidt (DESY, Hamburg, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2710-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Recent measurements of beam polarization in the electron-positron storage ring PETRA are presented. A method is described for compensating the depolarizing effects caused by vertical closed orbit distributions. This technique has been successfully applied, and reproducible polarization up to 80% has been obtained both in single beam and colliding beam operation with luminosities of about 3×10^{30} cm^{-2}s^{-1}. Polarization measurements as a diagnostic tool for studying other beam parameters such as absolute energy and momentum compaction factor are also briefly described. These latter measurements have been performed with the help of a fast depolarizing device. (7 refs.)

100027 Operating experience with an ion source in a superconducting cyclotron. T.A.Antaya, M.L.Malloy, J.A.Kuchar (Nat. Superconducting Cyclotron Lab., Michigan State Univ., East Lansing, MI, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2716-18 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The authors have developed a PIG ion source for axial insertion in the K500 cyclotron. The operation of the ion source has been limited to the requirements demanded by the operation of the cyclotron. These requirements have been for moderate charge state light heavy ions, of principally carbon, nitrogen and neon. The source design is more than adequate for moderate charge states with lifetimes of 8-12 hours for carbon and in excess of 15 hours for nitrogen and neon. They are now just starting to push the source to produce high charge states, and have not yet established whether this source design will be adequate. (4 refs.)

100028 An ECR heavy ion source for the LBL 88-inch cyclotron. D.J.Clark, J.G.Kalnins, C.M.Lyneis (Nuclear Sci. Div., Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2719-21 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
An electron cyclotron resonance heavy-ion source is under construction at the LBL 88-inch Cyclotron. This source will produce very high charge state heavy ions, such as O^{8+} and Ar^{12+} which will increase cyclotron energies by a factor of 2-4, up to A=80. It is a two-stage source using room temperature coils, a permanent magnet sextupole, and a 6-9 GHz microwave system. Design features include adjustable first to second stage plasma coupling, a variable second stage mirror ratio, high conductance radial pumping of the second stage, and a beam diagnostic system. A remotely movable extraction electrode will optimize extraction efficiency. The project includes construction of a transport line and improvements to the cyclotron axial injection system. The construction period is expected to be two years. (10 refs.)

100029 Polarized ^{3}He ion source based on the 2^3S_1 metastable state. R.J.Slobodrian, R.Labrie, R.Lapointe, L.Pouliot, J.Giroux, Y.Cagnon (Dept. of Phys., Univ. Laval, Quebec, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2731-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
This ^{3}He polarized ion source is based on the 2^3S_1 metastable atomic state. The authors produce an intense metastable beam, 6×10^{15} p.sec^{-1}.sr^{-1}, of energies between 0.07 and 0.1 eV, using a cold cathode discharge. The separation and focusing of Zeeman components ($F={}^1/_2$ $m_F={}^1/_2$) and ($F={}^3/_2$ $m_F={}^3/_2$) is effected with a sextupole of variable gap. An adiabatic RF transition enhances the nuclear polarization (theoretical) to 100%. Most design parameters of the source are now frozen for operation inside the HV terminal of a CN Van de Graaff, but the source is of universal use in (+) ion accelerators. (15 refs.)

100030 Developments of the CRYEBIS generation at Orsay. J.Arianer, C.Goldstein, H.Laurent, M.Malard (Inst. de Phys. Nucleaire, Orsay, France).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2737-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
CRYEBIS 2 is completed. The project is described. Main features are: 50 keV-3.5 A decelerated electron beam, 5T-1.6 m long superconducting solenoid at 2.3K. The gun to reach 10^4 A.cm^{-2} has been tested, and SILFEC 3, a smaller scale model of CRYEBIS 2, has been extensively used with a CW electron beam and joined cycles up to 6 kV-1 A. The deceleration of electrons is reliable (from 10 keV to 1.8 keV) and the production of atoms of metal species by means of a laser has been tested. (11 refs.)

100031 Optically pumped polarized ion source with 16.5-GHz ECR low source. Y.Mori, K.Ikegami, A.Takagi, S.Fukumoto (Nat. Lab. for High Energy Phys., Ibaraki-ken, Japan).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2740-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A new type of polarized H^- ion source which uses electron pick-up reactions of a low energy H^+ ion beam from electron-spin polarized sodium atoms has been developed at KEK. The authors have obtained 10~25 μA polarized H^- ion beam when the electron-spin polarization of sodium atoms was about (46~100)±8%. (5 refs.)

100032 A brighter H^- source for the intense pulsed neutron source accelerator system. V.Stipp, A.DeWitt, J.Madsen (Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2743-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Further increases in the beam intensity of the Intense Pulsed Neutron Source (IPNS) at Argonne National Laboratory required the replacement of the H^- source with a higher current source. A magnetron ion source of Fermi National Accelerator Laboratory (FNAL) design was adapted with a grooved cathode to provide a stable 40-50 mA of beam operating at 30 Hz for up to a 90 μs pulse duration. Problems of space charge blowup due to the lack of neutralization and the H^- beam were solved by injecting additional gas into the 20 keV transport system. The source has recently been installed in the machine and the available input to the accelerator has more than doubled. (6 refs.)

100033 Tests for pulsed high current heavy ion synchrotron injection with an MP-tandem Van de Graaff. P.Thieberger, M.McKeown, H.E.Wegner (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2746-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The new MARK VII high current negative heavy ion source designed by R. Middleton (1980) was operated in a pulsed mode to provide 100-200 μa negative ion currents in 230 μsec square pulses, 10/sec. These pulses, 50-100 times more intense than normal DC beams, were then accelerated by the MP7 Tandem Van de Graaff accelerator while operating at 14 MV. After charge state analysis, the emittance of the pulsed beam was also measured. The very stable accelerator behavior indicated that even higher currents are possible. Values for ^{16}O are: 115 μa ^{16}O-injected, 100 MeV $^{16}O^{6+}$, 260 μa (43.3 pμa) 1.8 mm.mr; and for ^{32}S are: 170 μa $^{32}S^-$ injected, 140 MeV $^{32}S^{9+}$, 240 μa (26.7 pμa) 0.51 mm.mr. The high intensity and low emittance of these ion beams make them ideal for injection into a synchrotron like the AGS 30 GeV proton accelerator at BNL. (6 refs.)

100034 Millimeter high power sources for high gradient accelerators. D.Prosnitz (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2754-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The potential for achieving high accelerator gradients with high power RF sources is evaluated. (18 refs.)

100035 The application of magnetic switches as pulse sources for induction linacs. D.Birx, E.Cook, S.Hawkins, S.Poor, L.Reginato, J.Schmidt, M.Smith (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2763-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Future accelerator requirements of the Particle Beam Program for increased repetition rates and reliability led to the investigation of alternative switching schemes of pulse compression using saturable inductors. This technique has been in use for several decades, but at relatively low power levels and long pulses. Recent developments in amorphous magnetic materials has eased the challenging problem of generating 250 kV pulses for 50 ns at power levels exceeding 20 GW with fast risetime and good efficiency. The timing simultaneity required in linacs from many such parallel systems was achieved with a high degree of voltage regulation and timing feed-forward techniques. The application of magnetic switching has not only exceeded the rep-rate and jitter requirements for short bursts of pulses, but has provided excellent reliability making them applicable for a variety of other high-average power applications besides the Particle Beam Program. (no refs.)

100036 Operation of the Tevatron six-kilometer-long transfer line. C.H.Rode, R.Ferry, T.Lincicome, J.Makara, J.Theilacker, R.Walker (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2769-71 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The Tevatron transfer line consists of twenty-six 250 meter sections interconnected with vacuum jacketed U-tubes forming a loop. Each section contains a 4.50 cm i.d. super-critical helium line and a subcooled liquid nitrogen shield with an expansion joint in the middle of the run. (3 refs.)

100037 Pulsed power supply system for the fast quadrupoles in the AGS. R.J.Nawrocky, R.F.Lambiase (Brookhaven Nat. Lab., Associated Univ. Inc., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2772-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
In the acceleration of polarized protons in the AGS, a number of depolarizing resonances will be encountered. Depolarization due to the so-called intrinsic resonances will be minimized by crossing each resonance in less than one beam revolution period ($\sim$2 μs). This will be accomplished with a set of twelve 'fast' tune-shifting quadrupoles distributed symmetrically around the ring. During a typical acceleration cycle, the fast quads will be energized with a burst of alternating polarity, fast rise/slow fall triangular current pulses. The amplitude of these pulses will vary from 160 A to about 2700 A peak. The authors describe the development of the pulsed power supply for the fast quads, the construction of a prototype modulator and some of the initial test results obtained with the prototype. (2 refs.)

100038 Beam transport and targetry in the 1-TeV Fermilab meson area. E.Malamud, D.C.Carey, R.Coleman, D.Eartly, H.Haggerty, A.Jonckheere (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2775-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Three ED/S 1 TeV primary beams will be transported to the meson area and targeted in above-ground stations designed for intensities up to 5×10^{12} protons/pulse. Muon backgrounds will be reduced to acceptable levels with active shielding. New secondary beams, one providing polarized protons, the other high intensity hadrons, will feed experiments located in new buildings approximately 300 m north of the present Meson Detector Building (MDB). (5 refs.)

100039 Antiproton production and collection for the CERN antiproton accumulator. E.Jones, S.Van der Meer, F.Rohner, J.C.Schnuriger, T.R.Sherwood (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2778-80 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Antiprotons are produced for the CERN antiproton accumulator (AA) by focusing 26 GeV/c protons onto a 3 mm diameter, 11 cm long copper wire. Negatively charged particles with momenta about 3.5 GeV/c are focused by a short focal length coaxial horn and transported to the AA by a normal quadrupole focusing channel. The yield of antiprotons was found to be considerably less than anticipated (factor about 2) and the reason is presumed to be the assumption of too large a production cross-section in the original machine design proposal. Studies involving new horn design, introduction of an axial current ($\simeq$ 150 kA) along the target and use of lithium lenses as an alternative to the magnetic horn are under way. Some preliminary measurements involving some of these techniques have been made, both to confirm the validity of calculations and to test the feasibility of building targets and focusing systems to withstand the mechanical forces and heat load due to the proton beam and the high pulsed currents. (15 refs.)

100040 A design for antiproton collection and beam transport in the Fermilab Tevatron I project. E.Colton (Argonne Nat. Lab., Evanston, IL, USA), C.Hojvat.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2784-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
120 GeV protons from the Main Ring will be used to produce 8 GeV antiprotons. A pulsed lithium lens collects and matches the antiprotons to a beam line for injection into the Debuncher Ring. The $\bar{p}$ beam has a transverse emittance of 20π mm-mr and a $\delta p/p = \pm 2.0\%$. The beam line consists of a clean-up section with vertical emittance selection, two long dispersion free sections, a bend and a vertical injector. Antiproton with a transverse emittance of 2π mm-mr and $\delta p/p = \pm 7.0\times10^{-4}$ are transported in the reverse direction, bypassing the target area, and along the 120 GeV proton transport line for reverse injection in the Main ring. (4 refs.)

100041 Charge exchange injection at the AGS. D.S.Barton, L.A.Ahrens, E.Gill, J.W.Glenn, R.K.Reece, R.L.Witkover (Brookhaven Nat. Lab., Associated Univ. Inc., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2787-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The AGS was brought into operation in October 1982 with multi-turn H^- charge exchange injection. The injection area of the AGS has been modified to bring the H^- beam from the 200 MeV linac through the main magnet fringe field to a stripping foil located within the magnet aperture. The injection system is described in detail and initial performance of the accelerator is reported. (9 refs.)

100042 Evaluation and minimization of aberrations for a solenoid lens. D.D.Armstrong, J.D.Schneider (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2793-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Relativistically correct computer simulations of transporting a beam of charged particles through a solenoid lens were used to study nonlinear focusing effects of this lens type. Input beams with both zero and nonzero emittance can be studied. The magnetic field is specified either by a Fourier-Bessel function-type expansion of the vector potential at a suitably chosen radius or by a direct interpolation of the fields calculated by the magnet design code POISSON. As an area in phase space, the dependence on nonlinear effects on field strength and beam radius was determined for a few magnetic field distributions. Attempts to tailor the field to minimize spherical aberrations are discussed. (no refs.)

100043 Laser photoionization of H^0 beams for charge-changing injection. B.Blind, A.J.Jason (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2795-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The two-step charge-changing injection used in the Los Alamos Proton Storage Ring (PSR) requires stripping of H^- to H^0 by high magnetic fields and subsequent stripping of H^0 to H^+ by a carbon foil. The authors consider single- and multiphoton laser ionization as alternatives to using a fragile foil. The multiphoton case is of possible interest for selection of practical lasers, which tend to have increased power output at higher wavelengths. The formulas derived express the necessary laser powers for ionization of monoenergetic H^0 beams; they also hold for beams of particles other than atomic hydrogen. The numerical examples given are for the 800-MeV PSR beam with momentum spread taken into account. Additionally, they discuss selective stripping as an implication of the inherent energy selectivity of the photoionization process. (5 refs.)

100044 Bunching system for the Stony Brook tandem linac heavy-ion accelerator. J.M.Brennan, C.E.Chen, J.W.Noe, P.Paul, G.D.Sprouse, A.Scholldorf (Phys. Dept., State Univ. of New York, Stony Brook, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2798-800 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A versatile high-efficiency bunching system which is used to couple the Stony Brook 9 MV tandem Van de Graaff to the recently completed superconducting heavy-ion LINAC is described. The major elements of the system are: a pre-tandem double-drift harmonic buncher working at 9.4 and 18.8 MHz, a post-tandem sine-wave beam chopper at 4.7 MHz, a pre-LINAC superconducting double-drift harmonic buncher at 150 and 300 MHz and a high voltage DC-coupled single pulse selecting beam switch. (5 refs.)

100045 Graphite targets at LAMPF. R.D.Brown, D.L.Grisham (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2801-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Rotating polycrystalline and stationary pyrolytic graphite target designs for the LAMPF experimental area are described. Examples of finite element calculations of temperatures and stresses are presented. Some results of a metallographic investigation of irradiated pyrolytic graphite target plates are included, together with a brief description of high temperature bearings for the rotating targets. (4 refs.)

100046 The design of periodic beam transport systems. J.A.Farrell (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2804-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Periodic beam-transport systems have several advantages including insensitivity to errors, minimum magnet apertures, and use of standardized components. A simple procedure is given for the design of modules, with and without bending magnets, that have the same matched beam properties. These modules can be combined in certain ways to produce systems that are achromatic and require a minimum number of matching elements. (6 refs.)

100047 Design of the NSCL coupling line. L.H.Harwood, J.A.Nolen, R.F.Resmini, H.G.Blosser (Cyclotron Lab., Michigan State Univ., East Lansing, MI, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2806-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The K500 and K800 cyclotrons at the National Superconducting Cyclotron Laboratory must be joined by a beamline which matches the emittance of the K500 to the acceptance of the K800. The paper describes the optical design of that beamline, with particular emphasis on the conceptual design process. Specific optical constraints are given along with the techniques used for meeting them. Beam diagnostics are also discussed. All magnets will be superconducting. (3 refs.)

100048 The Fermilab Tevatron I project target station for antiproton production. C.Hojvat, G.Biallas, R.Hanson, J.Heim, F.Lange (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2815-17 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Production of 8 GeV antiprotons in the Fermilab Tevatron I project will utilize 120 GeV protons from the main ring. The target station consists of an entrance collimator, the target itself, a pulsed lithium lens for $\bar{p}$ collection, a pulsed magnet for the separation of the 8 GeV secondaries, and a beam dump. These components are mounted on vertical modules within the target service building. Allowance has been made for future improvements to increase the collected $\bar{p}$ flux. The design of the target station and its components is discussed. (8 refs.)

100049 120-GeV proton transport for antiproton production in the Fermilab Tevatron I project. E.Colton (Argonne Nat. Lab., Evanston, IL, USA), C.Hojvat, L.Oleksiuk.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2818-20 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Short bunches of 120 GeV protons will be used for the production of 8 GeV antiprotons. Protons will be extracted vertically from the Main Ring using two high field Lambertson type magnets at location F17. The beam transport is made of three sections: horizontal dispersion cancellation, vertical dispersion cancellation and final focusing. The final focusing section is composed of two quadrupole doublets and allows for variation in β^* values at the target from 1.5 m to 20.0 m. (3 refs.)

100050 Low momentum kaon beam lines. D.E.Lobb (Phys. Dept., Univ. of Victoria, Victora, BC, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2827-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Current low momentum ($\gtrsim$500 MeV/c) high acceptance ($\gtrsim$5 msr) kaon beam lines feature high ratios of charged contaminant particles to kaons. The results of computer calculations on scattering and pion production from K_S^0 decay are presented to indicate some of the sources of this contamination. Criteria for the design of beam lines are discussed and a new beam line design is proposed. (17 refs.)

100051 An RF separator for cloud muons at TRIUMF. J.A.Macdonald, E.W.Blackmore, D.A.Bryman, J.Doornbos, K.L.Erdman, R.M.Pearce, R.L.Poirier, J.-M.Putissou, J.Spuller (TRIUMF, Vancouver, BC, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2833-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A particle separator utilizing a magnetic field crossed with an RF electric field has been built and incorporated into the M9 secondary channel to produce a clean negative muon beam at 77 MeV/c $\pm$5%. The separator is driven at the main cyclotron frequency (23 MHz) and phase locked to the primary proton beam. Separation is achieved by using both the temporal and velocity differences between the muons, produced near the production target (cloud muons), and both the pion and electron contaminants in the beam. (2 refs.)

100052 Lambertson magnetic design for the Tevatron extraction channel. M.P.May, M.A.Harrison (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2836-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The beam splitting requirements of the Tevatron extraction system necessitated the design of two different high field (11 kG and 15 kG) magnetic septa. The authors present details of the magnet design with emphasis of the construction techniques used to achieve good vacuum behaviour and septum straightness while maintaining magnetic field quality. (1 ref.)

100053 A nonlinear lens system to smooth the intensity distribution of a Guassian beam. P.F.Meads,Jr..
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2838-40 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The intensity distribution of a typical ion beam is quite nonuniform with a bright center and a diffuse edge; in many cases, the actual distribution is adequately approximated by a Gaussian distribution. However, many uses for such beams require uniform illumination from the center of the target to its edges. It is shown that a system of controlled third-order aberrations produced by a pair of octupole magnets is able to substantially smooth the intensity distribution by spreading the center and folding in the edges of the beam such as the intensity is nearly uniform over the entire target. (3 refs.)

100054 Recent developments of beam dumps and targets at the SPS. R.Bellone, A.Ijspeert, P.Sievers (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2841-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Proton intensities of about three times the original design value of 10^{13} protons/pulse (ppp) have recently been achieved in the CERN-SPS. Failures due to the resulting elevated energy deposition densities in targets and absorbers are reported and the design and construction of new, fail safe equipment is described. (7 refs.)

100055 Electrode shaping for ion and electron extractors. J.D.Schneider, D.D.Armstrong (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2844-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A technique has been developed that defines the shapes of electrodes needed to produce a good-quality cylindrically symmetric beam of ions or electrons. This work was motivated by the need to opitmize electrode shapes for a high-brightness, low-energy, deuteron injector. The authors' experience had indicated that correct shaping of electrodes becomes increasingly important as beam perveance increases. This provided the motivation for developing a computer program that could specify electrodes producing optimum or improved beam quality. Several techniques have been developed and evaluated. The procedure described has been very successful in meeting design goals. (3 refs.)

100056 Long ceramic beam tubes for accelerator magnets. E.B.Tilles, G.H.Biallas, M.A.Harrison, P.A.Adderley, M.P.May (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2847-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The ceramic beam tubes for the fast kickers, abort kickers, bucker and pinger magnets used at Fermilab must meet a number of rather exacting requirements. The tube must be long and sufficiently straight so as not to limit magnet design, with wall strength capable of withstanding the atmospheric and mechanical forces encountered during construction and operation. Vacuum tight ceramic to stainless steel transitions must be of reasonable cost, be able to withstand high temperature processing and remain vacuum tight to the 10^{-9} Torr range. In order to remove the possibility of static charge build up, each tube has a surface coating of indium oxide applied to the inner wall. This thin coating is difficult to achieve, requiring the most careful attention to detail. Indium oxide in the In_2O_3 form is used. The methods used at Fermilab to achieve these goals are presented in the paper. (5 refs.)

100057 An energy independent electron spin precessor. B.E.Norum, R.C.York (Dept. of Phys., Univ. of Virginia, Charlottesville, VA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2921-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Discusses the production of a polarised electron beam from a circular accelerator. An energy-independent electron spin processor device is described. (5 refs.)

100058 Pulsed air-core deflector-magnet design parameters. A.J.Jason, R.K.Cooper, A.D.Liebman, B.Blind, A.R.Koelle (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2938-40 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The response of air-core magnets to pulsed excitation is dependent on the pulse frequency spectrum because of fields produced by induced currents in the magnet structure. The authors discuss this phenomenon quantitatively in terms of magnet performance optimization. (2 refs.)

100059 The Los Alamos Proton Storage Ring (PSR) injection deflector system. A.J.Jason, E.F.Higgins, A.R.Koelle (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2941-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Describes a pulsed magnetic deflector system planned for the injection system of the PSR. Two sets of magnets, appropriately placed in the optical systems of both the ring and the injection transport line, provide control of the rate at which particles are injected into a given portion of transverse phase space and limit the interaction of stored beam with the injection stripping foil. High-current modulators that produce relatively complex waveforms are required for this purpose. Solid-state drivers using direct feedback to produce the necessary waveforms are discussed as replacements for the more conventional high-voltage tube technology. (3 refs.)

100060 Injected beam chopper system for the Intense Pulsed Neutron Source accelerator system. A.Rauchas, R.Zolecki (Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A new chopper system has been designed and built to allow versatile manipulation of the H^- beam for the Intense Pulsed Neutron Source accelerator system. The beam is chopped at an energy of 750 keV, just before injection into the 50 MeV linear accelerator. The system consists of a high speed logic control system, a high power pulse amplifier and a travelling wave beam deflection electrode. The control system allows for up to four concurrently operable functions. The first mode is dedicated to personnel and equipment protection interlocking. The second is for low frequency pulse shaping. The third is a high frequency chop mode for RF synchronized injection of the 50 MeV beam into the Rapid Cycling Synchrotron. The fourth mode allows width and/or time modulation of the RF synchronized chopping to control the loading of the RF bucket area in the RCS. (4 refs.)

100061 Bending magnets for the CBA beam transport line. R.E.Thern (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2950-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The beam transport line from the AGS to CBA requires 68 large bending magnets, consisting of pure dipoles and two types of combined function gradient magnets. All three types were designed with the magnetic field calculation program POISSON, using the same exterior dimensions and coil package. The design goal of ±1% momentum acceptance for the transport line required a wide horizontal aperture, with a much smaller vertical aperture for economy. Two prototypes of one gradient magnet were built, and a facility constructed to measure them and the later production magnets. Measurements were done using both a long coil and a point coil (Rawson-Lush gaussmeter). Preliminary results show $\Delta B/B<0.2\times10^{-3}$, $\Delta G/G<0.3\times10^{-2}$, and $\Delta B_2/B<0.3\times10^{-4}$ cm^{-2} over the beam aperture. Due to end effects, the actual gradient differs from the design gradient by 1%, which has been compensated for in the beam line design. (5 refs.)

100062 The Fermilab injection kicker. R.Trendler, M.Harrison, E.Tillis, C.Needles, W.Williams.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2953-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Describes the proton injection kicker system designed to accept protons from the Fermilab Conventional Main Ring in the Tevatron Superconducting Ring. The pulse forming network based thyratron switch tube pulsed delivers a 100 ns rise, 200 ns fall, 40 kV pulse to a 6.25 ohm traveling wave magnet load. The pulse duration adjustable up to a maximum of ~22 μsec. The design philosophy, magnet parameters, and system performance are discussed. (no refs.)

100063 The AGS new fast extraction system and the single bunch extraction test. W.T.Weng (Brookhaven Nat. Lab., Associated Univ. Inc., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2956-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
For the neutrino physics program and for the CBA injection, a new fast extraction system has been implemented to improve the extraction efficiency and the quality of the extracted beam. Central to the new system is a new fast kicker, placed at the H5 straight section, capable of rising between bunches, $t_r<170$ nsec, and staying constant for 2.6 μsec with flat top ripple less than ±1.5%. So far, the system has been operated for longer than 3000 hours and routinely extracts 10^{13} ppp at 99% efficiency. Experiment 745 on QCD test requires a single AGS bunch of 40 nsec. For this purpose another fast kicker was placed at the E5 straight section and powered by a new pulser to produce a half sinusoidal pulse with both a rise and fall time of 200 nsec. A single AGS bunch was extracted through the slow beam channel at 22 GeV/c leaving the remaining 11 bunches undisturbed which continued to be accelerated to 29.4 GeV/c and extracted by the H5 kicker through the fast beam channel. Because the ring circumference ratio of CBA to the AGS is 4-3/4, some of the injected beam from the AGS has to contain 11 bunches instead of 12; consequently, this single bunch extraction mode will also be used for CBA injection. (5 refs.)

100064 Status of the SNS. G.H.Rees (Rutherford Appleton Lab., Chilton, England).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3044-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The current status of the SNS Project is outlined, with more emphasis on the details of the 50 Hz, 800 MeV proton synchrotron than on the high intensity neutron target. Points of interest in the synchrotron and target hardware are given. (6 refs.)

100065 Inertial fusion with low energy heavy ions. A.W.Maschke (Brookhaven Nat. Lab., Associated Univs. Inc., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3055-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
High energy heavy ions have been under study for inertial fusion applications for some time. The author points out that it may be possible to utilize heavy ions with energies less than 1 MeV, compared with the usual HIF approach using multi-GeV beams. (11 refs.)

100066 An isochronous stacking ring approach to the HTE. F.Selph, H.Grunder, B.Leemann (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3073-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Target heating for the high temperature experiment (HTE) requires a short beam burst on the order of tens of nanoseconds with a total beam energy of a kilojoule or more. The RF linac falls far short of this capability. A number of studies have considered the use of storage rings for accumulating beam current. The authors look at an alternative means, using an RF linac followed by an isochronous stacking ring (ISR), producing rapidly the high multiplication of beam current required. This method avoids the necessity for beam manipulations such as beam splitting, RF bunching in a storage ring, etc. Because of the fast transit time in the ISR, storage ring instabilities are not a problem. (5 refs.)

100067 Undulators as sources of synchrotron radiation. S.Krinsky (Nat. Synchrotron Light Source, Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3078-82 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Wigglers and undulators are used as enhanced sources of synchrotron radiation in electron storage rings. The author discusses the properties of the radiation from these devices, and some of the considerations which arise in their design and use in storage rings. The main emphasis is on undulators. (16 refs.)

100068 High energy gamma ray beams from Compton backscattered laser light. A.M.Sandorfi, M.J.LeVine, C.E.Thorn, G.Giordano, G.Matone, C.Schaerf (Phys. Dept., Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3083-7 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Collisions of light photons with relativistic electrons have previously been used to produce polarized γ-ray beams with modest ($\sim 10\%$) resolution but relatively low intensity. In contrast, the LEGS project (laser+electron gamma source) at Brookhaven will produce a very high flux ($>2\times10^{7}\ s^{-1}$) of background-free polarized γ-rays whose energy will be determined to a high accuracy ($\Delta E=2.3$ MeV). Initially, 300(420) MeV γ-rays will be produced by backscattering UV light from the new 2.5(3.0) GeV X-ray storage ring of the National Synchrotron Light Source (NSLS). The LEGS facility will operate as one of many passive users of the NSLS. In a later stage of the project, a free electron laser is expected to extend the γ-ray energy up to 700 MeV. (7 refs.)

100069 Anomalous laser induced bunch lengthening on the ACO storage ring free electron laser. K.E.Robinson (High Energy Phys. Lab., Stanford Univ., Stanford, CA, USA), J.M.J.Madey, M.F.Velghe, D.A.G.Deacon.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3088-90 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Laser induced bunch lengthening has been measured on the ACO storage ring free electron laser (SRFEL) in the anomalous bunch lengthening regime. The experimental results show correlations between the appearance of coherent modes in the electron bunch and anomalous behavior in the presence of the laser. Simultaneous time resolved laser induced bunch lengthening, mode strength, bunch length, and synchrotron sideband measurements were made as anomalous thresholds were traversed several times by changing the RF accelerating voltage. Bunch shortening, multiple time constants, and oscillatory behavior are among the phenomena which have been observed. (5 refs.)

100070 An all wiggler and undulator synchrotron radiation source. H.Winick, H.Wiedemann, I.Lindau, K.Hodgson (Stanford Synchrotron Radiation Lab., Stanford, CA, USA), K.Halbach, J.Cerino, A.Bienenstock, R.Bachrach.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3097-9 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Successful experience with wiggler and undulator (w/u) magnets as synchrotron radiation (SR) sources has led to new facility design concepts. The authors review the design features and performance criteria of new rings and describe a proposed facility at SLAC consisting of two rings (1-2 and 5-6 GeV) in the same tunnel, both optimized for w/u insertions. The authors also present conceptual designs for permanent magnet dipoles and quads. (9 refs.)

100071 The Advanced Light Source. R.C.Sah (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3100-2 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The Advanced Light Source (ALS) is a new synchrotron radiation source which has been proposed by Lawrence Berkeley Laboratory. The ALS will be a key component in a major new research facility, the National Center for Advanced Materials. The ALS will consist of an electron linear accelerator, a 'booster' synchrotron, a 1.3-GeV electron storage ring, and a number of photon beam lines. Most or all photon beam lines will originate from wiggler and undulator magnets placed in the 12 long straight sections of the ALS. A very low electron beam emittance will provide photon beams of unsurpassed spectral brilliance from specially-designed undulators, and a high radiofrequency will produce very short pulse lengths. (1 ref.)

100072 Closed orbit correction of the NSLS VUV ring. E.Bozoki, J.Bittner, L.Blumberg, T.Dickinson, J.Galayda (Nat. Synchrotron Light Source, Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3106-8 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The authors describe the results obtained from the orbit correction system in the NSLS VUV storage ring which consists of 24 PUE stations and 16 horizontal and vertical correction dipoles. The data were obtained by the PUEREAL module of the RING control program which provides automatic switching of the signal from individual electrodes of the PUE stations and provides a readout at harmonic of the RF frequency. The closed orbit is then calculated and corrected by measured displacements of the PUEs from the adjacent quadrupoles. The ORBIT module of the RING program was used to minimize the RMS orbit deviations choosing the most effective correctors and calculating their strengths. For the horizontal case, the correction was accomplished using 3 correctors in two iterations starting with RMS values $X=2.9$ mm to $X=0.9$ mm. Vertically three iterations and 6 correctors were required to correct the RMS value from $Z=6.8$ mm to $Z=0.8$ mm. (6 refs.)

100073 Amplifier optimization study for an FEL wiggler with a helical magnetic field and an axial electric field. H.Takeda, S.B.Segall (KMS Fusion Inc., Ann Arbor, MI, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3112-14 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A one-dimensional multiparticle free electron laser (FEL) amplifier simulation code based on a single particle interaction model is used to determine laser gain and energy spread in an FEL amplifier in which gain is enhanced by means of an axial electric field. Limitations on achievable laser intensity due to limits on the energy spread an energy recovery system can accept are discussed and a comparison is made with tapered wiggler systems. (3 refs.)

100074 The beam line VI rec-steel hybrid wiggler for SSRL. E.Hoyer, T.Chan, J.W.G.Chin, K.Halbach, K.J.Kim (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA), H.Winick, J.Yang.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3118-20 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A wiggler magnet with 27 periods, each 7 cm long which reaches 1.21 T at a 1.2 cm gap and 1.64 T at 0.8 cm gap has been designed and is in fabrication. Installation in SPEAR is scheduled for mid 1983. This new wiggler will be the radiation source for a new high intensity synchrotron radiation beam line at SSRL. The magnet utilizes rare-earth cobalt (REC) material and steel in a hybrid configuration to achieve simultaneously a high magnetic field with a short period. The magnet is external to a thin walled variable gap stainless steel vacuum chamber which is opened to provide beam aperture of 1.8 cm gap at injection and then closed to a smaller aperture (<1.0 cm). Five independent drive systems are provided to adjust the magnet and chamber gaps and alignment. Magnetic design, construction details and magnetic measurements are presented. (9 refs.)

100075 Free electron laser for a mildly relativistic electron beam. H.S.Uhm (Naval Surface Weapons Center, Silver Spring, MD, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3121-3 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The bandwidth and frequency enhancement of the free electron laser instability in a mildly relativistic ($\gamma\lesssim1.15$) electron beam propagating through a dielectric loaded waveguide is presented. For an appropriate choice of the dielectric constant $\hat{\epsilon}$ and the thickness of the dielectric material, it is shown that the instability bandwidth and frequency can be greatly enhanced for specified values of the beam energy and the wiggler wavelength. (7 refs.)

100076 SRS behaviour with a superconducting 5-Tesla wiggler insertion. V.P.Suller, N.Marks, M.W.Poole, R.P.Walker (Sci. Engng. Res. Council, Daresbury Lab., Daresbury, England).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3127-9 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A 5 Tesla superconducting wavelength shifting wiggler magnet has been inserted into the SRS lattice. Observations have been made of the behaviour of the stored electron beam with the magnet powered. Betatron tune shifts and modulation of the betatron function have been measured and good agreement obtained with theory. Closed orbit changes have been examined and the stored beam lifetime optimised. The magnet is fully operational and is producing intense X-ray beams for users. (3 refs.)

100077 Laser accelerators. A.M.Sessler (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3145-9 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Laser accelerators may be conveniently characterized, by their mode of operation, into media, far-field, and near-field accelerators. The first category—media accelerators—include the Inverse Cherenkov Effect Accelerator, the Plasma Focus Accelerator, and the Beat Wave Accelerator (BWA). The second category—far-field accelerators—include the Two-Wave Device and the Inverse Free Electron Accelerator (IFEL). The third category—near-field accelerators—includes conventional linacs scaled to small dimensions, dielectric sheets, small holes in dielectric cylinders, and gratings. Attention is devoted to an example from each category; namely (1) the BWA, (2) the IFEL, and (3) the linac scaled to small dimensions (about 30 GHz) and powered by a free electron laser (FEL). Finally, special attention is given to grating accelerators. (12 refs.)

100078 Intense electron beam autogenerator. M.G.Mazarakis, S.L.Shope, D.L.Smith, R.B.Miller (Sandia Nat. Labs., Albuquerque, NM, USA), R.J.Adler.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3171-3 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A novel autogeneration mechanism was conceived and used to generate and accelerate an intense relativistic electron beam. This was accomplished via the passage of a primary relativistic electron beam pulse through an uncharged pulse forming transmission line cavity. A second beam pulse was generated with the same duration as the primary beam, e.g., 10-20 nsec, but delayed by a time interval equal to the double transit time of the induced electromagnetic wave inside the cavity. (8 refs.)

100079 SRA: a new ion accelerator scheme. J.Y.Choe, H.S.Uhm (Naval Surface Weapons Center, White Oak, Silver Spring, MD, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3174-6 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The space-charge resonance accelerator (SRA) consists of a relativistic electron beam propagating through a dielectric loaded drift tube. In a range of physical parameters, the phase velocity of a self-growing space-charge wave increases slowly from zero to a large beam velocity as it propagates into the downstream region, thereby trapping and accelerating ions by its electric field. The self-growing mechanism of the space-charge wave is typical Cherenkov radiation. (9 refs.)

100080 Studies of the helix controlled beam front accelerator concept. W.W.Destler, P.G.O'Shea, M.Reiser, C.D.Striffler, D.Welsh, H.H.Fleischmann (Electrical Engng. & Phys. Dept., Univ. of Maryland, College Park, MD, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3183-5 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Helix controlled collective ion acceleration involves the use of a helical slow wave structure to control the propagation velocity of an intense relativistic electron beam front, in which ions could be trapped and accelerated to high energy. Experimental and theoretical studies of the propagation of an IREB inside both cylindrical and helical conducting boundary systems have been conducted. In the experiments, an IREB (1 MeV, 30 kA, 30 ns, confined by an applied axial magnetic field) is injected from a 1 cm diameter hollow stainless steel cathode through a 2.4 cm diameter hole in a stainless steel anode into either cylindrical or helical downstream drift chambers. Beam propagation in the cylindrical systems is in good qualitative agreement with theoretical calculations based on a modified Bogdankevich, Rukhadze beam model. When a helical slow wave structure is used as the conducting boundary, the beam front velocity is significantly reduced to values approaching those associated with the helix pitch angle. (3 refs.)

100081 Collective acceleration of laser produced ions. J.T.Cremer, W.W.Destler (Electrical Engng. Dept., Univ. of Maryland, College Park, MD, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3186-8 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Experimental studies of the collective acceleration of laser produced ions have been conducted. An intense relativistic electron beam (1 MeV, 30 kA, 30 ns) is emitted from a 4 mm diameter tungsten cathode and passes through a 2.4 cm hole in a stainless steel anode into a 14 cm diameter downstream drift tube. Ions are provided on the downstream side of the anode plane by firing a 4-10 J, 15 ns Q-switched ruby laser pulse at solid or foil targets mounted on the downstream side of the anode plane. Accelerated ion energies are measured using time of flight and range energy/track etching techniques. Ion charge states are measured using an E$\|$B Thomson spectrometer. Results will be compared with measurements of the pre-acceleration characteristics of the laser produced ions from these target geometries obtained using an electrostatic analyzer. (14 refs.)

100082 The IFA-2 collective ion accelerator system. C.L.Olson, C.A.Frost, E.L.Patterson, J.W.Poukey (Sandia Nat. Labs., Albuquerque, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3189-91 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A second generation ionization front accelerator system (IFA-2) is being brought into operation. Results of IFA-2 IREB optimization experiments, laser characterization experiments, beam switch experiments, and laser deflector experiments are presented. The status of the IFA-2 system is summarized. (9 refs.)

100083 Compact pulsed accelerator. M.J.Rhee, R.F.Schneider (Lab. for Plasma & Fusion Energy Studies, Univ. of Maryland, College Park, MD, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3192-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The formation of fast pulses from a current charged transmission line and opening switch is described. By employing a plasma focus as an opening switch and diode in the prototype device, a proton beam of peak energy 250 keV is produced. The time integrated energy spectrum of the beam is constructed from a Thomson spectrograph. Applications of this device as an inexpensive and portable charged particle accelerator are discussed. (7 refs.)

100084 Alternate transport techniques for electron induction linacs. R.J.Adler, B.Sabol, G.F.Kiuttu (Mission Res. Corp., Albuquerque, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3198-200 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Recently, there has been a great deal of interest in producing intense, high energy electron beams in induction linear accelerators. These machines will have applications in radiation effects studies, intense neutron pulse production, free electron lasers, Tokamak current drive, betatron injection, and plasma heating. Most of the induction accelerators built to date have used solenoidal focusing to confine and transport the beam. The authors present various alternate transport techniques. (21 refs.)

100085 Transverse particle acceleration techniques using lasers and masers. N.C.Schoen (TRW Systems, Redondo Beach, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3206-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A preliminary investigation of a concept for accelerating electrons using traveling electromagnetic waves in a vacuum environment has been presented. Energy levels of the order of 100 MeV can be attained in distances of the order of several Rayleigh lengths, although practical limitations on source size and extraction devices will limit figures of merit to the order of 100 MeV/m. The primary challenge to designing high power devices will be to devise ways to increase the volume of the acceleration region and/or the repetition rate of the device so as to increase the output current. More accurate models for the time history of electric and magnetic field vectors in the focal region are also needed to determine more carefully the limits on the electron injection process. Nonetheless, the simplicity of the acceleration process should provide the impetus for the development of these devices. (8 refs.)

100086 High field superconducting magnets for particle accelerators. H.Hirabayashi (KEK Nat. Lab. for High Energy Phys., Ibaraki, Japan).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3304-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983)
Based on an extensive study of NbTi/Cu dipoles cooled with 1.8K pressurized helium II and Nb_3Sn/Cu racetrack dipoles at 4.2K, the merit and demerit of these two kinds of magnets are discussed from the viewpoint of practical applications in future accelerators. There are many thermal, mechanical and electromagnetic difficulties in designing high field accelerator magnets in the 10 T region. The author's experience with NbTi/Cu and Nb_3Sn/Cu dipole magnets is reported and possible designs for high field magnets are presented, based on results of detailed calculations. (13 refs.)

100087 Superconducting cavities for high energy accelerators—progress and prospects. M.Tigner (Cornell Univ., Ithaca, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3309-12 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Real progress in applications of radio frequency superconductivity to high energy electron storage rings has been registered recently. It is clear now that this technology will make a significant contribution to the advancement of particle physics in the 10's to 100's of GeV-CM energy range. This progress and its foundation are reviewed briefly. While considerable work remains in consolidating present accomplishments into reliable engineering technology, long lead times for significant technological developments make it appropriate to inquire now about the future prospects for this technology. Does this technology have a potential for being useful in a generation of accelerators that can take us into the TeV domain? This question and its associated R/D questions are addressed. (16 refs.)

100088 Development of the different REQ accelerating structures and operation experience. H.Klein (Inst. fur Angewandte Phys., Univ. Frankfurt am Main, Frankfurt am Main, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3313-22 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Fourteen years after the invention of the 'spatially continuous strong focusing' principle in the USSR and five years after the start of the RFQ research program in the USA numerous (~15) laboratories all over the world are concerned with this new accelerator concept and many projects are under way. A brief review of these activities and the considered applications is given and the different approaches in beam dynamics, electrode configuration and resonators are outlined. (54 refs.)

100089 Permanent multipole magnets with adjustable strength. K.Halbach (Lawrence Berkeley Lab., Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3323-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Preceded by a short discussion of the motives for using permanent magnets in accelerators, a new type of permanent magnet for use in accelerators is presented. The basic design and most important properties of a quadrupole will be described that uses both steel and permanent magnet material. The field gradient produced by this magnet can be adjusted without changing any other aspect of the field produced by this quadrupole. The generalization of this concept to produce other multipole fields, or combination of multipole fields, is also presented. (5 refs.)

100090 Adjustable strength REC quadrupoles. R.L.Gluckstern (Dept. of Phys., Univ. of Maryland, College Park, MD, USA), R.F.Holsinger.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3326-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The development of high field rare earth cobalt (REC) permanent magnet materials has led to the development of rings which produce high field, high quality quadrupoles used primarily to focus charged particle beams. The authors obtain an expansion of all matrix elements up to and including terms of second order in the magnet strength. These results suggest a non-uniform choice of disk thicknesses which leads to a particularly simple prescription for the rotations. The accuracy of these suggestions is then confirmed by numerical computations, including the effects of known fringing fields from an REC ring. They conclude, that fringing fields have almost no influence on the prescription of rotation angles which eliminates coupling between the two transverse fields, nor do they affect the focal strength of the total configurations in lowest order. The primary effect of the fringing fields will be shown to be a shift in the principal planes, as is the case for single quadrupole rings. (3 refs.)

100091 Long term stability of Fermilab Energy Saver magnets. W.E.Cooper, B.C.Brown, R.W.Hanft, E.E.Schmidt (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3330-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The quench and field properties of Energy Saver dipole and quadrupole magnets are measured at the Fermilab Magnet Test Facility shortly after the magnets have been produced. It is important that magnet properties remain unchanged with time. This question has been investigated by remeasuring magnets at a later time and comparing the two sets of measurements. (6 refs.)

100092 Operation of a superconducting accelerating cavity in PETRA. W.Bauer, A.Brandelik, A.Citron, F.Graf, L.Szecsi (Univ. of Karlsruhe, Karlsruhe, Germany), D.Proch.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3333-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
To investigate the feasibility of superconducting cavities in electron-positron storage rings a single cell Niobium cavity was tested in PETRA. The authors describe the experimental setup and summarizes the results obtained: Accelerating field gradients of 3 MV/m and Q-values of 10^9 are measured in an operating storage ring and maintained over many weeks. Synchrotron radiation impinging on the cavity surface did not affect the performance. Higher order modes excited by the beam were coupled out, their amplitudes agree with theory. PETRA was operated at 5 GeV and 2 mA with the superconducting cavity alone. (12 refs.)

100093 Superconducting cavity beam test in CESR. R.Sundelin, J.Amato, S.Herb, J.Kirchgessner, P.Kneisel, J.Mioduszewski, N.Mistry, K.Nakajima, H.Padamsee, F.Palmer, H.L.Phillips, M.Pickup, R.Siemann, M.Tigner, E.von Borstel (Newman Lab. of Nuclear Studies, Cornell Univ., Ithaca, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3336-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The first use of a superconducting accelerating structure in a storage ring is described. Two 5-cell 1500 MHz 'muffin tin' superconducting niobium cavities (1 m active length) were operated in the Cornell 8 GeV e^+e^- storage ring, CESR. A 6.1 mA beam was captured and stored at 3.5 GeV using only the superconducting cavity. Up to 12.5 kW was transferred to the beam by the cavity. Single bunch currents up to 12 mA were reached in conjunction with the normal 500 MHz RF. Beam induced higher order mode (HOM) powers of 290 W were carried to room-temperature loads by four couplers and waveguides; no HOM-induced cryogenic dissipation was detectable. Q's of the 76 most prominent resonances were measured. Transverse and longitudinal beam instabilities were studied by mechanically sweeping the tune of the cavities; current thresholds are compared to theory. The cavity exhibited the ability to survive breakdown at high incident power without degradation. (11 refs.)

100094 A superconducting accelerating structure for particle velocities from 0.12- to 0.23-C. K.W.Shepard, G.P.Zinkann (Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3339-41 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A split-ring resonator has been designed for an optimum particle velocity $\beta=v/c=0.16$ and a frequency of 145.5 MHz. The ratio of peak surface electric field to effective accelerating field in the resonator has been reduced 20% from the value obtained in previously developed split-ring resonators. The improved design results from the use of elliptically-sectioned loading arms and drift-tubes which have been enlarged to reduce peak surface fields and also shaped to eliminate beam steering effects in the resonator. All fabrication problems presented by the more complex geometry have been solved and a prototype superconducting niobium resonator has been completed. An accelerating field of 3.3 MV/m at 4 watts RF input has been so far achieved, corresponding to an effective accelerating potential of 1.17 MV per resonator. (3 refs.)

100095 Status report of the superconducting 5-cell acceleration structure at CERN. P.Bernard, D.Bloess, G.Cavallari, E.Chiaveri, W.Erdt, E.Haebel, H.Lengeler, P.Marchand, P.Queru, J.Tuckmantel, W.Weingarten (CERN, Geneva, Switzerland), H.Piel.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3342-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
At CERN, a 5 cell 500 MHz superconducting accelerating cavity has been constructed. At present the cavity is installed in the PETRA storage ring at DESY for a test run which will start middle of March. The cavity is equipped with a high power coupler and with 5 higher order mode couplers, two of the loop type and three of the antenna type. Frequency tuning and regulation are achieved by varying the length of the two end-cells. In a test of the complete cavity-cryostat system at CERN, acceleration fields of 2.8 MV/m and Q_0-values above 10^9 have been reached. The cryostat losses remained below 10 W. (4 refs.)

100096 Fundamental and higher order mode couplers on superconducting RF cavities for electron storage rings. E.Haebel (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3345-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The design of a coaxial high power loop coupler for use on a 500 MHz superconducting (SC) accelerating cavity of 'spherical' shape is described.

Non-superconducting construction materials (copper and copper plated stain-ess steel) are used. Cooling is obtained by cold helium gas in counter flow. The coupler is located at the cavity equator and a choke provides an uncritical RF joint at a minimum current flow position. For the coupling required ($Q_{ext}=10^5$-10^6) the loop does not protrude into the cavity. Test experiments up to 70 kW incident RF power with a matched copper cavity and up to 17.5 kW with a superconducting cavity (corresponding to an acceleration field $E_{acc}=3.6$ MV/m) are described. Design and measurements with two types of compact higher order mode couplers, coupling to the magnetic and electric field respectively are described. Both couplers are manufactured from Nb and are low Q resonant devices with their centre-frequency matched to the relevant part of the cavities' higher order mode spectrum. All couplers have been operated with a SC cavity up to the design field level. (9 refs.)

100097 Development of superconducting cavities of cylindrical symmetry at Cornell. P.Kneisel, K.Nakajima, J.Kirchgessner, J.Mioduszewski, M.Pickup, R.Sundelin, M.Tigner (Floyd R. Newman Lab., Cornell Univ., Ithaca, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3348-50 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The fabrication, processing and measurement of five single cell and one 5-cell L-band niobium cavities of elliptical shape are discussed. Q-values of 2 to 5×10^9 have typically been obtained without high temperature firing. In single cells magnetic surface fields as high as 56 mT corresponding to an accelerating field of 7 MV/m have been measured. In the 5-cell structure a gradient of 4.7 MV/m was achieved. (15 refs.)

100098 Fabrication of superconducting niobium radio frequency structures. J.Kirchgessner, J.Amato, J.Brawley, P.Kneisel, J.Mioduszewski, H.Padamsee, H.L.Phillips, R.Sundelin, M.Tigner, J.Walters (Lab. of Nuclear Studies, Cornell Univ., Ithaca, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3351-3 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
During the last several years a variety of superconducting radio frequency structures have been designed, fabricated and tested. The diverse structures and fabrication techniques will be described. For much of the work described, no claim is made as to the original conception having taken place in the laboratory. This paper is a description of the authors' experiences in this field. (5 refs.)

100099 Superconducting cavities from a niobium-copper material. H.Padamsee (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3354-6 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
For large-scale applications, such as superconducting LEP or TRISTAN, cavities made from Nb-Cu composite material offer several advantages over 100% Nb cavities—material cost reduction, defect stabilization, and cryostat simplification through pipe cooling application. Thermal model calculations presented show that if thicknesses less than 0.5 mm can be achieved for the Nb layer, surface defects can tolerate higher power levels. This improves the reliability of achieving target field levels, usually limited by thermal instabilities at defects. Calculations that model pipe cooling copper-backed Nb cavities show that even if coils are spaced as loosely as one every 10 cm, satisfactory cooling of defects can be accomplished. Nb-Cu composite material of good bond quality as well as Nb-Cu cavities have been made. In one S-band cavity, Nb-layer thickness 0.3 mm, $Q_0>2\times10^9$ and $E_{acc}>6.5$ MV/m were achieved. In this cavity 0.5 mm diameter defects operated at 4.2 MV/m whereas in 100% Nb wall cavities they break down at 3.2 MV/m. (4 refs.)

100100 Superconducting RF-cavities for a 30-GEV PETRA storage ring. W.Ebeling, W.Flauger, W.D.Moller, J.Peters, D.Proch, J.Susta (DESY, Hamburg, Germany), G.Arnolds-Mayer, H.Heinrichs, T.Grundey.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3357-9 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The installation of superconducting RF-cavities offer the possibility to increase the beam energy of the PETRA storage ring to 30 GeV. To investigate the large scale use of superconducting RF technology a prototype cryogenic module compatible with space requirements in the PETRA tunnel is developed. The cryostat has a length of 4.2 m and contains two 9 cell 1 GHz structures of elliptical shape. Rectangular and capacitive loaded circular waveguides are explored for high power input and higher mode output couplers. (12 refs.)

100101 Superconducting delay line for stochastic cooling filters. M.Kuchnir, J.D.McCarthy, R.J.Pasquinelli (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3360-2 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The stochastic cooling system of the antiproton source at Fermilab uses notch filters for reducing the feedback power at frequencies corresponding to particles in the core. At the same time these filters assist in shaping the gain vs. momentum in the stack tail. These filters, therefore, must attenuate all the harmonics of the revolution frequency (629 kHz) in the operating frequency band (1 to 2 GHz). They require components providing delays of 1.59 μsec, with a minimum of attenuation and undesirable distortion in this passband. Transmission lines providing such delays are typically 328 m long (or 164 m if used in a reflecting mode), have a rather large diameter, and are fabricated from a high conductivity material to keep the attenuation sufficiently low. The use of superconductors allows a dramatic reduction in the diameter, total size and cost of this component in spite of the added cryogenic requirements. Superconducting coaxial transmission lines are not new. N.S. Nahman (1973) concisely traced their development from his invention in 1960 to 1973. Y. Hoshiko (1975) and H. Yoshikiyo et al. (1977) described the development of such cables in Japan. While pursuing ways of manufacturing or procuring such transmission lines, the authors measured the performance of two such cables in order to demonstrate the feasibility of the superconducting cable notch filters concept. (5 refs.)

100102 Transient high-field behavior of niobium superconducting cavities. I.E.Campisi, Z.D.Farkas, H.Deruyter, H.A.Hogg (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3366-8 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Tests have been performed on the breakdown behavior of a TM_{010} mode, S-band niobium cavity at low temperatures. Unloaded Q's of 9×10^7 at 4.2K and of 7×10^9 at 1.35K were measured during several tests performed using pulses long enough for the cavity to reach steady state. The breakdown field at 1.35K was increased from 15 to 20 MV/m by processing the cavity at room temperature using 1 MW, 2.5 μs pulses. The response of the cavity at 4.2K to 1 MW, 2.5 μs pulses was also tested in several cool-downs. In these tests the cavity was heavily overcoupled to lower its time constant to a value of 0.80 times the RF pulse length of 2.5 μs. This condition maximizes the energy transfer from the klystron source to the cavity. Measurements made during these experiments clearly indicated that fields of about 50 MV/m were being reached in the cavity without breakdown. (3 refs.)

100103 Quench protection studies on CBA magnets. A.J.Stevens, J.G.Cottingham, A.Ghosh, K.Robins, W.B.Sampson (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3369-71 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Results from quench studies on both short cable samples and prototype Colliding Beam Accelerator project magnets are presented. The quantity of paramount interest is $\int I^2dt$ which is a monotonic function of the maximum conductor temperature obtained in a quench. Conductor damage in short samples has been observed for $\int I^2dt\gtrsim8.4\times10^6$ amp^2-sec at 50 kG and 4.2K. Each magnet is equipped with spot heaters in various locations so that systematic studies of quench propagation under controlled conditions can be made. Values of $\int I^2dt$ as a function of current, location, bath temperature, and cooling mode (single phase helium versus two phase helium) are presented. The magnets are able to absorb their own energy with a modest margin of safety for the type of quenches expected in an accelerator environment. In order to obtain an additional margin of safety, a quench protection scheme which employs current shunting diodes across each magnet half has been adopted. (6 refs.)

100104 Internal trim coils for CBA superconducting magnets. P.A.Thompson, S.Aronson, J.G.Cottingham, M.Garber, H.Hahn, W.B.Sampson (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3372-4 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
In order to correct iron saturation effects and shape the beam working line, superconducting trim coils have been constructed, which operate inside the main coils. Detailed studies of mechanical properties, quench behaviour, fields produced and hysteresis have led to the production of accelerator quality coils generating the required strength harmonics up to cos (7θ). These are routinely installed in CBA main magnets and operate at 80% of short sample with negligible training in an ambient field of more than 5.3T. (5 refs.)

100105 End fields of CBA superconducting magnets. H.G.Kirk, J.Herrera, E.Willen (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3375-7 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Measurements of the two dimensional harmonic content of the end fields generated by the Brookhaven CBA dipole and quadrupole superconducting magnets are presented. Both the local longitudinal structure and the integrated and effects are examined. (2 refs.)

100106 Cryogenic correction coil testing. A.McInturff, M.Kuchnir, P.Mantsch (Fermi Nat. Accelerator Labs., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3378-80 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The lattice of the Fermi National Accelerator Laboratory's Energy Saver/Doubler contains a group of superconducting correction windings with each quadrupole which are housed in an element referred to as a 'spool'. There are 192 spools in the ring plus 12 special power spools which contain the main buss 5000 ampere power as well as correction elements. There will be constructed and tested 260 spools including spares of each of the eight different types. There have been 243 individual spools tested to date. During last fiscal year 188 spool tests were conducted at the test facility. The spools were tested for a) high voltage integrity, b) critical transport current, c) cryogenic heat load, d) cryogenic operating characteristics, e) thermometry calibration and at another facility, magnetic field quality. Data are summarized for 288 cryogenic tests of the 246 different spools, 488 coil sets, and 1464 correction magnets. (10 refs.)

100107 Magnetic field properties of Fermilab Energy Saver dipoles. R.Hanft, B.C.Brown, W.E.Cooper, D.A.Gross, L.Michelotti, E.E.Schmidt, F.Turkot (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3381-3 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
At Fermilab the authors have operated a production line for the fabrication of 901 21 foot long superconducting dipoles for use in the Energy Saver/Doubler. At any one time 772 of these dipoles are installed in the accelerator and 62 in beamlines; the remainder are spares. Magnetic field data are now available for most of these dipoles; in this paper we present some of these data which show that we have been able to maintain the necessary consistency in field quality throughout the production process. Specifically they report harmonic field coefficients, showing that the mechanical design permits substantial reduction of the magnitudes of the normal and skew quadrupole harmonic coefficients; field shape profiles; integral field data; and field angle data. Details of the measurement apparatus and procedures are described elsewhere. (4 refs.)

100108 Magnetic field data on Fermilab Energy Saver quadrupoles. E.E.Schmidt, B.C.Brown, W.E.Cooper, H.E.Fisk, D.A.Gross, R.Hanft, S.Ohnuma, F.T.Turkot (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3384-6 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The Fermilab Energy Saver/Doubler (Tevatron) accelerator contains 216 superconducting quadrupole magnets. Before installation in the Tevatron ring, these magnets plus an additional number of spares were extensively tested at the Fermilab Magnet Test Facility (MTF). Details on the results of the tests are presented here. (6 refs.)

100109 Maximum field capability of Energy Saver superconducting magnets. F.Turkot, W.E.Cooper, R.Hanft, A.McInturff (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3387-9 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
At an energy of 1 TeV, the superconducting cable in the Energy Saver dipole magnets will be operating at ~96% of its nominal short sample limit; the corresponding number in the quadrupole magnets is 81%. All magnets for the Saver are individually tested for maximum current capability under two modes of operation; some 900 dipoles and 275 quadrupoles have now been measured. The dipole winding is composed of four individually wound coils. In general, the cable in the four coils comes from four different reels of cable. As part of magnet fabrication quality control, a short piece of cable

from both ends of each reel has its critical current ($\rho=1\times10^{-12}\Omega$-cm) measured at 5 T and 4.3K. The authors present the statistical results of the maximum field tests on Saver magnets and explore the correlation with cable critical current. (7 refs.)

100110 Performance of 1-m long/75-mm bore superconducting prototype coils for HERA. G.Horlitz, H.Kaiser, G.Knust, K.-H.Mess, S.Wolff (DESY, Hamburg, Germany), P.Schmuser, B.H.Wiik.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3390-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Two short prototypes of the new HERA superconducting dipole magnets with 75 mm inner bore have been built and tested in a bath cryostat. Both coils have reached the short sample current of the cable after a few training steps. The quench current depends linearly on the temperature between 4.0 and 5.0K. The field quality of both coils is in general within specifications. There is no current dependence of the higher harmonics except for the well-known hysteresis due to persistent currents. (5 refs.)

100111 High field accelerator magnet design (10 T, 2 T/cm), material and model development. A.D.McInturff, W.E.Fowler, K.Ishibashi, M.Kuchnir, R.A.Lundy, A.V.Tollestrup (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3393-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Some of the options to be carefully studied and considered for the next generation particle acceleraors are those based on high field ring magnets, i.e. 8→10 T dipole and a 2 T/cm gradient quadrupole. For an intelligent accelerator design decision to be made, it is necessary to design and develop these magnets to a manufacturable prototype. Most of the dipole calculations presented here will be based on a four shell, five kiloampere/turn, five centimeter aperture magnet, approximately six meters long. The calculations, for this size dipole indicate that with presently available materials, the field quality, force containment and currents required for construction of the magnet, are possible. The main objection is the voltage needed to bring the field down without damaging the magnet after a quench (i.e. the inductance/unit length is too large). Recently the concept of a ten thousand ampere/turn design appears to alleviate the inductance problems. (6 refs.)

100112 A layer-wound, 8.7-Tesla superconducting dipole magnet. W.V.Hassenzahl, S.Caspi, W.Gilbert, C.Peters, J.Rechen, C.Taylor (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3396-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The superconducting dipole magnet (D-9B) described in this report is similar in construction to a previous model coil (D-9A) described by Hassenzahl et al. (1982). The authors discuss the features of D-9B that are different from those of D-9A and the results of tests in He I at about 4.3K and in He II between 1.8 and 2.16K. The development of D-9A and D-9B is part of a program at the Lawrence Berkeley Laboratory to establish the technology of 8 to 10 T accelerator dipoles. The performance of the magnets show that dipoles can operate successfully at least at the lower end of this field range. (3 refs.)

100113 Superconducting combined function magnets. H.Hahn, R.C.Fernow (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3402-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Superconducting accelerators and storage rings, presently under construction or in the design phase, are based on separate dipole and quadrupole magnets. It is here suggested that a hybrid lattice configuration consisting of dipoles and combined function gradient magnets would (1) reduce the number of magnet units and their total cost and (2) increase the filling factor and thus the energy at a given field. Coil cross sections are presented for the example of the Brookhaven Colliding Beam Accelerator. An asymmetric two-layer cable gradient magnet would have transfer functions of 10.42 G/A and 0.628 G cm^{-1}/A versus 15.77 G/A and 2.03 G cm^{-1}/A of the present separate dipoles and quadrupoles. (8 refs.)

100114 Superconductivity and future accelerators. G.T.Danby, J.W.Jackson (Accelerator Dept., Brookhaven Nat. Lab., Associated Univs. Inc., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3405-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
For 50 years particle accelerators employing accelerating cavities and deflecting magnets have been developed at a prodigious rate. New accelerator concepts and hardware ensembles have yielded great improvements in performance and GeV/$. The 'great idea' for collective acceleration resulting from intense auxiliary charged particle beams or laser light may or may not be just around the corner. In its absence, superconductivity (SC) applied both to RF cavities and to magnets opened up the potential for very large accelerators without excessive energy consumption and with other economies, even with the CW operation desirable for colliding beams. (5 refs.)

100115 Traveling-wave tube amplifier characteristics study for stochastic beam cooling experiments. B.Leskovar, C.C.Lo (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3423-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The characteristics of continuous-wave wideband traveling-wave tube amplifiers have been experimentally investigated over a frequency range of 1.5 to 4.5 GHz. The authors present measurements of characteristics important for stochastic beam cooling systems that are generally not available from manufacturers' data sheets. The amplifiers measured include models 1177 HO1 and 1277 HO1 having output power capabilities of 10 to 20 W, respectively, at frequencies of 2 to 4 GHz. The power transfer characteristics, the phase-shift characteristics as functions of frequency and the input power level, the voltage standing-wave ratio, harmonics and intermodulation products content were accurately measured and are discussed. Also several approaches are discussed for the reduction of harmonics and intermodulation products. (10 refs.)

100116 Design of the RF cavity and power amplifier for the Fermilab antiproton source. J.E.Griffin, J.A.MacLachlan, A.Moretti (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3435-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
In the Fermilab program, for production of an intense antiproton beam, trains of 82 short antiproton bunches (~1 nsec) separated by 18.8 nsec are produced with a large momentum spread about a mean energy of 8.9 GeV. The bunch trains are delivered to a debuncher ring where a 3% momentum bite is reduced to about 0.2% by exchanging momentum spread for time spread. During the bunch rotation the RF system is required to provide a stable RF voltage of 5 MV at 53.1035 MHz for 60 μ_{sec}, or about 35 turns. Then the voltage must be lowered to 98 kV within about 56 μ_{sec} to match the rotated distribution. The voltage is then reduced to 5 kV in about 12 msec for final adiabatic debunching of the antiprotons. The process is repeated at a 2 second repetition rate. The RF voltage is to be generated by eight RF cavities in a long straight section. Each cavity, when excited with 112 kW of RF power, will generate a peak voltage of 625 kV. Each cavity is excited by a self contained power amplifier mounted directly on top of the cavity to minimize RF interference with nearby high sensitivity stochastic cooling systems. (2 refs.)

100117 Performance tests of the 600-kW CW, 80-MHz, radio-frequency systems for the FMIT accelerator. R.F.Nylander, M.V.Fazio, F.F.Bacci, J.D.Rogers (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3438-40 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The high-power RF system for the Fusion Materials Irradiation Test (FMIT) accelerator consists of 14 sets of equipment, each of which can deliver up to 600 kW (CW) at 80 MHz into a load having a VSWR of 1.4 or less (any phase). Four sets have been shipped to Los Alamos for use with the accelerator [two with the radio-frequency quadrupole (RFQ) and two with the drift-tube linac (DTL)]. Tests conducted at Los Alamos, both into a resistive (electrolytic) load and into a resonant cavity (Q~21000), have confirmed that this system meets, and in most cases far exceeds, the specified performance limits. (no refs.)

100118 The RF system for the Los Alamos free electron laser (FEL). C.C.Friedrichs, P.J.Tallerico, W.J.Hoffert (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3441-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The FEL electron linac consists of three buncher cavities: two accelerator cavities and a deflection cavity, each with its own phase-current RF source. All sources will be pulsed for 100 μs at a 1-pps rate. The phase and amplitude stability requirements are ±1/2°, and ±1/2%. There are two subharmonic bunchers, each requiring 5 kW at 108.33 MHz. All remaining cavities operate at 1300 MHz. The fundamental buncher requires 5 kW, whereas each of the accelerating cavities requires at least 3 MW. The deflection cavity requires up to 100 kW, which is coupled from one of the accelerator cavity RF sources. Prominent features of the RF system are the phase and amplitude control circuits and the multimegawatt klystron amplifiers. (no refs.)

100119 SURF-II upgrade features magnet and RF system enhancements. G.Rakowsky (NBS, Washington, DC, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3444-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The NBS electron storage ring, SURF-II, has been upgraded with a number of major enhancements. The magnet system capability has been increased from 240 to 300 MeV, although actual operation is presently RF limited to 280 MeV. The storage ring magnet has been carefully mapped, resulting in more precise determination of beam energy and better radiometric data. The RF system has been augmented by an auxiliary second harmonic system, terminating in a novel, dual purpose cavity. This structure performs the function of the bump coil during injection, while during acceleration and stored beam operation it functions as a second harmonic cavity. In the latter mode it can either be tuned passively to suppress longitudinal bunch oscillations, or it can be driven actively to modify the longitudinal bunch shape. With proper amplitude and phasing relative to the main RF cavity, bunch lengthening can be achieved, resulting in improved beam lifetime without an increase in vertical size. (2 refs.)

100120 Damping ring RF system for SLC. M.A.Allen, H.D.Schwarz, P.B.Wilson (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3447-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The linear collider project at SLAC contains two damping rings to reduce the emittance of short electron or positron bunches which contain 5×10^{10} particles per bunch. Two of these bunches are stored at a time and then extracted for acceleration in the collider. The RF system is subject to strong transients in beam loading. A computer model is used to optimize capture while minimizing RF power. The introduction of phase jumps in the RF drive at injection time together with offsets in the tuning loops of the RF cavities when no beam is stored allows optimum performance under heavy beam load conditions. The RF system (800 kV at 714 MHz) for the electron damping ring has been built, tested and installed, and is being tested with a beam. (2 refs.)

100121 The RF-system for SuSe. W.Wilhelm, E.Dorner, G.Hinderer, E.Jaeschke, P.Kienle, W.Schott, U.Trinks (Phys.-Dept., Tech. Univ. Munchen, Garching, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3450-1 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The RF-System for SuSe consists of two large cavities in opposite valleys. The cavities are driven in the TE 101-mode and have a radial increasing voltage distribution. The maximum accelerating voltage per cavity is 1 MV at a power consumption of about 170 kW. A frequency variability in the range between 59 MHz and 74 MHz is possible in reducing the gap between the capacitively loaded lips, the fine tuning is done with two cylindrical perturbing objects. The cavities were optimized with the aid of the recently developed three-dimensional cavity calculation program CAV3D and measurements on several models in the scale 1:5, 1:8 and 1:2.5. A full scale power model is in construction. It will be tested with existing facilities at the Munich tandem laboratory, the large vacuum chamber HEXE and the RF power-generator for the post-accelerator SchwelN. A later application of this test cavity as part of a mass-separator is under consideration. (5 refs.)

100122 Three phase RF systems for superconducting cyclotrons. J.Riedel (NSCL, Michigan State Univ., East Lansing, MI, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3452-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The initial design of the MSU K500 cyclotron RF system was reported on at the 1979 Cyclotron Conference. In the course of bringing this system into operation some changes had to be made to that design, and these are discussed. (2 refs.)

100123 Criteria for vacuum breakdown in RF cavities. W.Peter, R.J.Faehl, A.Kadish, L.E.Thode (Los Alamos Nat. Lab., Advanced Concepts & Plasma Applications Group, Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3454-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A new high-voltage scaling based on Kilpatrick's criterion is presented that suggests that voltages more than twice the Kilpatrick limit can be obtained with identical initial conditions of vacuum and surface cleanliness. The calculations are based on the experimentally observed decrease in secondary electron emission with increasing ion impact energy above 100 keV. A generalized secondary-emission package has been developed to simulate actual cavity dynamics in conjunction with $2^1/_2$-dimensional fully electromagnetic particle-in-cell code CEMIT. The results are discussed with application to the suppression of vacuum breakdown in RF accelerator devices. (26 refs.)

100124 Experiments with very high power RF pulses at SLAC. H.A.Hogg, G.A.Loew, V.G.Price (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3457-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Experiments in which the powers of two SLAC klystrons were combined and fed into a resonant cavity pulse-compression system (SLED) are described. Pulse powers up to 65 MW into SLED were reached. The corresponding instantaneous peak power out of SLED was 390 MW. After normal initial aging, no persistent RF breakdown problems were encountered. X-radiation at the SLED cavities was generally less than 400 mR/hr after aging. The theoretical relationship between X-radiation intensity and RF electric field strength is discussed. (3 refs.)

100125 A high-Q ferrite-tuned cavity. L.M.Earley (Sandia Nat. Labs., Albuquerque, NM, USA), H.A.Thiessen, R.Carlini, J.Potter.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3460-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Rapid cycling proton synchrotrons, such as the proposed LAMPF II accelerator, require approximately 10 MV per turn RF with 17% tuning range near 50 MHz. The traditional approach to ferrite-tuned cavities uses a ferrite which is longitudinally biased (RF magnetic field parallel to bias field). This method leads to unacceptably high losses in the ferrite. At Los Alamos, the authors are developing a cavity with transverse bias to the bias field, making use of the tensor permeability of the ferrite. Initial tests of a small (10-cm-diameter) quarter-wave singly re-entrant cavity tuned by several different ferrites indicate that the losses in the ferrite can be made negligible compared with the losses due to the surface resistivity of the copper cavity. Details of the test results will be presented. (6 refs.)

100126 An RF electron beam buncher. J.L.Vomvoridis, T.Tajima, F.S.Felber, B.Spivey, R.O.Hunter,Jr. (Western Res. Corp., San Diego, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3466-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A method is described for producing density modulations on an intense relativistic electron beam by the use of RF fields in a betatron configuration. In concept, a device embodying this method should be capable of producing short (1-10 ns) electron bunches from a long (10-100 ns) beam, and is expected to be relatively compact and to operate efficiently on low power and energy. The method requires that the azimuthal phase velocity of the RF wave equal the electron beam velocity. Depending on phase relative to the RF wave, electrons in the beam gain or lose energy and form bunches by the negative mass effect. The dynamics of the electrons in the combined RF wave and betatron field have been analyzed. An example of an RF electron beam buncher is given. (no refs.)

100127 Field quality aspects of CBA superconducting magnets. S.Kahn, R.Engelmann, R.Fernow, A.F.Greene, J.Herrera, H.Kirk, J.Skaritka, P.Wanderer, E.Willen (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3469-71 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A series of superconducting dipole magnets for the BNL Colliding Beam Accelerator, which were manufactured to have the proper field quality characteristics, has been tested. The authors present the analysis of the field harmonics of these magnets. (4 refs.)

100128 Magnetic properties of the iron laminations for CBA magnets. M.J.Tannenbaum, A.K.Ghosh, K.E.Robins, W.B.Sampson (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3472-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The required magnetic properties of the iron for CBA dipoles are for the most part the same as those for conventional accelerators, namely low coercive force, high permeability at both low and high inductions and high saturation induction. There are two main differences in the CBA application: i) the iron is at 3.8K; ii) the magnetic field in the iron can go as high as 6 Tesla, which is well above saturation. Measurements of the magnetization curves for CBA iron laminations at 300K and 4.2K are presented. The data are analyzed in terms of a simple model in which the variation in saturation induction can be separated from the low field permeability variation. Tolerances on coercive force, permeability and saturation induction are discussed. (5 refs.)

100129 Development of a high power RF system for the Daresbury SRS. D.M.Dykes, B.Taylor (Sci. & Engng. Res. Council, Daresbury Lab., Daresbury, England).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3475-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The RF system for the high current electron storage ring is illustrated in its present state of development, attention being drawn to modifications and countermeasures added to the original design. Some of the characteristics, problems and achievements of the system are discussed. Practical techniques for the diagnosis of system problems are described. (2 refs.)

100130 Theoretical and observed behaviour of the Daresbury SRS RF system. E.A.Hughes (Sci. & Engng. Res. Council, Daresbury Lab., Daresbury, England).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3478-80 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Theoretical predictions of both the steady-state and transient behaviour of the SRS RF system are presented. These are compared with observed behaviour which includes anomalous steady-state beam loading and phase oscillations of the beam. The steady-state theory is shown to provide an adequate explanation of observations and some conclusions are drawn about beam phase oscillations. (2 refs.)

100131 Breakdown and resonance behaviour of the SRS waveguide. D.M.Dykes, A.Jackson, B.Taylor (Sci. & Engng. Res. Council, Daresbury Lab., Warrington, England).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3481-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
During the early running of the SRS storage ring the energy was limited to 1.8 GeV because of unexpected electrical breakdown in the waveguide-cavity system. High power tests showed an unacceptably large amount of third harmonic generated by the klystron, which was found to be produced by a faulty component in the feeder system. The faulty component was replaced, and the waveguide system rearranged. With these changes and the system adjusted to avoid any third harmonic modes, the RF system was immediately able to operate at full power. The SRS has since operated consistently at its design energy of 2 GeV with no RF trips from these effects. The low power tests revealed a rich resonance spectrum and that the magic trees only provide good isolation at the 500 MHz operating frequency thus the waveguide system forms a feedback loop at higher order mode frequencies with the circulating beam and the cavities. This may explain some of the beam instabilities observed in the SRS. (1 ref.)

100132 Time-jitter reduction on the RF buncher signal for the Los Alamos Proton Storage Ring (PSR). E.Higgins, G.Paffenroth (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3484-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The measure of control pursued by the described circuit design will provide RF references with timing uncertainty much less than the expected uncertainty in the micropulse time of arrival at the ring, $\Delta T \approx \pm 80$ ps. For the short-bunch PSR mode where timing is much more critical than for the long-bunch mode, and where the bunching wave has a $\approx$2-ns period, a maximum uncertainty of ± 10 ps was chosen as the error budget for the low-level RF system. The authors discuss the steps taken to develop the low-level RF reference signal with some measure of margin relative to this ± 10-ps budget. Phase-locked loop stabilizers, narrow-band high rejection-rate filters, and low-noise multipliers/dividers provided the means to achieve the goal. The multiplier described is part of a considerably larger system whose function is to generate several synchronizing signals for the PSR. (no refs.)

100133 Higher order mode studies in accelerator waveguides. D.R.Shoffstall, W.J.Gallagher (Boeing Aerospace Co., Seattle, WA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3487-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
While a study of the higher order modes of propagation in periodic structures has, perhaps, its own inherent interest, the motive for the investigation reported here was avoidance of beam excitation and interaction with higher order modes of a waveguide supporting an intended accelerating mode and the lessening of wake field effects by using the largest mean diameter in the waveguide consistent with the operating frequency. All the experimental data reported here was taken at 2856 mcs (10.5 cm) but clearly may be scaled. (8 refs.)

100134 A proposed second harmonic acceleration system for the Intense Pulsed Neutron Source Rapid Cycling Synchrotron. J.Norem, F.Brandeberry, A.Rauchas (Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3490-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The Rapid Cycling Synchrotron of the Intense Pulsed Neutron Source operating at Argonne National Laboratory is presently producing intensities of 2-2.5×10^{12} protons per pulse (ppp) with the addition of a new ion source. This intensity is close to the space charge limit of the machine, estimated at $\sim 3 \times 10^{12}$ ppp, depending somewhat on the available aperture. With the present good performance in mind, accelerator improvements are being directed at 1) increasing beam intensities for neutron science, 2) lowering acceleration losses to minimize activation, and 3) gaining better control of the beam so that losses can be made to occur when and where they can be most easily controlled. On the basis of preliminary measurements, the authors are now proposing a third cavity for the RF system which would provide control of the longitudinal bunch shape during the cycle which would permit raising the effective space charge limit of the accelerator and reducing losses. (5 refs.)

100135 A 'monochromatic' radio frequency accelerator cavity. S.Giordano (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3493-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
In circular accelerators and storage rings it is important that any device placed in the beam line be relatively free of spurious resonances. Accelerating RF cavities inherently have an infinite number of spurious modes. The cavity described makes use of certain geometric construction configurations that eliminate all the spurious modes. A cavity was constructed with an accelerating TMolo mode of 90 MHz. Measurements showed that the TMolo mode was essentially unchanged from a conventional cavity but all modes up to 3 GHz were either completely eliminated or reduced by at least 30 db. (no refs.)

100136 A low coupling impedance double helix structure for use in a ferrite kicker magnet. S.Giordano (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3496-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
In a machine such as the CBA, the ejection ferrite kicker magnet has a very large longitudinal and transverse coupling impedance which could destroy the beam. Using a double helix structure that surrounds the beam, the beam induced fields are confined within the helix and, therefore, decoupled from the kicker; but at the same time the helix is transparent to the external fields of the kicker. At first, this may seem paradoxial that the helix is opaque to the fields generated inside the structure by the beam and simultaneously transparent to the external fields generated by the kicker. (2 refs.)

100137 A second harmonic (6-16 MHz) RF system with feedback-reduced gap impedance for accelerating flat-topped bunches in the CERN PS Booster. J.M.Baillod, L.Magnani, G.Nassibian, F.Pedersen, W.Weissflog (CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3499-501 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Since all experimental and theoretical evidence indicates that the beam intensity in the PSB is at present limited by the Laslett Q shift after trapping, a

second harmonic accelerating system is being added with the aim of producing the flat-topped bunches. Calculations indicate that the resulting improvement in bunching factor should permit an intensity increase of 25 to 40%. Additionally, the bucket area is increased by 25 to 45% depending on intensity. A general description of the new cavities, which operate over a frequency range of 6-16 MHz with a maximum gap voltage of 8 kV, is given together with a description of associated power amplifiers and low level electronics. A notable feature is the use of a fast feedback system to reduce the gap impedance seen by the beam by an order of magnitude, incorporating a 130 W wide-band transistor amplifier with a total delay of about 5 ns. (8 refs.)

100138 Isolated bucket RF systems in the Fermilab Antiproton Facility. J.E.Griffin, C.Ankenbrandt, J.A.MacLachlan, A.Moretti (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3502-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983). (4 refs.)

100139 Buncher for a microwave linear electron accelerator. E.P.Westbrook (Condensed Matter & Radiation Sci. Div., Naval Res. Lab., Washington, DC, USA), R.L.Kyhl.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3505-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The authors report on design and construction features of a bunching system built at the Naval Research Laboratory (NRL) for a NRL linac, with emphasis on solution of the impedance matching and tuning problems inherent in the buncher design. (no refs.)

100140 Rapidly tuned buncher structure for the Los Alamos proton storage ring (PSR). L.M.Earley, G.P.Lawrence, J.M.Potter (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3511-13 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
In the PSR's short-bunch operating mode, accumulated beam currents are intense and change rapidly. The resonant frequency of the 503.125-MHz buncher used in this mode must be rapidly adjusted through a 100-kHz range to maintain the correct 90° phase relation between cavity voltage and beam current. Modulation rates are up to 3 kHz/μs. Each structure consists of two side-coupled buncher cavities, resonantly coupled to a ferrite-loaded tuner cavity. The needed frequency change Δf in the buncher cells is produced by a $50 \times \Delta f$ change in the tuner, accomplished by varying a magnetic field applied to the ferrite perpendicular to the RF magnetic field. Fast modulation of this bias is provided by a low-inductance ferrite-core magnet excited by a special function generator. The resonantly coupled multicavity structure configuration allows buncher and tuner cells to be independently optimized for their specific functions. The authors describe the buncher design, ferrite selection, and test results from a prototype ferrite-loaded tuner cavity. The tests have demonstrated the tuning scheme's feasibility, showing that the necessary 5-MHz range can be attained with only 12% of the tuner cell filled with ferrite, and that losses in the ferrite are small throughout this frequency interval. (5 refs.)

100141 An equivalent circuit model of the general 3-dimensional RFQ. R.M.Hutcheon (Chalk River Nuclear Labs., AECL, Chalk River, Ontario, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3524-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
An equivalent circuit model has been developed, based on the description of the RFQ as a terminated waveguide. The RFQ is modeled as a length of inductively loaded square waveguide operating in 'TE_{10}- and TE_{11}-like' modes in the dipole and quadrupole configurations respectively. This is described by 6 coupled first order differential equations using distributed values for the four quadrant shunt admittances and series impedances. The end terminations are represented by lumped terminating reactances. The first few orders of both dipole and quadrupole modes are described by the model. By relating the equivalent circuit values to physical dimensions, the effects on frequency and field distributions of vane momement, tube distortion, individual end tuner movement and vane strapping were determined. Agreement with measured properties is reasonable, and some new insights on RFQ operation have been gained. (7 refs.)

100142 Development of an RFQ linac at KEK. T.Kato, Z.Igarashi, C.Kubota, E.Takasaki, T.Takenaka, S.Fukumoto (KEK, Nat. Lab. for High Energy Phys., Ibaraki-ken, Japan).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3569-71 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
An RFQ model linac of 62 cm long at a frequency of 200 MHz was constructed using a computer program 'QKEK' developed at KEK. QKEK generates an RFQ linac, calculates beam dynamics, and provides geometrical data of vanes for a numerically controlled milling machine. A detailed study of RF characteristics was performed. The accelerating and focusing fields measured by the bead perturbation method on axis agree well with the design values. An RFQ linac, which accelerates protons from 50 keV to 750 keV, is designed. (4 refs.)

100143 Development of disk-and-washer cavity in KEK. S.Inagaki, T.Higo, K.Takata, H.Nakanishi, S.Noguchi, T.Furuya, K.Kitagawa, E.Ezura, Y.Kojima, T.Takashima (KEK, Nat. Lab. for High Energy Phys., Ibaraki-ken, Japan).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3572-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The behavior of the deflecting mode of the disk and washer structure was studied experimentally and computationally. A possibility was proved that the second HEM_1 passband can be moved above the accelerating frequency and that the value of R/Q can be increased by 60% compared to that of the shunt impedance optimized DAW cavity, if one makes a compromise with 80% of the optimized shunt impedance. The transverse coupling impedance of the second HEM_1 mode at π phase shift is less than 1 Mohm/m for a single cell, which is small by more than an order of magnitude compared to that of the re-entrant cavity or disk loaded cavity. (11 refs.)

100144 Parasitic modes removal out of operating mode neighbourhood in the DAW accelerating structure. V.G.Andreev, V.M.Belugin, S.K.Esin, L.V.Kravchuk, V.V.Paramonov (Inst. for Nuclear Res., Acad. of Sci., Moscow, USSR).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3575-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The disk and washer (DAW) accelerating structure finds its use in a number of new projects (PIGMI, SNQ, etc.). It composes the main part of the accelerating structure of the meson factory now under construction in the Institute for Nuclear Research (INR), Moscow. It is known, that the parasitic modes with azimuthal (ϕ) field variations exist at the operating mode region. In this report different methods of the parasitic modes frequency shift are considered. The main attention is given to the resonant methods, which are the most efficient. (9 refs.)

100145 On the way to the series production of steel-concrete cores for the LEP dipole magnets. J.P.Gourber, J.Billan, H.Laeger, A.Perrot, L.Resegotti (LEP Div., CERN, Geneva, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3614-14 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
CERN has now launched the series production of the steel-concrete cores for the LEP dipole magnets after a three-year development programme during which 14 prototypes were built in collaboration with industry. The paper describes the mechanical, geometrical and magnetic characteristics of these cores and the fabrication techniques which have been developed. Particular emphasis is put on the following points: the controlled mixing of steel in order to reduce the field variations between cores; the influence of the thickness and of the pitch of the laminations on the field quality, and the composition and working conditions of the mortar in relation to the tolerances on core geometry. (4 refs.)

100146 Radiation-hardened field coils for FMIT quadrupoles. R.J.Grieggs, D.J.Liska, A.Harvey (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3617-19 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Modern accelerators of the Fusion Materials Irradiation Test (FMIT) class deliver enormous power onto their targets. The high beam currents of such machines produce highly activating radiation fields from beam/target interaction and normal beam losses. The 100-mA deuteron beam from the FMIT accelerator produces a backstreaming fast-neutron flux of 10^{11} n/s-cm^2 near the target. In addition, the neutron contribution from distributed beam spill of 3 μA/m along the rest of the machine prevents the use of epoxy resin potting materials in all magnet field coils above 10-MeV beam energies. Two special techniques for radiation-hardened field coils have been developed at Los Alamos for use on the FMIT accelerator. One technique uses vitreous enamel coatings on the conductors and appears attractive for the drift-tube quadrupoles. Another method uses a thermally efficient two-layer coil design that has solid mineral-insulated (MI) conductors with indirect cooling coils, all bonded together in a lead matrix. Test results are discussed, along with applications of the quadrupoles in the FMIT facility that reduce gamma exposures during maintenance periods. (2 refs.)

100147 REC quadrupoles and dipoles with circular and elliptical cross sections. R.L.Gluckstern (Dept. of Phys., Univ. of Maryland, College Park, MD, USA), R.F.Holsinger.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3623-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The use of segmented rare earth cobalt (REC) rings to produce high field, high quality quadrupoles to focus charged particle beams is increasing. Current designs are based on the properties of 2-D rings with continuous rotation of the easy axis. Since many applications involve elliptically shaped beams, the authors explore the possibility of using elliptically shaped 2-D rings as a means of reaching higher fields with less REC material. After showing that such improvement is possible, they investigate the modifications required by segmentation numerically. (1 ref.)

100148 The higher order modes calculation of RF cavity with cylindrical symmetry. Wen Zhou (Nat. Synchrotron Light Source, Brookhaven Nat. Lab., Upton, NY, USA), Chu Xuanwen, Zhou Mingda.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2627-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Presents a new computer calculating method for cylindrical symmetry cavities. This method can calculate not only the fundamental mode and longitudinal modes but also the transverse higher modes. The Hertz vector is used as fundamental quantity and the separated variable method is applied. An empty cylindrical cavity has been calculated. The calculating result is in accord with analytic solution fairly well. (7 refs.)

100149 A method of correcting the SUPERFISH-calculated value of ZT^2/Q for cavities with truncate beam tubes. J.C.Amato, R.Sundelin, E.Blum (Lab. of Nuclear Studies, Cornell Univ., Ithaca, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3630-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The performance of an accelerating cavity can be characterized by the values of ZT^2/Q for each of the cavity's resonant modes. For cylindrically symmetric structures the program SUPERFISH can be used to find the field patterns of the azimuthally—invariant ('accelerating') modes. However, SUPERFISH is limited to lossless regions of space entirely enclosed by Dirichlet or Neumann boundaries, i.e. standing-wave solutions, and so cannot correctly treat the physical case of a cavity with open beam tubes through which energy can propagate. Instead, it is necessary to truncate the beam tubes with perfect reflectors, which introduce large amplitude standing-waves in the beam tubes, and consequently large errors in the calculated accelerating voltage and ZT^2/Q. In the past, these errors have been avoided by employing long tapered beam tubes. This technique requires a considerable amount of additional computer memory, and cannot be used when memory is at a premium. The authors describe a new technique which evaluates the errors in the accelerating voltage due to the truncated beam tubes. The method requires no special geometries or time-consuming calculations, and the results are in excellent agreement with other cavity calculations. (2 refs.)

100150 Numerical simulation of high power RF sources. A.T.Drobot, L.Seftor, K.Ko (Sci. Applications Inc., McLean, VA, USA), H.Hanerfeld, W.B.Herrmannsfeldt.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3633-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
In high power microwave tubes the efficient conversion of kinetic electron beam energy to RF in a narrow frequency band involves complicated nonlinear electron dynamics and may involve the spontaneous generation of waves at other frequencies. The authors describe the adaptation of an electromagnetic 2D-3V particle-in-cell code MASK to the simulation of such high power RF sources. In situations where the RF interaction results in the reflection of beam particles, or where there is the excitation of multiple modes internal to the microwave device, simulations are a new tool that permit a representation of the physical processes. In addition, they are capable of modeling the transient behavior and not just steady state operation. (1 ref.)

100151 A coupled eigenmode theory applied to RF structures. D.T.Tran (Thomson-CSF Electron Tube Div., Boulogne-Billancourt, France).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3636-8 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Presents a comprehensive analysis of the coupling mechanism between waves propagating in a periodic system of complex structure. The theory is developed in such a way as to utilize results from computer programs, based upon the finite-element method to solve the two-dimensional eigenvalue problem. The author first studies a single system, simple enough to be considered as being characterized by two regions, for which the eigenmodes are all known. A matrix analysis is developed next and applied to an n-port circuit, representing the whole system considered as an assembly of subsystems such as studied first. An example is given for illustration. Theoretical results and measurements are compared. (4 refs.)

100152 Three-dimensional analysis of RF electromagnetic fields by a finite element method. M.Hara, T.Wada, T.Fukasawa (Inst. of Phys. & Chem. Res., Saitama, Japan), F.Kikuchi.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3639-41 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The authors have developed a program which computes the resonant frequencies and fields in an arbitrary shaped three dimensional cavity by finite element method. They take the electric field $\mathbf{E}=(E_x,E_y,E_z)$ as unknown variables and solve the eigenvalue problem for the Maxwell equations in time-harmonic case imposing boundary conditions. Divergence-free condition is treated approximately by penalty method. They show the formulation for the three dimensional analysis of RF electromagnetic fields and some test calculations. Satisfactory results are obtained for rectangular cavities, cylindrical cavities and those with smoothly deformed parts. In the present calculations, number of the nodal points is limited to less than 1000 because of the memory size of the computer, which means about ten nodes in each direction. For very complicated boundry shapes, errors become large because mesh size is coarse and therefore the condition $\mathrm{div}\ \mathbf{E}=0$ is not fully satisfied, but this difficulty will be overcome with increasing available memory size. (4 refs.)

100153 Microwave measurements of azimuthal asymmetries in accelerating fields of disk-loaded waveguides. G.A.Loew, H.Deruyter, Wang Defa (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3642-4 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Presents microwave measurements of azimuthal asymmetries in the accelerating fields of the SLAC disk-loaded waveguide. These field asymmetries lead to RF phase-dependent beam steering which can be detrimental to operation of linear accelerators in general and of the SLAC Linear Collider in particular. (4 refs.)

100154 Experimental comparison of beam excited modes in biperiodic structures. K.C.D.Chan, H.Euteneuer, J.-P.Labrie, J.McKeown (Chalk River Nuclear Labs., AECL, Chalk River, Ontario, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3645-7 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
An experiment to study excitations of higher order modes in a coaxial coupled structure and an on-axis coupled structure is in progress. The tuning and assembly of these structures is complete. Calculations have shown that a coaxial coupled structure is 5% less sensitive to beam excitation of its axially symmetric modes than an on-axis coupled structure. Low power tests have identified mode frequencies above the accelerating mode passband showing that higher order modes propagate in an on-axis coupled structure and not in a coaxial coupled structure. High power beam tests are scheduled for late 1983. (10 refs.)

100155 Test facility for relativistic beam pickups. J.Simpson, R.Konecny, S.L.Kramer, D.Suddeth (Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3648-50 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The most frequently used method for bench-calibration of pickup devices is that of passing a (usually thin) wire through the device. Electrical excitation of the wire, as a TEM line, simulates a beam and the transfer functions of the device is measured directly. As many people have discovered, this procedure can frequently lead to incorrect predictions of pickup response to particle beams. The reasons for the differences are not always obvious, but plausible explanations are: 1) that wires are incapable of exciting or permitting many modes in the pickup structure which real beams excite; 2) that the interaction of the pickup device with the wire (e.g. large arrays of pickups such as independent striplines with outputs power added), produced unpredictable and unresolvable results. These deficiencies have been eliminated in a facility at ANL which uses a relativistic electron beam to calibrate beam pickups. The facility is extensively used in the development of pickups, and is the primary calibration facility for pickups designed for the FNAL TeV-I antiproton source. (1 ref.)

100156 Filters for stochastic cooling of longitudinal beam emittance. S.L.Kramer, R.Konecny, J.Simpson, A.J.Wright (Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3651-3 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The shorted stub filter has been used extensively to provide the electronics gain shaping for stochastic cooling of longitudinal beam emittance. The repetitive notch of this filter results from the cancellation of the incident signal by the reflected signal at frequencies where the cable electrical length equals an integer number of half wavelengths. The authors also describe another type of notch filter. This analysis demonstrates the advantages of this filter in providing small notch dispersion and other properties necessary for stochastic cooling systems. Because this filter uses only forward signals, it is quite insensitive to imperfections in cables and components, and can therefore be constructed from commercially available components. (10 refs.)

100157 Slot coupled beam signal pickup development at Argonne National Laboratory. J.D.Simpson, S.L.Kramer, D.Suddeth, R.Konecny (Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3654-6 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The need for more experimental studies plus the availability of Argonne's pickup test facility motivated an R&D activity for slot couplers at ANL. The goal is to experimentally examine the characteristics of aperature coupled beam signal pickups and to search for designs applicable to stochastic cooling systems. (4 refs.)

100158 An electron beam buncher to operate over the frequency range 1-4 GHz. D.A.Goldberg, A.A.Arthur, W.S.Flood, F.Voelker (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3657-9 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Presents a description of an electron buncher to be installed in the terminal of a Van de Graaff, which is to produce a modulated beam over the frequency range 1-4 GHz. The modulator geometry has been optimized so that the modulation amplitude should be nearly constant over the frequency ranges 1-2 GHz and 2-4 GHz. Preliminary results indicate the device work as predicted. (1 ref.)

100159 Mechanical and electrical design of the Fermilab lithium lens and transformer system. G.Dugan, C.Hojvat, A.J.Lennox, G.Biallas, F.Cilyo, M.Leininger, J.McCarthy, W.Sax, S.Snowdon (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3664-2 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A lithium lens focusing device will be used for the collection of 8 GeV antiprotons in the Fermilab Tevatron I Project. The details of the mechanical and electrical design of the Fermilab lens and its associated toroidal transformer are discussed. The lens, with a radius of 1 cm and length 15 cm, is expected to achieve gradients of 1000 T/m for a focal distance of 0.225 m. The gradient requires a current on the order of 5×10^5A, resulting in large electromagnetic and thermal stresses. The power supply discharge current and the effect of the inductant of the power leads and connections are minimized by the use of a toroidal matching transformer surrounding the lens itself. (6 refs.)

100160 The design parameters for a lithium lens as antiproton collector. A.J.Lennox (Fermi National Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3663-5 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Maxwell's equations with appropriate boundary conditions are solved for a pulsed cylindrical conductor. The results are applied to the lithium lens used as an antiproton collector for the Fermilab $\bar{p}p$ collider. The magnetic field is expressed as a function of radial distance and time. The time corresponding to maximum linearity is calculated. A method for measuring the current density at the surface is discussed and the Joule heat produced per pulse is calculated. (13 refs.)

100161 Design of a versatile ESQ transport system. J.Brodowski (Accelerator Dept., Associated Univs. Inc., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3666-8 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A versatile precision beam transport channel was built was inexpensive parts requiring minimum precision machining. The critical items, an optical bench and sliding bases are commercially available standard items. The only important precision machining is where a small section of an optical bench is used as a quadrupole assembly holding fixture. With this type of fixturing there is no loss of precision during the transfer of the quadrupole assembly from the EDM setup onto the final assembly, other than the manufacturer-specified mounting and dismounting tolerance. Displacement measurements of the pole tips taken on ten different quadrupole assemblies determined that RMS displacement in the 'x' direction was .000307″ and in the 'y' direction was .000290″. (3 refs.)

100162 Performance results of a low current, high gradient superconducting quadrupole magnet. R.P.Smith, J.D.Gonczy, D.C.Underwood (Argonne Nat. Lab., Argonne, IL, USA), P.H.Garbincius, P.O.Mazur, R.P.Stanek.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3672-4 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A large bore, high gradient superconducting quadrupole magnet has been fabricated and tested which generates a gradient of 60 T/m in a cold bore 12.7 cm in diameter and 2.8 m long. The magnet operates safely without active quench protection and the unwanted multipole fields of the magnet sum to four parts per thousand at a bore radius of 5.0 cm. The magnet has been exposed to a neutral secondary beam at Fermilab produced by targeting a 400 GeV/c primary proton beam on a 30 cm Be target. When operated at a gradient of 52.5 T/m (86% of short sample) the magnet is quenched at a primary beam intensity of 6×10^{11} protons per one second spill. The corresponding energy deposition in the magnet coils has been calculated to be 2 mJ/cm^3. (3 refs.)

100163 Dual aperture dipole with 2nd harmonic. W.F.Praeg (Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3675-7 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Two rapid-cycling accelerator rings are arranged in one magnet-iron structure. There are two sets of coils, one located in each ring, which are connected in series and excited with a first harmonic frequency. One DC bias coil and one second harmonic coil are common to both rings. The second harmonic reduces $\dot{B}$ during acceleration by 33% as compared to single frequency operation. The features of this economical arrangement are described and compared to more conventional systems. This system is especially suitable for combined function magnets. (4 refs.)

100164 Measurement of the SRS cavities higher order resonances using electron beam excitation. D.M.Dykes (Daresbury Lab., Sci. & Engng. Res. Council, Warrington, England).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3678-80 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The resonance spectra of two of the SRS cavities have been investigated by exciting their resonance modes with the circulating electron beam. During these studies the cavities were disconnected from the RF feeder system, with the electron energy loss being made up by the remaining two cavities in circuit. The method is described and the effect of different modes on the beam are presented. (3 refs.)

100165 Test of new accelerator superconducting dipoles suitable for high precision field. A.Patoux, J.Perot, J.M.Rifflet (CEA-CENS, Gif-sur-Yvette, France).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3681-3 (Aug. 1983).
(1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Field homogeneity of superconducting dipoles for accelerators is still difficult to achieve. To reach the required homogeneity level of 10^{-4} the conductors must be located within a few hundreths of mm. At present all the superconducting machines in construction or in project use the most developed tech-

nique of the double shell configuration. This technique is very sensitive to conductor size and a great care must be taken to reach the needed field homogeneity. The design proposed in this paper is a current block configuration which uses accurately punched laminations with slots for conductor location. The design is then much less sensitive to conductor size. Furthermore the tooling needed to build such magnets is much less expensive than the one needed for the shell design. Three short dipoles have been constructed and tested. Very good results in field homogeneity have been obtained directly from the original design. (3 refs.)

100166 Pulsed ion beam generation with cryogenic-anode diode. T.Takahashi, K.Horioka, M.Hijikawa, A.Urai, K.Kasuya (Dept. of Energy Sci., Tokyo Inst. of Technol., Yokohama, Japan).
J. Appl. Phys. (USA), vol.54, no.8, p.4269-74 (Aug. 1983).
Magnetically insulated ion diodes with a cryogenically refrigerated anode are proposed and their characteristics are examined. Proton beams of 7 A/cm^2 and deuteron beams of 5 A/cm^2, with energy of about 80 keV are extracted from a refrigerated H_2O or D_2O anode with good reproducibility and reasonable repetition rate. (7 refs.)

100167 Carbon sample preparation for negative ion source. I.Brissaud, J.P.Mouffron (Inst. de Phys. Nucleaire, Orsay, France), J.M.Garnier, J.L.Michelot.
Rev. Phys. Appl. (France), vol.18, no.8, p.519-22 (Aug. 1983).
Numerous carbon samples were prepared by RF cracking of acetylene. These samples give a $^{12}C^-$ current as intense as pure graphite when used in a sputtering ion source of tandem accelerator. Isotopic fractionation $^{13}C/^{12}C$ is measured. (9 refs.)

100168 Symmetrical systems in charged-particle beam transport. C.M.Merry, J.C.Cornell (Nat. Accelerator Centre, CSIR, Faure, S Africa).
S. Afr. J. Phys. (S. Africa), vol.6, no.1, p.12-21 (1983).
The properties of symmetrical groupings of beamline elements such as dipole or quadrupole magnets used for charged-particle beam transport, are investigated using matrix methods. The symmetries studied form a complete abelian eight-group. Symplectic equations are used to simplify the matrix elements of the various systems. The complete transfer matrix of any symmetrical system can easily be obtained from the matrix of one half of the system, and the properties of the overall system can thus be predicted. A number of useful properties result from first- and second-order matrix elements which vanish because of the symmetry. (16 refs.)

100169 Beam transport systems consisting of two quadrupole triplets. J.C.Cornell, C.M.Merry (Nat. Accelerator Centre, CSIR, Faure, S Africa).
S. Afr. J. Phys. (S. Africa), vol.6, no.1, p.22-8 (1983).
The versatility of charged-particle beam transport systems consisting of two symmetric triplets of magnetic of electrostatic quadrupole lenses is investigated. It is shown that the two-triplet configuration can be operated with a number of different symmetries so that telescopic transfer properties are obtained. As a consequence of the symmetry, the system automatically has unit horizontal and vertical magnification ('unit telescope'). The transfer matrix elements for this system are calculated, and the operation of a typical system is illustrated by plotting rays traced through the system using matrix methods. Results are also presented for the more general cases of (a) unit magnification in one plane and variable magnification in the other ('modified telescope'), and (b) equal but variable magnifications in both planes ('zoom lens'). These characteristics are independent of the shape of the initial beam. (8 refs.)

100170 A quadrupole system for independent horizontal and vertical beam control. C.M.Merry, J.C.Cornell (Nat. Accelerator Centre, CSIR, Faure, S Africa).
S. Afr. J. Phys. (S. Africa), vol.6, no.1, p.29-34 (1983).
A system of quadrupole lenses is described for independent horizontal and vertical control of charged-particle beams from accelerators. Optimal positioning of the quadrupoles for both coincident and non-coincident initial waists is found by a simple analytic treatment. The operation of the system for a range of initial and final waist sizes is demonstrated by means of beam envelope plots derived from a program using a matrix representation of beam transport elements. The width of the final waist in either dimension can be varied over a wide range by adjusting the field strengths of only two quadrupoles, without affecting the width in the other dimension. (no refs.)

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Effect of synchrotron radiation in the proposed 4-GeV Argonne microtron ....See Entry 99891

Transverse beam containment in the ANL 4-GeV microtron ....See Entry 99892

Conceptual design for a CW 1-GeV double-sided microtron ....See Entry 99893

Analytical study of the generation and control of orbit errors in the ANL 4-GeV CW electron microtron design ....See Entry 99894

150-MeV pulse stretcher of Tohoku University ....See Entry 99895

Relativistic collective effect accelerator to reach ultrahigh energies ....See Entry 99896

ELSA, a stretcher and post accelerator for the Bonn 2.5-GeV electron synchrotron ....See Entry 99899

Multi-GeV electron linac-pulse stretcher design options ....See Entry 99900

A four gap synchrotron RF cavity ....See Entry 99912

Thermal analysis and loss in shunt impedance of the LEP accelerating cell ....See Entry 99914

Construction of a system for transport and focusing of ion bunches by the CV-28 cyclotron of IEN/Rio ....See Entry 99918

Synchrotron radiation from the low-beta quadrupoles scattered back toward the short insertion of LEP ....See Entry 99919

Precision measurements of gamma-ray intensities. IV. Low energy region: ^{75}Se and ^{133}Ba ....See Entry 100179

Precision measurements of gamma-ray intensities. V. ^{160}Tb, ^{168}Tm and ^{182}Ta ....See Entry 100180

Resonance neutron radiography using a pulsed neutron source and a 2-dimensional scintillation detector ....See Entry 100585

Use of axially symmetric electrostatic fields for ion beam focusing ....See Entry 100651

High-efficiency free-electron laser results ....See Entry 100781

The UK free electron laser project ....See Entry 100782

Subharmonic triple buncher for a high-efficiency free electron laser ....See Entry 100783

Time-resolved electron beam diagnostics for the Los Alamos free-electron laser oscillator experiment ....See Entry 100784

RF superconducting properties of thin films on niobium .... See Entry 102601

Charge state of ions in liquid metal field ion sources .... See Entry 103034

Application of neutron radiography in Japan ....See Entry 103453

Neutron radiography facilities using neutron beams from nuclear reactors ....See Entry 103454

External tandem target system for efficient production of short-lived positron emitting radionuclides ....See Entry 104052

29.30 RADIATION SPECTROMETERS AND SPECTROSCOPIC TECHNIQUES

100171 Semiconductor telescope spectrometer for beta-ray spectra. W.Trzaska, J.Aysto, J.Kantele (Dept. of Phys., Univ. of Jyvaskyla, Jyvaskyla, Finland).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.221-5 (1 July 1983).
A telescope beta-ray spectrometer consisting of a 3 mm thick Si(Li) ΔE plus a 5 mm thick Ge(HP) E detector was built and tested. Simplicity and insensitivity to γ-rays (when operated in a coincidence mode) make the device well suited to β^+ and β^- end-point energy measurements, and it can also be used in on-line studies of very short-lived β emitters. Due to a number of effects associated with the interactions of the β-particles with the spectrometer, the calibration curves for $\beta+$ and β^- end-point energies were found to be different and were determined using several well-known β activities. As an application of the method, the ${}_{44}{}^{93g}$Ru β^+ end-point energy was measured. The result, 5315 (85) keV, is in good agreement with the prediction from the mass-systematics of the 1977 Mass tables. (11 refs.)

100172 A compact Compton suppression spectrometer using bismuth germanate scintillator. M.Mohsen (Dept. of Phys., King Abd El Aziz Univ., Jeddah, Saudi Arabia).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.241-4 (1 July 1983).
Geometrical and random sampling methods of calculation have been used to estimate the dimensions of a Compton suppression spectrometer using bismuth germanate (BGO) scintillator. Similar calculations have been done using sodium iodide. It has been found that the dimensions of the BGO shield can be decreased to nearly half those of NaI(Tl). (11 refs.)

100173 Cryogenic system for a superconducting spectrometer. J.Porter (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2909-10 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The Heavy Ion Spectrometer System (HISS) relies upon superconducting coils of cryostable, pool boiling design to provide a maximum particle bending field of 3 tesla. The author describes the cryogenic facility, including helium refrigeration, gas management, liquid nitrogen system, and the overall control strategy. (no refs.)

100174 Magnet coil system for a superconducting spectrometer (HISS). R.M.Reimers, R.C.Wolgast, R.M.Yamamoto (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2911-13 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The Heavy Ion Superconducting Spectrometer (HISS) facility and coils are briefly described while most of the paper discusses the support structures consisting of flanged doubly tapered stainless steel cylinders having a Z-shaped cross-section with average diameter of approximately 2.35 meters and height of approx. .49 meters. This member serves as a one piece coil support to resist gravitational, seismic, and magnetic forces with an approximate heat leak to helium of 59 watts per cylinder during operation of magnet at 4K. Maximum magnetic forces on each coil are over 11 meganewtons at 3 T excitation. Magnetic forces attracting the coils to the core vary with excitation in direction as well as in magnitude. Radial magnetic forces produce stresses internal to the coil bobbin. (5 refs.)

100175 Spectrograph for free electron laser experiments. R.C.Kennedy, J.L.Adamski (Boeing Aerospace Co., Seattle, WA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3142-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The design and construction of a Browne-Buechner type round pole face magnetic electron spectrograph is described. The design is based on the first order transfer properties of the bending magnet including the focal surface, dispersion, magnification and resolution. Second order aberrations are compared with numerical ray tracing results using measured field data to simulate the magnet. The numerical results are also compared with floating wire measurements on the system. Agreement is within one part in 10^4. Data extraction from the instrument is done with an array of copper detectors placed along the focal surface. The spectrograph has been successfully employed in free electron laser (FEL) experiments for over a year. (6 refs.)

Profile deconvolution method for small computers ....See Entry 99085

Novel spectrometer for time-angle resolved ultraviolet photoemission ....See Entry 99242

Numerical calculations of electron trajectories in the 127° analyzer using a position-sensitive detector under conditions of fringing fields .. See Entry 99243

Precision measurements of gamma-ray intensities. IV. Low energy region: ^{75}Se and ^{133}Ba ....See Entry 100179

Precision measurements of gamma-ray intensities. V. ^{160}Tb, ^{168}Tm and ^{182}Ta ....See Entry 100180

Upper limit of peak area ....See Entry 100212

29.40 RADIATION DETECTORS

(for mass spectrometers, see 07.75)

100176 Detection of charged particles with a phoswich counter. C.Pastor, F.Benrachi, B.Chambon, D.Drain (Inst. de Phys. Nucleaire, Univ. Claude Bernard Lyon-I, Villeurbanne, France), A.Dauchy, A.Giorni, C.Morand.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.209-15 (1 July 1983).
The essential features, construction details and performance of a phoswich detector are described. Results about the Z and mass identification, energy calibration and total energy response for protons, deuterons, tritons and alphas in the energy range from 20 up to 80 MeV are presented. (21 refs.)

100177 A new method for identification of low energy fragments with $8<Z\leq18$ in plastic track detector Makrofol. Z.Todorovic, R.Antanasijevic (Inst. of Phys., Beograd, Yugoslavia).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.217-19 (1 July 1983).
A new method is introduced to identify low energy fragments with charges of $8<Z\leq18$ in a plastic track detector Makrofol. Makrofol calibration is performed by using known ion beams. This method has been utilized to identify light fragments in binary events produced by the interactions of 12.7 GeV α-particles with Au. (9 refs.)

100178 Particle identification through the measurement of the Bragg curve centroid. K.Kimura (Dept. of Phys., Faculty of Sci., Kyushu Univ., Fukuoka, Japan).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.227-34 (1 July 1983).
A new method of particle identification in heavy ion reactions through the measurement of the Bragg curve centroid and particle energy has been developed using a gas ionization chamber with a resistive anode layer. Z-resolutions comparable to the conventional ΔE-E counter telescope could be attained easily. (5 refs.)

100179 Precision measurements of gamma-ray intensities. IV. Low energy region: ^{75}Se and ^{133}Ba. Y.Yoshizawa, Y.Iwata (Dept. of Phys., Faculty of Sci., Hiroshima Univ., Hiroshima, Japan), T.Katoh, J.-Z.Ruan, Y.Kawada.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.249-57 (1 July 1983).
Relative intensities of gamma rays were measured in Hiroshima and Nagoya in the region of 122-356 keV. Two Ge(Li) detectors were calibrated with four kinds of standard sources and a cascade gamma-ray source. The disintegration rates of the standard sources were determined by means of the coincidence method. Relative intensities of ^{75}Se and ^{133}Ba were obtained with estimated errors less than 1% for strong gamma rays. Gamma-ray intensities per decay were also extracted. (11 refs.)

100180 Precision measurements of gamma-ray intensities. V. ^{160}Tb, ^{168}Tm and ^{182}Ta. J.Jin, J.Takada, Y.Iwata, Y.Yoshizawa (Dept. of Phys., Faculty of Sci., Hiroshima Univ., Hiroshima, Japan).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.259-71 (1 July 1983).
For pt.IV see ibid., vol.212, no.1-3, p.249-57 (1983). Relative intensities of gamma rays in the decays of ^{160}Tb, ^{168}Tm and ^{182}Ta were precisely measured with a calibrated Ge(Li) detector. Experimental errors for strong gamma rays are 0.5-1%. A few new weak gamma rays for ^{168}Tm and ^{182}Ta were observed. Gamma-ray intensities per decay of three nuclides were derived from each of the relative intensities. These long-lived nuclides which emit multi-gamma-rays are useful for calibration of the gamma-ray spectrometer. (15 refs.)

100181 Gated time projection chamber. P.Nemethy, P.J.Oddone (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA), N.Toge, A.Ishibashi.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.273-80 (1 July 1983).
The authors describe test results on the operation of a gated time projection chamber. Symmetric pulses of ±120 V, applied to alternate wires of a gating

grid, turn the detector from an insensitive state to a sensitive state without impairing the readout of the chamber for more than 2.5 μs. (7 refs.)

100182 Pulse triggering mechanism of air proportional counters. T.Aoyama, T.Mori, T.Watanabe (Dept. of Nuclear Engng., Nagoya Univ., Nagoya, Japan).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.281-9 (1 July 1983).
The paper describes the pulse triggering mechanism of a cylindrical proportional counter filled with air at atmospheric pressure for the incidence of β-rays. Experimental results indicate that primary electrons created distantly from the anode wire by a β-ray are transformed into negative ions, which then detach electrons close to the anode wire and generate electron avalanches thus triggering pulses, while electrons created near the anode wire by a β-ray directly trigger a pulse. Since a negative ion pulse is triggered by a single electron detached from a negative ion, multiple pulses are generated by a large number of ions produced by the incidence of a single β-ray. It is therefore necessary not to count pulses triggered by negative ions but to count those by primary electrons alone when use is made of air proportional counters for the detection of β-rays. (16 refs.)

100183 Growth of the avalanche along the anode wire in a gas counter. II. J.Sanada (Tandem Accelerator Center & Inst. of Phys., Univ. of Tsukuba, Ibaraki, Japan).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.291-8 (1 July 1983).
For pt.I see ibid., vol.196, p.23 (1982). Using a long multi-cathode counter, the author investigated the growth of the avalance along the thin anode wire in a gas counter. In this paper, emphasis is put on the study of the pre-Geiger region. Coexistence, in an unstable mixture, of both a proportional mode and an under-developed Geiger-Muller mode was observed in this region; resulting in multiple peaks. (7 refs.)

100184 Plasma delay of ^{238}U ions in surface barrier detectors. H.-O.Neidel, H.Henschel (Univ. Giessen, Giessen, Germany), H.Geissel, Y.Laichter.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.299-300 (1 July 1983).
The authors have confirmed that the plasma delay of uranium ions with kinetic energies between 123 and 326 MeV does not increase significantly compared with the authors' results with fission fragments. (9 refs.)

100185 Effect of charge carrier collection on the shape of the amplitude spectrum of coaxial Ge(Li) detectors. V.P.Katkov, A.I.Krupman (Sci Res. Inst. of Radioisotope Instruments, Riga, USSR).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.327-32 (1 July 1983).
The paper presents a study of the effect of charge collection on the shape of the full energy peak for true coaxial Ge(Li)-detectors, homogeneous with respect to their electrophysical parameters. Calculations of amplitude spectra were carried out for a detector of 2.8 cm height, with 3.6 cm diameter, and with 0.6 cm diameter for the p^+-region. The transport of gamma radiation was simulated by means of a Monte Carlo method, and the process of charge collection was treated analytically. It is shown that resolution depends essentially on the rate of the collection efficiency in the region of the detector in which the greater part of the energy of a gamma photon is absorbed. Multiple scattering of gamma rays improves resolution under conditions of predominant hole trapping and deteriorates it if electron trapping dominates. The dependence of resolution on the electron trapping length at various hole trapping lengths are presented. (8 refs.)

100186 Bulk response of some polymeric nuclear track detectors to ionizing radiation. H.B.Luck (Akademie der Wissenschaften, Zentralinst. fur Kernforschung, Rossendorf/Dresden, Germany).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.371-3 (1 July 1983).
Response functions for bulk etching after electron or gamma irradiations are presented for Daicel, CR-39, PC and PETP. All response functions derived from available experimental data consist of a linear and one supralinear term. Based on the assumption that polymer chains are preferentially degraded from the chain ends the linear term can be explained in terms of a radiation induced growth in the surface concentration of chain ends. The supralinear term is supposed to be caused by the etching mechanism which is responsible for enhanced particle track etching as well. (27 refs.)

100187 Opto-electronic system for automatic track counting in plastic SSNTD. R.Flores, L.Ortiz, M.Moreno, G.Corkidi, A.Solar (Centro de Instrumentos, Univ. Nacional Autonoma, Mexico City, Mexico), M.Balcazar-Garcia.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.375-81 (1 July 1983).
A device which consists of an optical Fourier processor, a vidicon TV camera and integrated electronics was designed. This device is efficient in track counting for SSNTD, chemically as well as electro-chemically etched. The system's optical field of view covers the complete 1×1 cm^2 detector area and the count is displayed digitally. The complete processing time per detector is 1/60 s. A detailed description of the device and the counting procedure is given. (6 refs.)

100188 Response characteristics of cellulose nitrate track-detectors to radon and radon-daughter mixtures. T.M.J.Knofel, J.J.S.Estrada (CNEN, Inst. de Radioprotecao e Dosimetria, Rio de Janeiro, Brazil), O.A.P.Tavares, J.B.Martins, A.Goodwin.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.387-92 (1 July 1983).
The response of bare cellulose nitrate (CN) LR-115, type II (Kodak-Pathe), track detector exposed to various mixtures of radon and airborne radon-daughters is investigated. Under controlled irradiation conditions good linear correlation was obtained between through-etched track density ρ and the radon-daughter accumulated exposure ϵ_a (in units of WL-h). It is shown that the calibration factor $\Delta\epsilon_a/\Delta\rho$ for the CN LR-115, type II, track detector is an increasing function of the equilibrium ratios of the radon-daughter mixtures. (12 refs.)

100189 Large scintillation cells for high sensitivity radon concentration measurements. B.L.Cohen, M.El Ganayni, E.S.Cohen (Univ. of Pittsburgh, Pittsburgh, PA, USA).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.403-12 (1 July 1983).
Methods for improving the sensitivity of scintillation cells for radon concentration measurements were studied with emphasis on improving light collection efficiency. This allows the length and hence the volume of the cell to be increased. Variables studied were choice of scintillator material, its method of application and thickness, length of cell, cell material, type and configuration of reflectors, choice of photomultipliers, and factors affecting background. Response from various areas of the cell surface was studied with an alpha source and with radon filling. Coating the window with phosphor was found to be counter-productive. The optimum results obtained were with the inside of the cell (other than the window) covered with a thick layer of ZnS(Ag), or with a thick layer of reflective material coated with a thin layer of phosphor. With it, a 10 cm diameter plexiglass cell can be extended to at least 50 cm length without difficulty from insufficient pulse height a2940Me a2970−w a3510Bz b7420−m. (11 refs.)

100190 On the use of cellulose nitrate as solid state nuclear track detector. I. Detector preparation and etching behaviour. H.B.Luck (Akademie der Wissenschaften, Zentralinst. fur Kernforschung, Rossendorf/Dresden, Germany).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.479-82 (1 July 1983).
The study reveals that the surface etch rate ν_s of the CN detector is correlated to the fractional amount of disubstituted cellulose nitrate. The etching behaviour in KOH is characterized by a linear concentration dependence up to 6 mol/l. A further increase of the etchant concentration results in a steep growth of ν_s. The mechanism of alkaline degradation of cellulose nitrate is discussed. The appearance of an induction period in surface etching is supposed to be caused by a denitration reaction at the detector surface, which is considered to be nondegrading. (23 refs.)

100191 On the use of cellulose nitrate as solid state nuclear track detector. II. Response to light particles and applications. H.B.Luck (Akademie der Wissenschaften, Zentralinst. fur Kernforschung, Rossendorf/Dresden, Germany).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.483-7 (1 July 1983).
For pt.I see ibid., vol.212, no.1-3, p.479-82 (1983). As a result of a systematic investigation into the effect of the degree of substitution and the etching conditions on the response of cellulose nitrate to light particles a detector has been obtained which has an excellent sensitivity to protons, deuterons and alpha particles. A maximum sensitivity was attained using an etching procedure in 5N KOH at 70°C. A general response function was derived from 28 individual response functions for various material parameters and etching conditions. The experimental findings are discussed in terms of the concept of a free reaction volume. The applications of CN detectors in neutron dosimetry and energy determination of protons and alpha particles are considered. (23 refs.)

100192 Ion implanted nuclear radiation detectors passivated with anodic silicon oxide. J.Von Borany, G.Mende, B.Schmidt (Acad. of Sci., Central Inst. of Nuclear Res., Dresden, Germany).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.489-92 (1 July 1983).
Semiconductor radiation detectors are produced by planar technology using ion implantation for silicon doping and anodic oxidation for device passivation. An energy resolution of 13.5 keV for 5.486 MeV alpha-particles from ^{241}Am using active detector areas of about 13 mm^2 have been achieved. (9 refs.)

100193 The response of an isobutane filled ion chamber to heavy ions. A.N.James, P.A.Butler, T.P.Morrison, J.Simpson (Dept. of Phys., Univ. of Liverpool, Liverpool, England), K.A.Connell.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.545-53 (1 July 1983).
A gridded ion chamber with its anode split to record both total energy and rate of energy loss has been used with isobutane gas to detect ions of seventeen elements ($17 \leq Z_1 \leq 92$) in the velocity range $2 < (137v/c) < 6$. The rate of energy loss and the ionisation collection efficiency were found to be independent of pressure over the range 15-50 Torr. The effective charge of the ion moving in the gas is observed to oscillate with Z_1. This variation and its effect on the resolution of the rate of energy loss signal are discussed. The effective charge of the moving ion in the ion chamber window (solid propylene) does not oscillate with Z_1 but probably depends on the ion charge before entering the window. (24 refs.)

100194 The pairing extrapolation ionization chamber for (n,γ) mixed field dosimetry. Meng Xiangqin, Lin Guijing (Inst. of Biophys., Acad. Sinica, Peking, China).
Nucl. Tech. (China), no.2, p.10-13 (April 1983). In Chinese.
The chambers are of gas flowing type. Basic features and parameters are measured in the X-ray, γ-ray and (n,γ) mixed field. The results of the experiments show that the chambers can be applied to measure neutron absorbed dose in (n,γ) mixed field. It is also suitable for accurate determination of absorbed dose of a thin layer sample. (4 refs.)

100195 p-type ultra-high purity silicon detector. You Naitan, Gu Guijun, Shen Weisheng (Shanghai Inst. of Nuclear Res., Acad. Sinica, Shanghai, China).
Nucl. Tech. (China), no.2, p.28-9 (April 1983). In Chinese.
The fabrication and performance of p-type ultra-high purity silicon detectors are described. A 50 mm$^2 \times$1.73 mm Si(HP) detector consists of a single crystal of p-type ultra-high purity silicon supplied by Zhejiang University, and at 77K, the resolution of the detector for ^{207}Bi 1063.4 keV K-electrons is 1.72 keV. (no refs.)

100196 Some performance characteristics of modern liquid scintillation counters. S.A.McQuarrie, C.Ediss, L.I.Wiebe (Faculty of Pharmacy, Univ. of Alberta, Edmonton, Alberta, Canada).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.7, p.1009-12 (July 1983).
Three examples of modern liquid scintillation counters were tested and several of their performance characteristics measured. Color and chemical quenched samples were counted in a Beckman LS 9000, a Packard 460C and a Tracor Mark III to test the reproducibility of different quench-monitoring techniques. Instrumental differences and similarities are discussed and related to the performance of these counters. All three counters operated reliably over a wide range of sample quenching. (7 refs.)

100197 Easy direct evaluation of NR images on cellulose nitrate films. M.Fantini, G.Renard (Res. Labs. Kodak-Pathe, Paris, France).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.745-6
The use of plastic films especially cellulose nitrate, presents many advantages. But the direct examination of frosted images is rarely possible. The most used way is the projection print on a photographic surface. Using an adequate viewer with adaptation of a simple crossed polarizing filters device, neutronic images can be evaluated as black and white radiographs. (no refs.)

100198 A study of the neutron radiographic parameters of some solid state nuclear track detectors. R.Ilic, M.Najzer, A.Podgornik, J.Rant (J. Stefan Inst., E. Kardelj Univ. of Ljubljana, Ljubljana, Yugoslavia).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.755-65
The main radiographic parameters such as signal exposure characteristics, spatial resolution and detail discernment were calculated. The theoretical calculations were verified by experiments using LR-115, CA-8015 and CR-39

detectors in combination with a boron screen ($Li_2B_4O_7$ and boron glass). The signal versus exposure (defined as the product of the average visible track area and track density) characteristics were found to be linear within exposure limits 0.5 to 5. The spatial resolution was assessed in terms of the edge spread function. Its dependence on the neutron beam divergence, particle range, critical angle of etching, track size and removed detector layer was studied. Analysis of the image inhomogeneity caused by statistical fluctuations in the number of tracks forming the image allowed the evaluation of the smallest detail discernible in a track-etch neutron radiograph as a function of different system parameters. (35 refs.)

100199 Fission neutron radiography with etch-track detectors. J.J.Antal (Army Materials & Mech. Res. Center, Watertown, MA, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.793-7
Neutrons in a fission spectrum of energies are readily available from the californium-252 isotope in a point-source configuration convenient for radiography. These neutrons, of 1-2 MeV energy, have penetration properties different enough from those of thermal neutrons generally used for radiography to be of interest in special radiographic situations. The author describes the AMMRC Californium Laboratory source facilities and describes his early work in developing etch-track imaging of fission neutrons for radiography. (1 ref.)

100200 Allyl diglycol carbonate as a track detector material for boron autoradiography. T.B.Cameron (Climax Molybdenum Co. of Michigan, Ann Arbor, MI, USA), J.E.Morral.
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.799-805
Neutron autoradiography is among the most valuable techniques for studying low boron concentrations (<100 ppm). However, poor etched track resolution in conventional CAB type solid state detectors has discouraged track counting and quantitative applications for this technique. An alternate material has been evaluated (trade name CR-39) and found to provide much improved etched track resolution as well as a lower minimum particle registration angle. The application of this material for measuring low concentrations of boron in iron is also described. (8 refs.)

100201 A model describing quantitative neutron autoradiography for boron in iron. T.B.Cameron (Climax Molybdenum Co. of Michigan, Ann Arbor, MI, USA), J.E.Morral.
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.807-14
Because of the ability to measure low boron concentrations (<10 ppm) with a resolution approaching 1 μm, neutron autoradiography for boron is equivalent or superior to most of the sophisticated electron and ion beam instruments available. However, to this point only empirical relationships have been used to relate fission track etch pit density in solid state detectors with boron concentrations. A model has been developed which describes the relationship between track detector variables and boron concentration in iron. This model incorporates the concept of a minimum particle registration angle and can be used to compare various track detector materials. With this basis, the detection sensitivity for boron in grain boundaries and precipitates in iron is examined. (16 refs.)

Simple ultrahigh vacuum transfer system for surface barrier detectors .... See Entry 99118

Numerical calculations of electron trajectories in the 127° analyzer using a position-sensitive detector under conditions of fringing fields .. See Entry 99243

Digital neutron radiography using plane converters with multiwire proportional chambers .... See Entry 99259

Use of cellulose nitrate for neutron radiographic testing of burned fuel elements .... See Entry 99653

Development of an enriched elemental boron-10 conversion screen for improved 'track-etch' image recording .... See Entry 99655

Dimensional measurements of the Petten calibration pin .... See Entry 99662

Neutron dosimetry with spherical ionisation chambers. V. Experimental measurements and comparison with calculations of the cavity size dependence of the specific ionisation .... See Entry 99738

Polarimeters for the AGS polarized proton beam .... See Entry 99936

Semiconductor telescope spectrometer for beta-ray spectra ... See Entry 100171

A compact Compton suppression spectrometer using bismuth germanate scintillator .... See Entry 100172

Energy loss and energy straggling of protons and pions in the momentum range 0.7 to 115 GeV/*c* .... See Entry 100216

Resonance neutron radiography using a pulsed neutron source and a 2-dimensional scintillation detector .... See Entry 100585

Resonance neutron radiography .... See Entry 103484

29.60 COUNTING CIRCUITS AND NUCLEAR ELECTRONICS

100202 Spark-gap crowbar for high-voltage power supply. A.K.Mitra, P.J.Tallerico (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2862-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A new crowbar circuit employing a pressurized spark gap has been designed to replace the existing ignitron crowbar that protects a 500-kW klystron tube when it arcs. The spark gap offers definite performance advantages when compared to the conventional ignitron circuits. The small overall size makes the spark gap more convenient and the very few components make it more reliable than the ignitron crowbar. (no refs.)

100203 Application of a digital trigger generator to NSLS booster and storage ring dipole power suppliers. B.B.Culwick, R.E.Olsen (Nat. Synchrotron Light Source, Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2865-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The digital trigger generator described by Olsen (1983) has been used to control a number of power supplies at the NSLS. Two extensions to the basic controller have been used to preserve its inherent high performance in particular applications. In the case of fast slew rate applications, the bandwidth limits of the supply generate errors in tracking the current reference. The repetitive nature of the NSLS booster cycle has made possible an adaptive feedforward scheme which corrects the errors of a given cycle based on data derived from previous cycles. For slowly varying current regulated supplies, the residual subharmonic ripple due to unbalanced phase voltages, transformer unbalance, etc. is corrected by means of a microprocessor based harmonic analyser which feeds data to the phase correction input of the controller. (1 ref.)

100204 A high performance digital triggering system for phase controlled rectifiers. R.E.Olsen (Nat. Synchrotron Light Source, Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2867-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The larger power supplies used to power accelerator magnets are most commonly polyphase rectifiers using phase control. While this method is capable of handling impressive amounts of power, it suffers from one serious disadvantage, namely that of sub-harmonic ripple. Since the stability of the stored beam depends to a considerable extent on the regulation of the current in the bending magnets, subharmonic ripple, especially that of low frequency, can have a detrimental effect. At the NSLS, a 12 pulse, phase control system has been constructed using digital signal processing techniques that essentially eliminates sub-harmonic ripple. (2 refs.)

100205 A bipolar, high precision, low ripple power supply. H.Pfeffer, R.J.Yarema (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2870-2 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A ±600 V, ±50 Amp high precision SCR power supply has been developed for use in the Energy Doubler Correction System. The bipolar output is accomplished by means of a dual converter with circulating current for smooth zero-crossing current transitions. Absolute accuracy better than ±.025% is achieved with a high precision tansductor, current reference, and other high quality components. Stability is better than 2.5 ppm/°C and voltage ripple is less than 30 mV peak to peak. Low ripple is achieved through the use of bipolar series-pass transistor bank. Ripple attenuation of the transistor bank is a minimum of 60 dB from DC to 2 kHz. Microvolt level noise and pickup in the power supply regulator ultimately set the ripple level in the power supply output. A special 'active ground' circuit is included to filter the common mode ripple which is inherent in SCR supplies. (3 refs.)

100206 Dual frequency ring magnet power supply with flat-bottom. W.F.Praeg (Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2873-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A power supply is described that furnishes an essentially flat-bottom injection field, followed by a dual frequency cosine field. This results in efficient beam capture during injection and reduces significantly the peak RF power required during acceleration in a rapid-cycling synchrotron. (1 ref.)

100207 Power supply regulation by microprocessor. J.Sheehan, H.Langenbach (Nat. Synchrotron Light Source, Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2876-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Many small magnet power supplies are regulated by using a microprocessor system to generate control voltages to continuously servoregulate each power supply. The power supplies are of very simple design since all regulation and feedback hardware are parts of the microprocessor system. Most of the supplies are bipolar transistor followers, powered by a common unregulated DC power supply and are used to power trim steering magnets on the three NSLS synchrotron rings. Twelve bit accuracy is obtained using commercially available microprocessor PC cards. (1 ref.)

Opto-electronic system for automatic track counting in plastic SSNTD .... See Entry 100187

29.70 RADIATION MEASUREMENT, DETECTION AND COUNTING

(see also 29.30 Radiation spectrometers and spectroscopy, 29.40 Radiation detectors; for dosimetry, see 87.60M)

100208 A gas cell for Doppler-shift attenuation measurements up to 10^7 Pa. M.Bini, G.Poggi, N.Taccetti (Univ. Firenze, Firenze, Italy).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.235-40 (1 July 1983).
A cell suitable for Doppler-shift attenuation measurements in gas at high pressures is described. The variation of the gas density as a function of the beam current is studied for argon and krypton gases. Examples of lifetime measurements in the picosecond range are given. (11 refs.)

100209 Binomial vs. Poisson statistics in radiation studies. J.Foster, K.Kouris, I.P.Matthews, N.M.Spyrou (Dept. of Phys., Univ. of Surrey, Guildford, England).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.301-5 (1 July 1983).
The processes of radioactive decay, decay and growth of radioactive species in a radioactive chain, prompt emission(s) from nuclear reactions, conventional activation and cyclic activation are discussed with respect to their underlying statistical density function. By considering the transformation(s) that each nucleus may undergo it is shown that all these processes are fundamentally binomial. Formally, when the number of experiments N is large and the probability of success p is close to zero, the binomial is closely approximated by the Poisson density function. In radiation and nuclear physics, N is always large: each experiment can be conceived of as the observation of the fate of each of the N nuclei initially present. Whether p, the probability that a given nucleus undergoes a prescribed transformation, is close to zero depends on the process and nuclide(s) concerned. Hence, although a binomial description is always valid, the Poisson approximation is not always adequate. Therefore further clarification is provided as to when the binomial distribution must be used in the statistical treatment of detected events. (9 refs.)

100210 Experimental dead-time distortions of Poisson processes. G.Faraci, A.R.Pennisi (Istituto di Fisica, Univ. di Catania, Catania, Italy).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.307-10 (1 July 1983).
In order to check the distortions, introduced by a nonextended dead time on the Poisson statistics, accurate experiments have been made in single channel counting. At a given measuring time, the dependence on the choice of the time origin and on the width of the dead time has been verified. An excellent agreement has been found between the theoretical expressions and the experimental curves. (14 refs.)

100211 Two-dimensional curve fitting in counting experiments. T.Awaya (Dept. of Phys., Coll. of Sci. & Engng., Aoyama Gakuin Univ., Tokyo, Japan).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.311-17 (1 July 1983).
The author's (1979, 1980) method is applied to a two-dimensional curve fitting to the generated data with normal and Poisson errors in abscissa and ordinate, respectively. The method is compared with the least-squares one. It is concluded that the latter introduces significant deviations as the total count decreases and the former gives good results. (2 refs.)

100212 Upper limit of peak area. O.Helene (Inst. de Fisica, Univ. de Sao Paulo, Sao Paulo, Brazil).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.319-22 (1 July 1983).
The author discusses the determination of the upper limit of peak area in a multi-channel spectra with a known significance level. This problem is especially important when the peak area is masked by the background statistical fluctuations. The problem is solved exactly and, thus, the results are valid in experiments with small numbers of events. Results are presented for a Monte Carlo test and applied to the ^{92}Nb beta decay. (12 refs.)

100213 A simple method for detecting the radioactivity leakage of sealed high-level ^{60}Co sources in water well. Chen Jingfeng, Kou Xiuezhong, Ge Zhaohua, Yie Zhongquan, Zhang Yuejing, Yu Yue (Inst. of Biophys., Acad. Sinica, Peking, China).
Nucl. Tech. (China), no.2, p.55 (April 1983). In Chinese.
A simple and safe method is described to detect the radioactivity leakage from the stainless-steel shielded high-level cobalt-60 sources in water well. The source checked is placed in a small special sealable sampling can filled with water. After being kept a few days, water in the sampling can is pumped out and assayed. (no refs.)

100214 Measurements of radioactive materials: specifications of the limit of detection and the possibility of reaching them. M.Tschurlovits (Atominst. Osterreichischen Univ., Wien, Austria).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.7, p.965-71 (July 1983).
A consistent description of the required assumptions for the establishment of the lower limit of detection (LLD) when measuring radioactive substances is given. This description includes both the conceptual requirements and their fulfilment. The selection of a reasonable unit for the LLD and the significance level is discussed. The counting time, which can be chosen in a limited range, is considered. In addition, the figure of merit consisting of equipment parameters, namely efficiency and background rate, is used. However, both efficiency and background rate are subject to influence by the sample to be counted. This influence is discussed by means of a few examples which are taken from radiation protection measurements. Finally the range where the applied formalism can be used is checked empirically. (12 refs.)

100215 Energy-loss straggling and higher-order moments of energy-loss distributions for protons. E.Kuhrt, R.Wedell (Sektion Phys., Humboldt-Univ. Berlin, Berlin, Germany).
Phys. Lett. A (Netherlands), vol.96A, no.7, p.347-9 (18 July 1983).
Using the classical collision theory for two moving charged particles the energy-loss straggling and the skewness of an energy-loss distribution for protons passing a medium are calculated. It is shown that the motion of the target electrons is responsible for significant deviations from Bohr's results (1948) in the low-energy region. (13 refs.)

100216 Energy loss and energy straggling of protons and pions in the momentum range 0.7 to 115 GeV/*c*. S.Hancock (Imperial Coll. of Sci. & Technol., London, England), F.James, J.Movchet, P.G.Rancoita, L.VanRossum.
Phys. Rev. A (USA), vol.28, no.2, p.615-20 (Aug. 1983).
The energy-loss distribution for pions and protons, with momenta between 0.7 and 115 GeV/*c*, has been measured in an ion-implanted silicon detector of 300 μm thickness. The data are well described by an empirical energy-loss distribution. (24 refs.)

100217 Z_1^3 dependence of the energy loss of an ion passing through an electron gas. C.C.Sung, R.H.Ritchie (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Phys. Rev. A (USA), vol.28, no.2, p.674-81 (Aug. 1983).
The theory of the energy loss of an ion with charge $Z_1 e$ passing through an electron gas is considered. The term proportional to Z_1^3 in the expression for the stopping power of the medium is derived by taking a second functional derivative of the induced charge in the medium and is expressed as a product of three Green's functions. The actual evaluation is effected by separately treating the momentum transfer to distant and close collisions. Also, it is assumed that the Fermi energy E_F is less than $\hbar\omega_p$, the plasmon energy of the medium. The contribution to the Z_1^3 term from distant collisions is similar to that obtained by others using an atomic model for the stopping medium if one replaces that atomic binding energy by $\hbar\omega_p$. The contribution from the region of close collisions is shown to be unimportant compared to that from distant collisions because screening of close collisions is expected to be negligible in the electron gas. This work will discuss related work by Lindhard and Esbensen, and by Arista, who arrive at different conclusions with respect to this impact-parameter dependence. (18 refs.)

100218 Track and vertex fitting in an inhomogeneous magnetic field. J.C.Hart, D.H.Saxon.
Report RL-83-006, Rutherford Appleton Lab., Chilton, Oxon., England (May 1983), 45 pp.
Methods have been developed for fitting tracks and vertices in an inhomogeneous magnetic field for the PT55 experiment at Nimrod. Details of the methods, including the correction for $E\times B$ effects, are given. (9 refs.)

Charged-particle transport in one-dimensional systems [dosimetry application] .... See Entry 99050

Fast neutron detection with Al_2O_3 thermoluminescence dosimeter .... See Entry 99733

The slowdownatron: A suggestion for increasing stopping rates by using shaped magnetic field and absorbers .... See Entry 99923

Continuous tune measurements using the Schottky detector .... See Entry 99938

Further development of instrumentation for the Tevatron beam dump .... See Entry 99942

Semiconductor telescope spectrometer for beta-ray spectra ... See Entry 100171

Detection of charged particles with a phoswich counter .... See Entry 100176

A new method for identification of low energy fragments with $8<Z\leq 18$ in plastic track detector Makrofol .... See Entry 100177

Particle identification through the measurement of the Bragg curve centroid .... See Entry 100178

Precision measurements of gamma-ray intensities. IV. Low energy region: ^{75}Se and ^{133}Ba .... See Entry 100179

Precision measurements of gamma-ray intensities. V. ^{160}Tb, ^{168}Tm and ^{182}Ta .... See Entry 100180

Pulse triggering mechanism of air proportional counters .... See Entry 100182

Plasma delay of ^{238}U ions in surface barrier detectors .... See Entry 100184

Opto-electronic system for automatic track counting in plastic SSNTD .... See Entry 100187

Response characteristics of cellulose nitrate track-detectors to radon and radon-daughter mixtures .... See Entry 100188

Large scintillation cells for high sensitivity radon concentration measurements .... See Entry 100189

On the use of cellulose nitrate as solid state nuclear track detector. II. Response to light particles and applications .... See Entry 100191

The response of an isobutane filled ion chamber to heavy ions .... See Entry 100193

The pairing extrapolation ionization chamber for (n,γ) mixed field dosimetry .... See Entry 100194

p-type ultra-high purity silicon detector .... See Entry 100195

Ranges, reflections and secondary electron emission for keV hydrogen ions incident on solid N_2 .... See Entry 101824

Accuracy of stopping cross section determination from RBS-spectra by Warters' method .... See Entry 101825

Radon concentration and exhalation measurement with a semiconductor detector and an electrostatic precipitator working in a closed circulation system .... See Entry 103772

29.80 NUCLEAR INFORMATION PROCESSING

100219 FASTBUS for data acquisition and control. L.Costrell (Center for Radiation Res., NBS, Washington, DC, USA), W.K.Dawson.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2147-51 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
FASTBUS is a standardized modular data-bus system for data acquisition, data processing and control applications. It is the result of an interlaboratory development undertaken to meet the needs of the high energy physics community. However, the versatility, speed and addressing capability of FASTBUS make it attractive for many other types of application. A FASTBUS system consists of bus segments which operate independently but dynamically link together as needed for operation passing. This parallel processing feature accounts to a great extent for the high throughput of FASTBUS in multisegment systems. Master modules compete for single or multiple Segment Control through a bus arbitration scheme using assigned priorities. Logical, geographical, secondary and broadcast addressing methods are used to access either data space or control and status register space. Features include block transfers, a sparse data scan and interrupts. (no refs.)

100220 The LBL magnetic measurements data acquisition system. M.I.Green, D.H.Nelson (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3596-8 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The LBL Magnetic Measurements Engineering (MME) Group has developed a real-time data acquisition system (DAS) for magnetic measurements. An LSI 11/23 microcomputer is interfaced to a clock-calendar, printer, CRT control terminal, plotter with hard copy, floppy and hard disk, GPIB, and CAMAC buses. Off-the-shell hardware and software have been used where possible. Operational capabilities include: (1) measurement of high permeability materials, (2) harmonic error analysis of (a) superconducting dipoles and (b) rare earth cobalt (REC) and conventional quadrupole magnets, and (3) 0.1% accuracy x-y mapping with Hall probes. Results are typically presented in both tabular and graphical form during measurements. Only minutes are required to switch from one measurement capability to another. Brief descriptions of the DAS capabilities, some of the special instrumentation developed to implement these capabilities, and planned developments are given. (13 refs.)

29.90 OTHER TOPICS IN HIGH-ENERGY AND NUCLEAR EXPERIMENTAL METHODS AND INSTRUMENTATION

The NBS-LANL RTM end-magnet field mapper .... See Entry 99138

Report on the production magnet measurement system for the Fermilab Energy Saver superconducting dipoles and quadrupoles .... See Entry 99139

30.00 ATOMIC AND MOLECULAR PHYSICS

(for physical chemistry, see 82.)

31.00 THEORY OF ATOMS AND MOLECULES

(see also 71. Electron states in condensed matter)

31.10 GENERAL THEORY OF STRUCTURE, TRANSITIONS AND CHEMICAL BINDING

100221 Density functional theory of asymptotic form of electron density in heteronuclear diatomic molecules. J.A.Alonso, N.H.March (Theoretical Chem. Dept., Univ. of Oxford, Oxford, England).
J. Chem. Phys. (USA), vol.79, no.4, p.1903-5 (15 Aug. 1983).
Density functional theory is shown to lead to a simple differential equation for the asymptotic form of the electron density in a diatomic molecule. This equation can be solved, if one assumes building blocks which in a heteronu-

clear diatomic molecular correspond to fractionally charged ions. The resulting expression for the asymptotic electron density can be approximately expressed in terms of the fractional charge and the chemical potentials of the two free atoms. Two models are proposed for estimating the fractional charge. (18 refs.)

100222 Topology of the electronic current density in molecules. J.A.N.F.Gomes (Dept. de Quimica, Faculdade de Ciencias, Porto, Portugal).
Phys. Rev. A (USA), vol.28, no.2, p.559-66 (Aug. 1983).
Presents the first complete topological description of the electronic-probability current-density field in molecules under an external homogeneous magnetic field. The analysis is general, applying both to the many-electron current density and to its one electron (orbital) components. The singular lines of the vector field form a stagnation graph which is the skeleton of the qualitative theory presented here. This graph may be disconnected, with one connected part playing a leading role in the description. Other secondary connected parts are encased into topologically spherical separatrices defined by two isolated singular points. This is one of the types of separatrices which are introduced here. The other one is defined by saddle singular lines and encases the axial vortices which are associated with the vortex stagnation lines. The vertices of the stagnation graph are critical points of the current-density field, points where the stagnation lines may branch out according to an index theorem that is proved here. The basic units in this qualitative description of the current field are axial or toroidal vortices. Each vortex is a whirlpool of electronic-charge probability flowing around a vortex stagnation line and encased into a closed separatrix. Vortices may exist inside other vortices but separatrices cannot cross one another. Saddle stagnation lines belong to the boundary of four or more axial vortices. (20 refs.)

100223 Relativistic quantum-defect theory. General formulation. Jwei-Jun Chang (Vil Computing Lab., Artesia, CA, USA).
Phys. Rev. A (USA), vol.28, no.2, p.592-603 (Aug. 1983).
A relativistic multichannel quantum-defect theory is formulated in the same way as in the nonrelativistic theory of Seaton (1966, 1978). The solutions to the radial Dirac-Coulomb equations are reviewed in complex values of energy. The simple-model problem with finite-range potentials is used to clarify the scattering matrix and the reactance K matrix. The close-coupling approximation is discussed for real atomic systems. (12 refs.)

31.15 GENERAL MATHEMATICAL AND COMPUTATIONAL DEVELOPMENTS

100224 Characteristic function of momentum density distribution. II. T.Koga (Dept. of Appl. Chem., Muroran Inst. of Technol., Hokkaido, Japan).
J. Chem. Phys. (USA), vol.79, no.3, p.1384-6 (1 Aug. 1983).
For pt.I see ibid., vol.77, p.6345 (1982). Rigorous relations between the moments $\langle p_x{}^l p_y{}^m p_z{}^n \rangle$ and $\langle p^n \rangle$ and the characteristic function $B(r)$ of the momentum density distribution $\rho(p)$ are here generalized to the case of negative l, m, and n. A simple application is given which illustrates that the present results enable the author to obtain the moments of momenta without referring to any momentum-space quantity. (11 refs.)

100225 Universal basis sets of elliptical functions. S.Wilson (Dept. of Theoretical Chem., Univ. of Oxford, Oxford, England).
J. Phys. B (GB), vol.16, no.15, p.L429-31 (14 Aug. 1983).
The use of universal basis sets of elliptical functions in molecular electronic structure calculations for diatomic molecules is discussed. It is shown that universal elliptical basis sets have a number of advantages in studies of diatomic molecules over the more frequently used exponential-type and Gaussian-type basis sets. (11 refs.)

100226 Analytical results for Coulomb integrals with hydrogenic and Slater-type orbitals. D.Belkic (Inst. of Phys., Belgrade, Yugoslavia).
J. Phys. B (GB), vol.16, no.15, p.2773-84 (14 Aug. 1983).
Atomic form factors containing the product of the Coulomb wavefunction $\langle \mathbf{r}|\mathbf{k}\rangle$ with either the hydrogenic or Slater-type orbital $\langle \mathbf{r}|nlm\rangle$, are calculated in a closed form, for an arbitrary triple nlm. By choosing the quantisation axis for $|nlm>$ along the vector $\mathbf{k}$, it is shown that the present integrals can be reduced to a linear combination of easily calculable hypergeometric polynomials of two and three variables. Results are particularly useful for second-order theories of charge exchange, notably CDW and CIS approximations. (17 refs.)

100227 New approach to the calculation of density functionals. G.Zumbach, K.Maschke (Inst. de Phys. Appl., Ecole Polytech. Federale, Lausanne, Switzerland).
Phys. Rev. A (USA), vol.28, no.2, p.544-54 (Aug. 1983).
The density-functional theory relates the ground-state properties of an N-electron system to a universal functional of the charge density. The authors discuss a functional which avoids the problems of the Hohenberg-Kohn theory. They show that this functional can be calculated exactly, at least in principle. They present an upper bound for this functional, which is applied to the case $N=1$ and to the jellium problem. This upper bound is exact for $N=1$. (9 refs.)

On the phases of atomic eigenfunctions ....See Entry 98694
Relativistic quantum-defect theory. General formulation ....See Entry 100223

31.20 SPECIFIC CALCULATIONS AND RESULTS

100228 Symmetry and broken symmetry in molecular orbital (MO) descriptions of unstable molecules. Generalized MO theoretical studies on 1,3-dipolar species. K.Yamaguchi (Dept. of Chem., Osaka Univ., Osaka, Japan).
THEOCHEM (Netherlands), vol.12, p.101-20 (Aug. 1983).
The electronic and geometrical structures of 1,3-dipolar species are investigated by the semiempirical and ab-initio molecular orbital methods and energy gradient techniques. The diradical character (order parameter) is calculated to express quantitatively the symmetry and broken symmetry properties of their frontier orbitals. The clusterings of water to carbonyl oxide are investigated as an example for the stabilizations of unstable molecules by polar solvents. The present MO theoretical treatments indicate both nonradical and diradical behaviors of unstable 1,3-dipolar species such as carbonyl ylides, compatible with various experimental results reported by Huisgen (1977) and others. (46 refs.)

100229 Formulation of the total molecular energy in semi-empirical SCF-MO method with overlap: application to the determination of the approximate equilibrium geometry. C.Barbier (Lab. de Chimie Phys. Moleculaire, Univ. Claude-Bernard, Villeurbanne, France), G.Del Re.
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.19, p.1481-4 (30 May 1983). In French.
An expression for the evaluation of nuclear and screening contributions to the total energy is proposed. This expression is valuable for semi-empirical SCF methods without neglecting overlap. This method is utilized for the simple systems CO, FeCo, NiCO. (11 refs.)

100230 Reduced partition function ratios of titanium, zirconium, and hafnium compounds. K.Kogure, M.Kotaka, M.Okamoto (Tokyo Inst. of Technol., Tokyo, Japan).
Bull. Res. Lab. Nucl. React. (Japan), vol.8, p.19-28 (1983).
The reduced partition function ratios for some compounds of titanium, zirconium, and hafnium were calculated as functions of temperature using the general valence force field. The contribution of each normal vibrational frequency to the reduced partition function ratios was evaluated. The magnitudes of reduced partition function ratios of titanium, zirconium, and hafnium compounds at 300K were in the following sequences, respectively. $TiO_4{}^4 > TiF_4 > TiCl_4 > TiBr_4 > TiI_4 > TiO > TiCl$, $ZrO_4{}^{4--} > ZrBr_4 > ZrCl_4 > ZrI_4 > ZrO$, $HfO_4{}^{4-} > HfCl_4 > HfBr_4 > HfI_4$. (12 refs.)

100231 Conformations of simple disulfides and L-cystine. R.J.Boyd, J.S.Perkyns, R.Ramani (Dept. of Chem., Dalhousie Univ., Halifax, NS, Canada).
Can. J. Chem. (Canada), vol.61, no.6, p.1082-5 (June 1983).
Ab initio molecular orbital calculations at the STO-3G and STO-3G* levels on H_2S_2, $(CH_3)_2S_2$, $(CH_3CH_2)_2S_2$, and L-cystine show that the minimum energy conformation occurs at the angle at which the S-S overlap population is at a maximum. In agreement with experiment, the calculations favour a disulfide dihedral angle close to 90°. The variation of the S-S overlap population is essentially independent of substituents, whereas the cis barrier to rotation about the S-S bond increases relative to the trans barrier as the size of the substituents increases. These observations lead to the conclusion that electronic effects determine the disulfide dihedral angle and that both steric and electronic effects control the relative magnitude of the cis and trans barriers. (19 refs.)

100232 The vinyloxonium cation ($CH_2CHOH_2{}^+$). R.H.Nobes, L.Radom (Res. School of Chem., Australian Nat. Univ., Canberra, Australia).
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.107-11 (29 July 1983).
Ab initio molecular orbital calculations with large basis sets and incorporating correlation are used to examine the structures and relative energies of the vinyloxonium ($CH_2CHOH_2{}^+$) and 1-hydroxyethyl (CH_3CHOH^+) cations. The best structure of the vinyloxonium ion has the OH_2 plane perpendicular to the CCO plane. The energy difference between the vinyloxonium and 1-hydroxyethyl cations is predicted to be 92 kJ mol^{-1}, substantially greater than a recent experimental estimate of 41 ± 12 kJ mol^{-1}. (16 refs.)

100233 Proper characterization of MC SCF stationary points. J.T.Golab, D.L.Yeager (Dept. of Chem., Texas A&M Univ., Coll. Station, TX, USA), P.Jorgensen.
Chem. Phys. (Netherlands), vol.78, no.2, p.175-99 (15 July 1983).
The authors discuss several characteristics that an MC SCF stationary point should fulfil in order to be a proper representation of the exact Nth state in energy of a certain symmetry. The authors derive an MC SCF iterative scheme that invokes some of these characteristics directly as conditions on the iterative algorithm. Numerical examples demonstrate that convergence is obtained rapidly and reliably to a stationary point with this algorithm. Numerical examples also demonstrate one main point of this paper, i.e. the importance of carefully examining the characteristics of an MC SCF stationary point before assigning it to be an approximate representation of a state. Several different stationary points have been determined for BeO that satisfy some or all of the conditions for being an approximate representation of the same state and it is often not at all clear which stationary point should be chosen as a representative of the desired state. This difficulty may be present in all current and previous MC SCF calculations. (25 refs.)

100234 Complete valence-shell ionization spectra of N_2 and CO: application of the extended two-particle-hole Tamm-Dancoff approximation (2ph-TDA). J.Schirmer, O.Walter (Inst. fur Phys. Chem., Univ. Heidelberg, Heidelberg, Germany).
Chem. Phys. (Netherlands), vol.78, no.2, p.201-11 (15 July 1983).
Green's function studies of the valence-shell ionization spectra of N_2 and CO are reported. The employed method of calculation is the previously derived extended two-particle-hole Tamm-Dancoff approximation (2ph-TDA). This approximation gives a consistent treatment of the one-particle Green's function through third order in the electronic repulsion. Very accurate results are obtained for the outer-valence ionization potentials. The extended 2ph-TDA also allows for an improved description of the inner-valence ionization where as a rule the single-particle picture of ionization no longer applies. The present calculations are devised as a model application of the extended 2ph-TDA. A large orbital basis set has been employed and only minor technical approximations have been introduced. Comparison is made with results from other theoretical approaches, in particular with those of the related third-order equations-of-motion (EOM) scheme. (44 refs.)

100235 Can the H_5 molecule be observed?. K.Kaufmann, M.Jungen (Inst. of Phys. Chem., Univ. of Basel, Basel, Switzerland), V.Staemmler.
Chem. Phys. (Netherlands), vol.79, no.1, p.111-15 (15 Aug. 1983).
The energy levels of the Rydberg states of H_5 and their stability with respect to dissociation into H_3+H_2 have been studied with quantum-chemical methods. The authors predict that the lowest four electronic states of H_5 are dissociative, but that many Rydberg states are metastable. The lowest one of them (1^2B_2 in D_{2d} symmetry) has a dissociation energy of ≈ 76.6 kJ/mol; the higher ones are less strongly bound, some of them being distorted to C_{2v} symmetry by a Jahn-Teller distortion. The authors have also estimated emission frequencies and transition moments of the transitions from higher Rydberg states into the 1^2B_2 state. (16 refs.)

100236 Compton profiles and momentum expectation values, for atomic system gallium through krypton. B.S.Sharma (Dept. of Phys., D Jain Coll., Baraut, India), A.N.Tripathi.
Indian J. Phys. Part B, vol.57B, no.1, p.6-12 (Feb. 1983).
Compton profile in the impulse approximation and the momentum expectation values $\langle p^n \rangle$, have been calculated for the atoms gallium to krypton using three types of wave functions, viz. Gaussian type orbitals (GTO), Slater type orbitals (STO) and its Gaussian expansion (STO-NG) with $N=2$ to 6. It has been found that the peak values of the Compton profile calculated by STO-6G wave functions approaches to the respective true results (i.e. STO values). GTO wave functions give a flattened Compton profile compared to the other two wave function. Further, peak value is in good agreement with the value obtained using a relativistic Hartree Fock wave function. It is observed that the Gaussian type orbitals are well suited for the evaluation of the Compton profile since the key deficiency of GTOs, i.e. their incorrect behaviour at the nuclei, is moved to a region of little importance in momentum space. (20 refs.)

100237 Ab initio SCF study of hyperfine couplings, geometries, and inversion barriers in the isoelectronic radicals NF_3^+, CF_3, and BF_3^-. M.A.Benzel, A.M.Maurice, R.L.Belford, C.E.Dykstra (School of Chem. Sci., Univ. of Illinois, Urbana, IL, USA).
J. Am. Chem. Soc. (USA), vol.105, no.12, p.3802-5 (15 June 1983).
Ab initio SCF molecular orbital calculations with double-ζ and polarized double-ζ bases are reported for the isoelectronic series of C_{3v} radicals $.NF_3^+$, $.CF_3$, and $.BF_3^-$. At the potential minima, the bond lengths are 1.314 Å for NF_3^+, 1.341 Å for CF_3, and 1.442 Å for BF_3^-; the complements of the umbrella angles are +12.1° for NF_3^+, +17.1° for CF_3, and +19.6° for BF_3^-. Calculated inversion barriers are about 11, 33, and 28 kcal/mol for NF_3^+, CF_3, and BF_3^-, respectively. Bonding and the predicted dependence of EPR parameters upon radical geometry are discussed. With respect to the spin-density distribution and the radical geometry, these calculations confirm the general inferences drawn from the previous EPR analysis—in particular, the hyperfine interaction of the central atom. However, an experimental ambiguity in orientation of the principal axis of the fluorine hyperfine coupling matrix is resolved in favor of the nonintuitive alternative. It is concluded that quantitative information about the geometry of such radicals cannot be inferred from the orientation of the halogen hyperfine axes. (27 refs.)

100238 Molecular and electronic structure of phosphonium cyclopropylide ($H_3P{=}C(CH_2)_2$): a theoretical study. M.A.Vincent, H.F.Schaefer,III (Dept. of Chem., Univ. of California, Berkeley, CA, USA), A.Schier, H.Schmidbaur.
J. Am. Chem. Soc. (USA), vol.105, no.12, p.3806-11 (15 June 1983).
Theoretical studies have been carried out for a phosphonium cyclopropylide model, $H_3P{=}C(CH_2)_2$. The molecule was shown to have a ground-state equilibrium geometry (structure I) with a pyramidal carbanion center. One of the PH_3 hydrogen atoms is affected by the carbanion (partial) negative charge, and its position shows substantial distortion away from the idealized tetrahedral phosphorus geometry. In the energy profile for the carbanion inversion the stationary point of maximum energy (two imaginary vibrational frequencies) occurs not for the planar carbanion configuration but well beyond in a situation with a dihedral angle H0PC1C2 of 123° instead of 90°. The rotated configuration (a genuine transition state) is virtually the eclipsed analogue of structure I. The barriers to inversion and rotation are predicted to be 6.3 and 5.8 kcal, respectively. Calculated bond distances, bond angles, dihedral angles, total energy values, and total electron populations on atoms are given for all three conformations. Atomic orbital components and energies of frontier orbitals of the ground state are also discussed. (22 refs.)

100239 An experimental and ab initio study of the addition of atomic carbon to water. S.N.Ahmed, M.L.McKee, P.B.Shevlin (Dept. of Chem., Auburn Univ., Auburn, AL, USA).
J. Am. Chem. Soc. (USA), vol.105, no.12, p.3942-7 (15 June 1983).
The theoretical study, in which all geometries were optimized at 3-21 G level and single point calculations performed at the UMP3/6-31G** level, involved both ^1D and ^3P states of carbon. For $C(^1D)$ atoms, the process having the lowest activation enthalpy is cleavage of an initially formed carbon-water complex to CO and H_2 along a closed-shell surface ($\Delta H\ddagger = 5.2$ kcal/mol). Rearrangement of the closed-shell carbon-water complex to hydroxymethylene has $\Delta H\ddagger = 11.6$ kcal/mol. In the case of triplet carbon, the most favorable reaction of the initial carbon-water complex was simply dissociation to $C+H_2O$. The $\Delta H\ddagger$ for rearrangement of the $C(^3P)$-H_2O complex to hydroxymethylene was 22.8 kcal/mol while the corresponding barrier for an open-shell singlet complex was 18.0 kcal/mol. The barrier to rearrangement of singlet hydroxymethylene to formaldehyde (38.9 kcal/mol) and that of triplet hydroxymethylene (41.3 kcal/mol) were similar. The experimental results were in agreement with theoretical predictions. Atomic carbon, generated by the thermolysis of 5-diazotetrazole, reacts with water to give carbon monoxide (9.5%) and formaldehyde (2.4%). Addition of O_2, a scavenger of $C(^3P)$, increases the CO yield to 53.7% while leaving the formaldehyde yield unchanged. Reaction of carbon with O_2 alone produces only CO (47%). These results indicate that the state of carbon reactive toward water is a singlet, as indicated by the calculations. (28 refs.)

100240 Molecular properties from MCSCF-SCEP wave functions. I. Accurate dipole moment functions of OH, OH^- and OH^+. H.-J.Werner, P.Rosmus, E.-A.Reinsch (Fachbereich Chem., Univ. Frankfurt, Frankfurt, Germany).
J. Chem. Phys. (USA), vol.79, no.2, p.905-16 (15 July 1983).
Potential energy and dipole moment functions for the ground states of OH, OH^- and OH^+ have been calculated from MCSCF, MCSCF-SCEP and SCEP-CEPA electronic wave functions. The stability of the dipole moments with respect to the number of configurations (up to 598) and orbitals (up to 14) simultaneously optimised in the MCSCF procedure and the number of reference configurations (up to 11) in the MCSCF-SCEP wave functions (up to 69830 configurations) has been investigated. The dipole moment functions obtained from the best electronic wave functions are more accurate than all previously calculated ones. The deficiencies of the former calculations have been critically analysed. The OH^- and OH^+ ions are predicted to be stronger IR emitters than the neutral OH radical. The rotationless rates of spontaneous emission A_0^1 for the fundamental transitions are calculated to be 12.2, 137, and 263 s^{-1} for OH, OH^-, and OH^+, respectively. The calculated dipole moments in the vibrational ground states are 1.65, 1.04, and 2.32 D, respectively. (51 refs.)

100241 Determination of Slater-Condon and Trees parameters in terms of the exact effective valence shell Hamiltonian. J.J.Oleksik, K.F.Freed (Dept. of Chem., Univ. of Chicago, Chicago, IL, USA).
J. Chem. Phys. (USA), vol.79, no.3, p.1396-403 (1 Aug. 1983).
The empirical approximate Slater-Condon and Trees parameters of atomic spectra and semiempirical molecular electronic structure theories are expressed in terms of the matrix elements of the exact effective valence shell Hamiltonian ($\mathcal{H}^v$) for the s^np^m case. The nature of the configuration and occupation dependence of the Slater-Condon and Trees parameters is thereby made explicit by their representation in terms of exact configuration and occupation independent $\mathcal{H}^v$-matrix elements. Ab initio values of the latter for oxygen and nitrogen ions are utilized to provide ab initio Slater-Condon and Trees parameters for these systems. (15 refs.)

100242 An ab initio SCF calculation of the polarizability tensor of sulphur dioxide. G.G.Bacskay (Dept. of Theoretical Chem., Univ. of Sydney, Sydney, NSW, Australia).
J. Chem. Phys. (USA), vol.79, no.4, p.2090-2 (15 Aug. 1983).
The results of an ab initio Hartree-Fock SCF calculation of the static polarizability ($\lambda=\infty$) are presented which are believed to be sufficiently accurate to determine the sign of α_{xx}-$\bar{\alpha}$ and decide in favor of one of Murphy's assignment for the polarizability tensor. In agreement with Murphy's choice, the sign of α_{xx}-$\bar{\alpha}$ is found to be negative. (25 refs.)

100243 On H_2^+ for small internuclear separation. M.Klaus (Dept. of Math., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
J. Phys. A (GB), vol.16, no.12, p.2709-20 (21 Aug. 1983).
The author studies the behaviour of the electronic energy $E(R)$ of the hydrogen molecular ion as the internuclear separation R goes to zero. He proves that $E(R)$ is not analytic at $R=0$ and he finds its expansion in terms of powers of R and R^2 ln R up to order $R^9(\ln R)^3$. This rigorously justifies earlier work by Byers Brown and Steiner (1966). He also gives an outline of how one can prove non-analyticity by means of a perturbation treatment based on the united atom. (13 refs.)

100244 Bohr orbit theory revisited. I. Ground-state energies for the helium isoelectronic sequence. R.D.Harcourt (Dept. of Phys. Chem., Univ. of Melbourne, Parkville, Victoria, Australia).
J. Phys. B (GB), vol.16, no.15, p.2647-57 (14 Aug. 1983).
The (non-relativistic) ground-state energies for H^-, He, Li^+, C^{4+} and Ne^{8+} are calculated using the 1913 orbit model of Bohr for a two-electron atomic system, modified so that the electrons are able to move away from Bohr's 180° arrangement of them around the orbit. Both classical and non-classical weighting factors ($(P(\phi))$) are associated with the energy $E(\phi)$ for angle ϕ. If ϕ is restricted so that $E(\phi)$ cannot exceed the energy of He^+, then the calculated average energies $\bar{E}$ for He(-2.900 or -2.908 au, with classical and non-classical $P(\phi)$) are much closer to the exact energy (-2.9037 au) than is Bohr's estimate (-3.0625 au). Similar calculations for H^- and the isoelectronic cations give values for $\bar{E}$ that are respectively rather less than and greater than the exact energies. For H^-, with a classical $P(\phi)$, a simple further modification gives $\bar{E}=-0.52793$ au; the exact energy is -0.52775 au. For He, Ne^{8+} and Ca^{18+} the results of approximate calculations are also reported, which allow for the possibility that the two electrons move around separate orbits when ϕ is small. Relationships are developed between the orbit and orbital models for the ground states of two-electron systems. (16 refs.)

100245 Electronic transition dipole moment functions and difference potentials for transitions among low-lying states of Li_2 and Na_2. D.D.Konowalow, M.E.Rosenkrantz, D.S.Hochhauser (Dept. of Chem., State Univ. of New York, Binghamtom, NY, USA).
J. Mol. Spectrosc. (USA), vol.99, no.2, p.321-38 (June 1983).
Electronic transition dipole moment functions based on ab initio multiconfiguration self-consistent field wavefunctions are computed for the transitions $^1\Sigma_u^+$-$^1\Sigma_g^+$, $^3\Sigma_g^+$-$^3\Sigma_u^+$, $^1\Pi_u$-$^1\Sigma_g^+$, $^3\Pi_g$-$^3\Sigma_u^+$, $^1\Sigma_u^+$-$^1\Pi_g$, $^3\Sigma_g^+$-$^3\Pi_u$, $^1\Pi_u$-$^1\Pi_g$, and $^3\Pi_g$-$^3\Pi_u$ in Li_2 and Na_2. (In each case the states are the lowest lying of their symmetry). The authors also calculate the matrix element $\langle ^3\Sigma_u^+ | i(L_x$-$iL_y) | ^3\Pi_u \rangle$ for the predissociation of the $^3\Pi_u$ state by the $^3\Sigma_u^+$ state. Several unobserved spectral features are predicted. (36 refs.)

100246 The first valence states of the SO^+. Ion rotational analysis of the $A^2\Pi_i$-$X^2\Pi_r$ and $b^4\Sigma^-$-$a^4\Pi_i$ transitions. Comparison of experimental and ab initio calculated molecular parameters. D.Cossart (Lab. de Photophys. Moleculaire, CNRS, Univ. de Paris-Sud, Orsay, France), H.Lavendy, J.M.Robbe.
J. Mol. Spectrosc. (USA), vol.99, no.2, p.369-406 (June 1983).
Rotational analysis has been carried out for the first time for bands of the $A^2\Pi_i$-$X^2\Pi_r$ system of the SO^+ ion, as well as for newly discovered bands of the $b^4\Sigma^-$-$a^4\Pi$ transition of the same ion. At the same time, ab initio calculations were performed using the SCF method followed by configuration interaction. Theoretical results are presented as required for interpretation of the spectra. Important spin-orbit interactions are shown to occur between the four $X^2\Pi_r$, $A^2\Pi_i$, $a^4\Pi_i$, and $b^4\Sigma^-$ states and neighboring unobserved states. (43 refs.)

100247 The ab initio gradient revolution in structural chemistry: the importance of local molecular geometries and the efficacy of joint quantum mechanical and experimental procedures. L.Schafer (Dept. of Chem., Univ. of Arkansas, Fayetteville, AR, USA).
J. Mol. Struct. (Netherlands), vol.100, p.51-73 (July 1983).
The use of ab initio gradient calculations to determine structural information is reviewed. The significance of local geometries is discussed. Many calculated structural trends in local geometries are often unobservable by direct quantitative experimental techniques, presenting a challenge to develop more powerful experimental methods. The applications of calculated structural data in interpreting experimental results in microwave spectroscopy and electron diffraction are discussed. (64 refs.)

100248 Symmetry of Kekule structures. S.J.Cyvin (Div. of Phys. Chem., Univ. of Trondheim, Trondheim, Norway).
J. Mol. Struct. (Netherlands), vol.100, p.75-85 (July 1983).
The symmetry of Kekule structures for aromatic hydrocarbons is studied by group theory. The general problem of deducing the distribution over irreducible representations (Γ_{Kek}) or characters of the representation based on the Kekule structures (χ_{Kek}) has not been solved. A partial solution is given for two classes of molecules, namely (a) the 'straight chain' aromatics (polyacenes): naphthalene, anthracene, naphthacene etc., and (b) the 'zig-zag chain' aromatics: phenanthrene, chrysene, picene, etc. As a part of this solution the number of Kekule structures (K) in the two cases was found to be a (a) $K=Q+1$ and (b) $K=F_{Q+1}$, respectively. Here Q is the number of benzene rings in the molecule in question, and F_i denotes the i-th member of the Fibonacci series. Symmetrical structures (Γ_{Kek}) or characters (χ_{Kek}) are given for a number of additional molecules as examples: benezene (D_{6h}), tetraphene (C_s), benzo[c]phenanthrene (C_{2v}), pyrene (D_{2h}), triphenylene (D_{3h}), perylene (D_{2h}), pentaphene (C_{2v}), dibenzophenanthrene (C_{2v}), heptaphene (C_{2v}) and coronene (D_{6h}). Here the appropriate symmetry groups are given in parentheses. (7 refs.)

100249 Structural determination of recalcitrant molecule (S_2F_4). M.V.Carlowitz, H.Oberhammer (Inst. fur Phys. und Theoretische Chem., Tubingen, Germany), H.Willner, J.E.Boggs.
J. Mol. Struct. (Netherlands), vol.100, p.161-77 (July 1983).
The structure determination of S_2F_4 (or SF_3SF), the dimer of SF_2, is made difficult by the large variety of possible conformers and the instability of the compound. An electron diffraction and microwave study succeeded only with the help of a molecular model derived from ab initio calculations, after initial experimental attempts had failed. The force field required for a joint electron diffraction and microwave spectroscopy analysis was calculated by ab initio methods and adjusted to the experimental vibrational frequencies. The structure of S_2F_4 is a trigonal bipyramide with the electron lone pair, the SF group and one fluorine atom in equatorial positions. The SF_3 group is strongly distorted with the two axial S-F bonds differing by 0.10 Å and bond angles between axial bonds and equatorial plane of about 77° and 92°, respectively. The geometric structure of S_2F_4 in combination with the ab initio calculations allows one to visualize the dissociation process $SF_3SF \rightarrow 2\ SF_2$ more clearly. (32 refs.)

100250 A suggested revised conformation of methylthionitrite as seen by its spectra and preliminary ab initio calculations. B.Bak, N.Kristiansen (Chem. Lab. V, Univ. of Copenhagen, Copenhagen, Denmark), H.Johansen.
J. Mol. Struct. (Netherlands), vol.100, p.453-8 (July 1983).
A proof has recently been given that gaseous methylthionitrite, CH_3SNO, occurs exclusively (or mainly) in its anti conformation. The author claims that existing spectral evidence and ab initio calculations now performed suggest that gaseous methylthionitrite is mainly the syn conformer, the extra stability being of the order 1-2 kcal mol^{-1}. Methyl group rotation in the syn conformer is hindered by a three-fold barrier of height 689 cm^{-1} while the methyl group rotation in the anti conformer is hardly hindered. The syn/anti energy difference and the barriers hindering methyl group rotation closely parallel the corresponding measured quantities in methylnitrite, CH_3ONO. (19 refs.)

100251 Analytical relativistic wave functions for two-electron atoms and ions. V.F.Trusov.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.3, p.3-5 (1983). In Russian.
Relativistic radial wave function is constructed as a linear combination of Slater type basic orbitals. In contrast to the nonrelativistic version, factors depending on nonlinear parameters have been introduced. These factors are similar to those contained by the hydrogen-like relativistic ground-state function. It is shown, that the energy functional has a minimum in respect to such functions. (4 refs.)

100252 Resonance of an unshared electron pair between two atoms connected by a single bond. L.Pauling (Linus Pauling Inst. of Sci. & Medicine, Palo Alto, CA, USA).
Proc. Natl. Acad. Sci. USA, vol.80, no.12, p.3871-2 (June 1983).
The reported structure of the dimer of a compound of bicovalent tin indicates that the tin-tin bond is of a new type. It can be described as involving resonance between two structures in which there is transfer of an electron pair from one tin atom to the other. The tin atoms are connected by a single covalent bond (each also forms two covalent bonds with carbon atoms), and an unshared electron pair resonates between the fourth sp^3 orbitals of the two atoms. Similar structures probably occur in digermene and distannene. (8 refs.)

100253 Variational fit to the nonlocal electron-electron exchange potential: is an accurate N^3 Hartree-Fock method possible?. B.I.Dunlap (Naval Res. Lab., Washington, DC, USA).
Phys. Rev. Lett. (USA), vol.51, no.7, p.546-9 (15 Aug. 1983).
A variational method for fitting the Hartree-Fock exchange potential is investigated. The method has properties similar to an earlier method that successfully treats the direct part of the electron-electron Coulomb interaction in density-functional calculations. The present method is tested on atomic neon and should permit reliable linear combination of atomic orbital Hartree-Fock molecular calculations that grow in complexity only as the cube of the number of basis orbitals. (11 refs.)

100254 Nonadiabatic generator-coordinate calculation of H_2^+. J.G.Ribeiro Tostes (Inst. de Quimica, Univ. Estadual de Campinas, Campinas, Sao Paulo, Brazil), A.F.R.de Toledo Piza.
Phys. Rev. A (USA), vol.28, no.2, p.538-43 (Aug. 1983).
The authors report on a nonadiabatic calculation of the few lowest $J=0$ states in the H_2^+ molecule done within the framework of the generator-coordinate method. Substantial accuracy is achieved with the diagonalization of matrices of very modest dimensions. The resulting wave functions are strongly dominated by just a few basis states. The computational scheme is set up so as to take the best advantage of good analytical approximations to existing adiabatic molecular wave functions. (26 refs.)

100255 Emissive zones of complex atomic configurations in highly ionized atoms. J.Bauche, C.Bauche-Arnoult, E.Luc-Koenig, J.-F.Wyart (Lab. Aime Cotton, CNRS, Orsay, France), M.Klapisch.
Phys. Rev. A (USA), vol.28, no.2, p.829-35 (Aug. 1983).
The radiative properties of very complex atomic configurations in highly ionized species can be determined easily by means of statistical moments, computed ab initio from relativistic radial orbitals. A case of current interest, the spectrum of GdXII, is studied as an example. The locations and the widths of the zones of the upper configurations responsible for the bulk of the spontaneous emission are determined formally and numerically. The fact that these zones may sometimes lie well above the center of gravity of the configuration can be interpreted by considering the relevant $G^1(nl,n'l-1)$ Slater integral and its angular coefficients. Moreover, it is shown that two transition arrays involving the same upper configuration may actually originate from disconnected zones of the latter. A linear relationship is established formally between the coefficients of $G^1(nl,n'l-l)$ and the J-file sums of Condon and Shortley. This gives the authors the opportunity to evaluate the sum of the line strengths of all the transitions originating from a given upper level and, therefore, a method for checking oscillator-strength angular calculations. (16 refs.)

100256 Structure of the nitrite ion. J.D.Goddard, M.L.Klein (Div. of Chem., Nat. Res. Council of Canada., Ottawa, Ontario, Canada).
Phys. Rev. A (USA), vol.28, no.2, p.1141-3 (Aug. 1983).
Ab initio self-consistent-field calculations with large polarized basis sets have been used to determine the optimized geometry of an isolated nitrite ion. Similar calculations, performed for a nitrite ion interacting with either one or two sodium ions, suggest that only modest differences in geometry will occur when a nitrite ion is placed in an interactive environment. This finding appears to contradict an analysis of the absolute photodetachment spectrum of NO_2^- which indicates that in the gas phase the N-O bond length is 8% shorter than in the sodium nitrite crystal. (23 refs.)

100257 Semiclassical parametrization of the 6snh-6sni-6snk intervals in BaI. L.J.Curtis, P.S.Ramanujam, C.E.Theodosiou (Dept. of Phys. & Astron., Univ. of Toledo, Toledo, OH, USA).
Phys. Rev. A (USA), vol.28, no.2, p.1151-3 (Aug. 1983).
A semiclassical core-polarization-penetration model is used to parametrize the 6snh-6sni and 6sni-6snk intervals in BaI which were recently measured by Gallagher, Kachru, and Tran. The parametrization represents the existing data to within experimental uncertainties, and extrapolative predictions along these Rydberg series are presented. (20 refs.)

100258 Calculation of the ground and excited states of the Ne_2 molecule by the variational cellular method. A.M.Dias (Dept. de Fisica e Matematica, Fundacao de Ensino e Tecnologia de Alfenas, Alfenas, Brazil), A.Rosato.
Rev. Bras. Fis. (Brazil), vol.12, no.2, p.315-23 (June 1982).
The potential curves for the ground $^1\Sigma_g^+$ and for the first singlet excited state $^1\Sigma_u^+$ of the Ne_2 molecule are determined by the variational cellular method. From these curves some spectroscopic constants are obtained. Ionization energies of the excited state $^1\Sigma_u^+$ are calculated. (19 refs.)

100259 Symmetry breakdown in Hartree-Fock: localised solutions in molecules. S.Canuto (Dept. de Fisica, Univ. Federal de Pernambuco, Recife, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.3, p.459-72 (Sept. 1982). In Portuguese.
In Hartree-Fock theory the wave function is obtained variationally and the lowest energy solution does not necessarily reflect the total symmetry of the Hamiltonian. There from, through symmetry breakdown, it is possible to incorporate important correlation effects into the independent particle model. In the case of spatial symmetry they allow the molecular orbitals to transform according to the irreducible representation of a strategic sub-group of the total symmetry group of the molecule. This may lead to ionization and to local excitations. These aspects are discussed starting from several ab initio ΔE_{SCF} calculations for excitations n-π^* and π-π^*, as well as ionizations, both in deep and valence shells. (43 refs.)

On the stability of the hydrogen atom .... See Entry 98689

Advances in quantum molecular sciences—a tribute to Kenichi Fukui .... See Entry 98710

Solution of the Schroedinger equation in the potential representation for Coulomb interactions .... See Entry 98853

A brief survey of the basic theoretical arguments on molecular structures and chemical bondings .... See Entry 100276

Further studies of the promethium isoelectronic sequence .... See Entry 100284

Molecular Rydberg transitions .... See Entry 100286

Multireference many-body perturbation theory: application to O_2 potential energy surfaces .... See Entry 100294

KLL Auger energies for boron atomic ions based on the saddle-point variational method .... See Entry 100336

Vibrational levels in the self-consistent-field approximation with local and normal modes. Results for water and carbon dioxide .... See Entry 100344

Force field in the hydrazine molecule from ab initio MO calculation .... See Entry 100346

Ab initio rovibrational spectrum of LiNC and LiCN .... See Entry 100347

Anion radicals of bacteriochlorophylls c, d, and e. Likely electron acceptors in the primary photochemistry of green and brown photosynthetic bacteria .... See Entry 100409

Hartree-Fock-Slater LCAO calculation of the Mossbauer parameters of some antimony compounds .... See Entry 100433

Semiempirical approach to the determination of the probabilities of electronic-vibrational-rotational radiative transitions of diatomic molecules .... See Entry 100459

Density functional calculations for H_2O, NH_3, and CO_2 using localized muffin-tin orbitals .... See Entry 100495

A comparative study of lithium, sodium and hydrogen bonds formed by 1:1 interaction of electron donor molecules with lithium, sodium and hydrogen halides .... See Entry 100501

Use of *l*-dependent pseudopotentials in the study of alkali-metal-atom-He systems. The adiabatic molecular potentials .... See Entry 100502

On the Ne-Ne potential-energy curve and related properties . See Entry 100506

A comparison of quantal and semiclassical perturbed-rotational-state methods in H^+-CO collisions .... See Entry 100507

Molecular study of outer K-L shell interactions: the Na-He collisional system .... See Entry 100515

Theoretical investigation of rotational rainbows in $K+N_2$ and $K+CO$ collisions .... See Entry 100523

State-to-state differential and integral cross sections for vibrational-rotational excitation and elastic scattering of electrons by N_2 at 5-50 eV: calculations using extended-basis-set Hartree-Fock wave functions .... See Entry 100564

***R*-matrix calculation for the excitation of the lowest-lying autoionising level in lighter alkali metal atoms** .... See Entry 100566

EOM/propagator ionization potentials: extension of the excitation operator manifold .... See Entry 100598

Calculation of the vertical ionization potentials of XBO and XBS molecules (X=H, F and Cl) by perturbation corrections to Koopmans' theorem .... See Entry 100599

Effect of the shell structure of atoms on the shock adiabats of aluminum and iron .... See Entry 101859

The electronic structure of aromatic molecules adsorbed on Pd (111) .... See Entry 102159

Magnetic order and magnetogyration in π(2p) electron systems .... See Entry 102604

Molecular structure and reaction mechanism: a topological approach to quantum chemistry .... See Entry 103490

Ab initio study of the hydration of ketenimine ($CH_2=C=NH$) by water and water dimer .... See Entry 103506

31.20E Ab initio LCAO and GO SCF calculations

100260 Ab initio calculation of equilibrium geometry and hyperfine coupling constants of the cyclopentane cation. M.B.Huang, S.Lunell (Dept. of Quantum Chem., Uppsala Univ., Uppsala, Sweden), A.Lund.
Chem. Phys. Lett. (Netherlands), vol.99, no.3, p.201-5 (5 Aug. 1983).
The equilibrium geometry and hyperfine coupling constants of the cyclopentane cation have been calculated by the UHF method, within the ab initio MO LCAO SCF approximation. A non-planar carbon framework of C_s symmetry was found with one carbon atom out of the plane of the others. The geometry and the calculated isotropic constants give support to the ESR identification of the ion. (15 refs.)

100261 Proton affinities of GeH_4 and SiH_4. II. Calculations of the proton affinity of GeH_4 in terms of extended basis sets. S.Sudoh, O.Nomura, S.Ikuta, S.Katagiri, M.Imamura.
Rep. Inst. Phys. & Chem. Res. (Japan), vol.59, no.3, p.71-8 (1983). In Japanese.
The proton affinity of GeH_4 is calculated by the ab initio LCAO-MO SCF method using various basis sets: MIDI-1′-A, MIDI-1-B, CGTO-A and CGTO-C. The structure of the protonated germane (GeH_5^+) was found to be of a C_s symmetry. The germyl cation (GeH_3^+) interacts weakly with a hydrogen molecule (H_2) in the protonated germane. All the basis sets give the C_s structure. The result well explains the elusive nature of GeH_5^+ and the proton affinity of germane, but is not in conformity with the assertion of the symmetry (D_{3h}) proposed by Hartmann et al. (15 refs.)

31.20G Other accurate, or nearly ab initio calculations (DIM method, SAMO method, etc.)

Ab initio orbital calculations on clusters of methyl fluoride .. See Entry 100624

31.20L Statistical model calculations (Thomas-Fermi and Thomas-Fermi-Dirac models)

100262 Thomas-Fermi theory in a weak, slowly varying vector potential. R.A.Harris, J.A.Cina (Dept. of Chem., Univ. of California, Berkeley, CA, USA).
J. Chem. Phys. (USA), vol.79, no.3, p.1381-3 (1 Aug. 1983).
The gauge invariant kinetic energy of an inhomogeneous electron gas in the presence of a weak, slowly varying vector potential is determined by a generalization of Schwinger's method. The kinetic energy is a function of the charge density and current density. The resulting energy should prove useful in determining the linear responses of closed shell systems to magnetic fields. (24 refs.)

Atomic charge exchanges in close collisions between N^{+q} ions and gas targets in the MeV energy range ....See Entry 100549

31.20N Semi-empirical NDO calculations (CNDO, INDO, MINDO, PCILO methods, etc.)

100263 Development and status of MINDO/3 and MNDO. M.J.S.Dewer (Dept. of Chem., Univ. of Texas, Austin, TX, USA).
J. Mol. Struct. (Netherlands), vol.100, p.41-50 (July 1983).
The historical development of MINDO/3 and MNDO is outlined in relation to the parallel developments of the ab initio SCF approach. It is pointed out that both treatments are purely empirical so far as chemistry is concerned and complement one another, MINDO/3 and MNDO allowing calculations to be carried out when ab initio methods of comparable performance are inapplicable because they need one-thousand times more computing time. (38 refs.)

31.20R Valence bond calculations (ab initio or not)

A study of the valence interaction integrals in effective core potential applications ....See Entry 100491

31.20T Electron correlation and CI calculations

100264 The evaluation of two-photon absorptivities in molecules in the adiabatic approximation by CI expansion. G.L.Bendazzoli, A.Degli Esposti, S.Evangelisti, P.Palmieri (Istituto di Chimica Fisica e Spettroscopia, Univ. di Bologna, Bologna, Italy).
Chem. Phys. Lett. (Netherlands), vol.99, no.3, p.266-70 (5 Aug. 1983).
The authors stress the advantages of solving directly the equations of perturbation theory by CI expansion instead of using the sum-over states formulation of two-photon absorption. A formula to compute the matrix element entering the expression for the cross section taking into account the nuclear degrees of freedom is derived from the Karplus-Kolker variational principle. Numerical applications to H_2 are presented. (17 refs.)

100265 Intermolecular potentials for the H_2O-C_6H_6 and the C_6H_6-C_6H_6 systems calculated in an ab initio SCF CI approximation. G.Karlstrom, P.Linse, A.Wallqvist, B.Jonsson (Chem. Center, Lund, Sweden).
J. Am. Chem. Soc. (USA), vol.105, no.12, p.3777-82 (15 June 1983).
Ab initio SCF CI potentials have been calculated for the H_2O-C_6H_6 and the C_6H_6-C_6H_6 systems. The interaction energy is decomposed into contributions that could be given a physical interpretation. It is shown that it is necessary to obtain good estimates for each of these contributions in order to obtain a reliable potential. The calculated potentials are fitted to analytical forms, and the second virial coefficient for the C_6H_6-C_6H_6 system as well as the cross virial coefficient for the C_6H_6-H_2O system is calculated. (40 refs.)

100266 Electronic structure and orbital interactions in linear PtCO. H.Basch, D.Cohen (Dept. of Chem., Bar-Ilan Univ., Ramat Gan, Israel).
J. Am. Chem. Soc. (USA), vol.105, no.12, p.3856-60 (15 June 1983).
The electronic and geometric structural properties of linear PtCO have been investigated by using an ab initio *l*-dependent relativistic effective core potential for Pt within the framework of the multiconfiguration self-consistent field and configuration interaction methods. The energy ordering of electronic states is $^1\Sigma^+ < (^3\Sigma^+, ^3\Delta) < ^3\Pi$, where $^1\Sigma^+$ correlates with Pt $5d^{10}(^1S)$ and the triplet states arise from the Pt $5d^96s^1(^3D)$ atomic multiplet in the dissociated limits. Upon complexation with a Pt atom the loss of C=O antibonding character in the carbon lone-pair orbital dominates the decrease in π bonding due to the $Pt(5d_\pi)$-$CO(\pi^*)$ interaction. Charge transfer between the Pt and CO fragments is dominated by the CO→Pt σ dative bond at larger Pt-CO distances and by Pt→CO π-back-bonding at shorter bond lengths. The extra stability and shorter equilibrium Pt-CO bond distance of the ground $^1\Sigma^+$ state is due to nonoccupancy of the strongly antibonding σ orbital which in the triplet states has mainly Pt 6s character. This, in turn, allows a closer approach of CO to Pt and enhanced π bonding. Both $^3\Sigma$ and $^3\Delta$ are calculated to be bound on the SCF level while $^3\Pi$ has a repulsive Pt-CO energy interaction curve even with configuration interaction, apparently due to reduced π bonding in its primary electronic configuration. The $^1\Sigma^+$ state in its equilibrium geometry has a Pt atom configuration that is much closer to $5d^96s^1$ than to $5d^{10}$ while the 5d orbital population in the $^3\Delta$ state is close to 8 e. (27 refs.)

100267 Theoretical study of Jahn-Teller distortions in $C_6H_6{}^+$ and $C_6F_6{}^+$. K.Raghavachari, R.C.Haddon, T.A.Miller, V.E.Bondybey (Bell Labs., Murray Hill, NJ, USA).
J. Chem. Phys. (USA), vol.79, no.3, p.1387-95 (1 Aug. 1983).
Ab initio molecular orbital theory with the 6-31G basis set is used to study Jahn-Teller distortion effects in the benzene cation ($C_6H_6{}^+$) and the perfluorobenzene cation ($C_6F_6{}^+$), π-electron correlation is included in these calculations. Completely optimized Jahn-Teller distorted geometries are obtained for the ground electronic states of both $C_6H_6{}^+$ and $C_6F_6{}^+$. The stabilization energies resulting from these distortions are calculated for both systems. The stabilization is partitioned into contributions from C-C stretch, C-H or C-F stretch, C-C-C bend, and C-C-H or C-C-F bend coordinates. Detailed comparison is made between $C_6H_6{}^+$ and $C_6F_6{}^+$ to consider the effects of substitution. The calculated geometries and stabilization energies for $C_6F_6{}^+$ are compared to values derived from laser-induced fluorescence experiments. The overall calculated distortion parameters for $C_6F_6{}^+$ are in good agreement with the experimentally derived value. The total calculated stabilization energy ($\simeq$1000 cm^{-1}) is in good agreement with the experimental value (820$\pm\simeq$100 cm^{-1}). The individual stabilization energy contribution for the C-C stretch mode is calculated to be larger than the experimental estimate, paralleling the overestimation of the C-C bond length change for this mode. The other stabilization parameters are in reasonably good agreement with the experimental values. (24 refs.)

100268 A general method for approximating the electronic correlation energy in molecules and solids. R.Colle, O.Salvetti (Scuola Normale Superiore, Pisa, Italy).
J. Chem. Phys. (USA), vol.79, no.3, p.1404-7 (1 Aug. 1983).
A detailed analysis of a method proposed earlier for calculating a good approximation to the electronic correlation energy is presented here. The principal advantages of this method compared to the usual CI techniques are discussed. (14 refs.)

100269 Electron affinities of the alkali dimers: Na_2, K_2, and Rb_2. H.Partridge (Univ. of Southern California, University Park, Los Angeles, CA, USA), D.A.Dixon, S.P.Walch, C.W.Bauschlicher,Jr., J.L.Gole.
J. Chem. Phys. (USA), vol.79, no.4, p.1859-65 (15 Aug. 1983).
Ab initio calculations on the ground states of the alkali dimers, Na_2, K_2, and Rb_2, and their anions are reported. The calculations employ large Gaussian basis sets and account for nearly all of the valence correlation energy. The calculated atomic electron affinities are within 0.02 eV of experiment and the calculated adiabatic electron affinities for Na_2, K_2, and Rb_2 are, respectively, 0.470, 0.512, and 0.513 eV. (31 refs.)

100270 An ab initio study of core-valence correlation. H.Partridge (Univ. of Southern California, University Park, Los Angeles, CA, USA), C.W.Bauschlicher,Jr., S.P.Walch, B.Liu.
J. Chem. Phys. (USA), vol.79, no.4, p.1866-73 (15 Aug. 1983).
Including core-valence correlation ab initio CI calculations results in a contraction of the atomic valence shell, particularly for the first columns of the periodic table. In addition, including core-valence correlation improves the calculated atomic ionization potentials and the atomic energy separations. For the alkali dimers, Na_2, K_2, and Rb_2, the calculated R_es are in excellent agreement with experiment when core-valence is included. The authors find for the alkali dimers that the valence D_es are accurate. (23 refs.)

100271 The binding energy of the ground state of Be_2. B.H.Lengsfield,III, A.D.McLean, M.Yoshimine, B.Liu (IBM Res. Lab., San Jose, CA, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.1891-5 (15 Aug. 1983).
Two convergent sequences of multiconfiguration self-consistent field and configuration interaction (CI) calculations have confirmed the predictions of a previous interacting correlated fragments (ICF) calculation and given best values for the D_e and R_e of $Be_2(X^1\Sigma^+)$ of 2.04$\pm$0.21 kcal/mol and 4.73$\pm$0.03a_0, respectively. These calculations used a $6s/4p/3d/1f$ Slater basis set on each atom and correlated only the four $2s$ electrons. They were shown computationally to be free from basis set superposition and size-consistency errors. A large second order CI calculation yielded a rigorous lower bound to the full four-electron CI binding energy of 1.87 kcal/mol with the present basis set. Arguments are presented that the $1s$ electronic correlation effect on the binding energy is less than 0.2 kcal/mol. The earlier ICF calculation on Be_2 has been repeated and extended to a higher level of fragment correlation using the current basis set. The best ICF results are in close agreement with the second order CI calculations, indicating that the full four-electron CI limit within this basis set has been reached and providing the first computational proof of the convergence of ICF method. (14 refs.)

100272 Theoretical study of the lowest states of CsH and Cs_2. G.H.Jeung, F.Spiegelmann, J.P.Daudey, J.P.Malrieu (Lab. de Phys. Quantique, Univ. Paul Sabatier, Toulouse, France).
J. Phys. B (GB), vol.16, no.15, p.2659-75 (14 Aug. 1983).
The 19 lowest states of CsH and the 11 lowest states of Cs_2 have been calculated using a non-empirical relativistic effective core potential considering the caesium atom as a one-electron system. The core-valence polarisation and correlation energy has been included employing a recently developed perturbation treatment. The experimental atomic spectrum of caesium is well reproduced. The calculated energy curves show the remarkable precision of this procedure for the ground-state characteristics. For CsH, R_e=4.47 Bohr (experimental 4.71 Bohr), D_e=1.80 eV (experimental 1.83 eV), ω_e=871 cm^{-1} (experimental 891 cm^{-1}); for Cs_2, R_e=8.75 Bohr (experimental 8.78 Bohr), D_e=0.40 eV (experimental 0.45 eV), ω_e=41 cm^{-1} (experimental 42 cm^{-}). The well-to-well transition energies are in error by less than 400 cm^{-1} for experimentally known transitions. (52 refs.)

100273 Analysis of a configuration interaction calculation for a charge transfer transition in $MnO_4{}^-$. H.Johansen (Dept. of Chem. Phys., Tech. Univ. of Denmark, Lyngby, Denmark).
Mol. Phys. (GB), vol.49, no.5, p.1209-16 (10 Aug. 1983).
An analysis of the electron density distribution in the excited 1 $^1T_2$ state of the permanganate ion is presented. Based upon a configuration interaction calculation, it is shown how the charge transfer excitations lead to transfer of density from the ligands to the central atom by diagonal density matrix elements and how density is moved in the opposite direction by the off-diagonal terms, leaving the atomic charges relatively unchanged. There is, however, a large internal redistribution of the $3d$ electrons. Only a few of the configurations turn out to be very important. (6 refs.)

100274 Beyond the local-density approximation in calculations of ground-state electronic properties. D.C.Langreth, M.J.Mehl (Serin Phys. Lab., Rutgers Univ., Piscataway, NJ, USA).
Phys. Rev. B (USA), vol.28, no.4, p.1809-34 (15 Aug. 1983).
Justification, as extensive as is possible, is given for the authors' previously published nonlocal approximation for exchange and correlation. Some new exact limits for atoms and interfaces are obtained, as well as formal quantitative criteria for the validity of the local-density approximation and the gradient corrections to it. The scheme is applied to planar surface calculations, as well as to extensive self-consistent calculations at energies and densities in atoms. The results compare favorably, in every case attempted, to experimental and exact results that are available. A method is devised for separating exchange from correlation in atoms within the Kohn-Sham method (1965), and is tested favorably against exact-exchange calculations. Finally, they apply these results to atoms using exact exchange plus appropriately separated correlation expression. The results give atomic total energies to accuracies of $\sim\pm$0.01 Ry, and typically reduce the local-density-approximation error in density by an order of magnitude. (59 refs.)

Force field in the hydrazine molecule from ab initio MO calculation ....See Entry 100346

Magnetic circular dichroism and anomalous fluorescence spectra of azulenothiophenes ....See Entry 100436

Photodissociation processes in the OH molecule .... See Entry 100474

Determination of nonadiabatic potential curves from wavefunctions obtained by configuration interaction calculations ....See Entry 100498

A theoretical study of coherence effects in charge transfer collisions: application to Na-Li$^+$ ....See Entry 100542

A study of the first ionization potential of the CrO($X^5\Pi$) molecule with high-temperature photoelectron spectroscopy ....See Entry 100600

Crystal structure and electronic states of dithieno[3,2-*b*:2′,3′-*d*]thiophene ....See Entry 101683

Unique labelling of many-electron states in multicentre systems ....See Entry 102221

31.30 CORRECTIONS TO ELECTRONIC STRUCTURE

100275 The second-order Jahn-Teller effect. R.G.Pearson (Chem. Dept., Univ. of California, Santa Barbara, CA, USA).
THEOCHEM (Netherlands), vol.12, p.25-34 (Aug. 1983).
The second-order Jahn-Teller effect is an example of reactions proceeding by an interaction between the HOMO and the LUMO within the same molecule. The consequences can be decomposition of the molecule or a structural change. First the general theory is given, and then a number of examples are presented. (15 refs.)

100276 A brief survey of the basic theoretical arguments on molecular structures and chemical bondings. G.Leroy (Lab. de Chimie Quantique, Univ. Catholique de Louvain, Louvain-la-Neuve, Belgium).
THEOCHEM (Netherlands), vol.12, p.45-56 (Aug. 1983).
The authors briefly describe some theoretical approaches to the problems of chemical binding and molecular shapes and summarize their contribution to the description of the electronic structure of chemical species. (47 refs.)

100277 A method of studying atomic screening effects in pair production. J.Bose, N.Bhattacharjee, K.Sengupta, N.Chaudhuri (Dept. of Phys., North Bengal Univ., Darjeeling, India).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.539-43 (1 July 1983).
A simple method to study atomic screening effects in atomic pair production has been used in measurements using 1.115 MeV photons on medium and high Z targets in the range of atomic number 29-92. Some of the results are presented and discussed. (4 refs.)

100278 Polarisation propagator approach to the dynamic nuclear electric shielding in LiH molecule. P.Lazzeretti, E.Rossi, R.Zanasi (Istituto di Chimica Organica e Centro di Calcolo Elettronico, Univ. di Modena, Modena, Italy).
J. Chem. Phys. (USA), vol.79, no.2, p.889-93 (15 July 1983).
The frequency dependence of the dipole electric polarisability and electric shielding tensors of hydrogen and lithium nuclei in the LiH molecule has been studied via some approximations to the polarisation propagator method, i.e. STA, TDA, and RPA, allowing for dipole length, velocity, acceleration, and mixed formalisms. The RPA nuclear electric shieldings are in a fairly good agreement with the corresponding experimental data, a discrepancy being observed for the parallel component at the Li nucleus. (33 refs.)

100279 A note about a systematic study of the electrostatic potential at the nucleus and the interelectronic interaction in the atoms and ions. E.A.Castro, F.M.Fernandez (INIFTA, Seccion Quimica Teorica, La Plata, Argentina).
J. Chem. Phys. (USA), vol.79, no.3, p.1548-9 (1 Aug. 1983).
In the course of a systematic study of Politzer's energy relations (1976) for the free atoms and ions by using Clementi's near Hartree-Fock data, (1974) Teruya and Anno have obtained systematic sets of data on the interelectronic repulsion V_{ee} and on the nuclear electronic interaction V_{Ne}. $DV_{O,A}$ and DV_{ee}, the difference in $V_{O,A}$ and V_{ee} between two successive members of a given isoelectronic series, respectively, change monotonically for a given isoelectronic series of atoms and approach to a limiting value. Teruya and Anno explained this behavior by noting the fact that *AO*'s of an atom with a given number of electrons approach the hydrogenic *AO*'s when $Z \rightarrow \infty$ and that the general pattern of $DV_{O,A}$ or DV_{ee} curves can be accounted for from Slater's simple model (1930) involving the data of screening effect due to other electrons within the atom if the dependence of the screening constants upon ionic charge is assumed. The authors discuss the change of $DV_{O,A}$ and DV_{ee} for a given isoelectronic series, from an alternative point of view. Such analysis is based upon the Linderberg Z-perturbation treatment of the Hartree-Fock equations (1961). (17 refs.)

100280 Relativistic effects in Cu_2 bonding. M.Pelissier (Lab. de Phys. Quantique, Univ. Paul Sabatier, Toulouse, France).
J. Chem. Phys. (USA), vol.79, no.4, p.2099-100 (15 Aug. 1983).
In a recent paper Bauschlicher, Walch, and Siegbahn (ibid., vol.76, p.6015, 1982) attributed the difference between their ab initio computed bond length and the experimental value to relativistic effects. The bond length was found 0.15 bohr longer than experiment, which is consistent with the 0.064 bohr relativistic contraction of the 4*s* orbital. The author tries to clarify the role of relativistic contributions to the Cu_2 bonding. A better agreement with experimental values is obtained by using an effective core potential (ECP) to account for the effects of 1*s*, 2*s*, 3*s*, and 3*p* electrons. (6 refs.)

100281 The 2^3S-2^3P_J, $J=0$, 1, 2 intervals in neutral helium. J.Hata, I.P.Grant (Dept. of Theoretical Chem., Oxford, England).
J. Phys. B (GB), vol.16, no.15, p.L433-6 (14 Aug. 1983).
A recent comparison of theory and experiment by Juncar and co-workers (1983) suggested residual errors in the theory due to non-relativistic correlation energy and to radiative corrections. A careful analysis shows that theory and experiment agree to within the experimental limits, 5×10^{-4} cm^{-1}. (16 refs.)

100282 Precision determination of the nuclear *g* factor of $^{39}K^+$ ion and diamagnetic shielding constant difference between a ^{39}K atom and a $^{39}K^+$ ion. E.I.Obiajunwa, S.A.Adebiyi, E.A.Togun, A.F.Oluwole (Dept. of Phys., Univ. of Ife, Ile-Ife, Nigeria).
J. Phys. B (GB), vol.16, no.15, p.2733-5 (14 Aug. 1983).
An optical pumping charge exchange collision experiment for precise measurement of the nuclear g factor of the $^{39}K^+$ ion in a helium buffer gas is reported. $^{39}K^+$ ions are polarised by charge exchange collisions with oriented ^{39}K atoms. The NMR frequencies of $^{39}K^+$ and the ESR frequencies of free electrons polarised by oriented ^{39}K atoms are measured in a magnetic field (3-34 G). This gives the ratio of the nuclear g factor of the $^{39}K^+$ ion to the electronic g factor of free electrons to be: $g_I(^{39}K^+)/g_e=0.07088733\ (17) \times 10^{-3}$. Using this ratio together with the best available measured values of $g_e=2.0023193134\ (70)$ and $g_I(^{39}K)=1.4193489\ (12) \times 10^{-4}$ the authors obtain: (i) $g_I(^{39}K^+)=-1.4193906\ (34) \times 10^{-4}$ in units of the Bohr magneton; (ii) the diamagnetic shielding constants difference between free atoms and ions is: $\sigma(^{39}K^+)-\sigma(^{39}K)=-29(6) \times 10^{-6}$. (12 refs.)

100283 Vacuum polarization corrections and spin-orbit splitting in antiprotonic atoms. E.Borie (Inst. fur Kernphys., Univ. Karlsruhe, Karlsruhe, Germany).
Phys. Rev. A (USA), vol.28, no.2, p.555-8 (Aug. 1983).
Precise calculations of the energy levels and fine structure of antiprotonic atoms, in which the normal and anomalous magnetic moments of the antiproton are treated on an equal basis and vacuum polarization and relativistic recoil corrections are included, are presented. The results are applied to measurements of the antiproton mass and anomalous magnetic moment with the use of antiprotonic atoms. (15 refs.)

100284 Further studies of the promethium isoelectronic sequence. C.E.Theodosiou, V.Raftopoulos (Dept. of Phys. & Astron., Univ. of Toledo, Toledo, OH, USA).
Phys. Rev. A (USA), vol.28, no.2, p.1186-8 (Aug. 1983).
The authors have performed a fully relativistic calculation, using the Dirac-Fock approximation, of energy levels and excitation energies for several ions in the promethium isoelectronic sequence. The results verify the overall predictions on level ordering of the Hartree-Fock calculations, which included some relativistic effects perturbatively. Some differences were found concerning the atomic number at which the ground state of the ion has alkali-metal-like configurations. (8 refs.)

100285 Nuclear moments and isotope shifts of europium isotopes by hyperfine structure investigations with collinear laser-ion beam spectroscopy. K.Dorschel, W.Heddrich, H.Huhnermann, E.W.Peau, W.Wagner (Fachbereich Phys., Marburg, Germany), G.D.Alkhazov, E.Ye.Berlovich, V.P.Denisov, V.N.Panteleev, A.G.Polyakov.
Z. Phys. A (Germany), vol.312, no.3, p.269-70 (1983).
Hyperfine structures and isotope shifts of the transition $4f^7(^8S_{7/2}{}^0)6p_{3/2}(7/2,3/2)_4$-$4f^7(^8S_{7/2}{}^0)$ 5d $^9D_4{}^0$, $\lambda=604.95$ nm, of stable ^{151}Eu and ^{153}Eu and radioactive ^{152}Eu and ^{154}Eu have been investigated by collinear laser-ion beam spectroscopy. Nuclear quadrupole moments have been derived. (5 refs.)

Can the H_5 molecule be observed? ....See Entry 100235

Compton profiles and momentum expectation values, for atomic system gallium through krypton ....See Entry 100236

Analytical relativistic wave functions for two-electron atoms and ions ....See Entry 100251

Ab initio calculation of equilibrium geometry and hyperfine coupling constants of the cyclopentane cation ....See Entry 100260

Electronic structure and orbital interactions in linear PtCO . See Entry 100266

Theoretical study of Jahn-Teller distortions in $C_6H_6{}^+$ and $C_6F_6{}^+$ ....See Entry 100267

Theoretical study of the lowest states of CsH and Cs_2 ....See Entry 100272

Atom in extremely strong magnetic fields ....See Entry 100299

Dielectronic satellites of the $1s^2$ $^1S_0$-$1s2p$ $^1P_1$ resonance line. Isoelectronic series of carbon ....See Entry 100313

Microwave structures of cyanocyclopropane and cyclopropylacetylene. Effects of cyclopropyl π conjugation on structure ....See Entry 100367

Measurement of the $J=0 \rightarrow 1$ rotational transitions of three isotopes of ArD^+ ....See Entry 100368

The use of ^{18}O substitution in the characterization of $MReO_4$ molecules. The IR spectrum of matrix-isolated $CsReO_4$ ....See Entry 100374

Sequential two-photon spectroscopy of some ion-pair states of IBr ....See Entry 100383

EPR evidence on molecular and electronic structure of nitrogen trifluoride radical cation ....See Entry 100418

Tensorial analysis of the hyperfine interaction operator by extensive use of Racah algebra and of translational invariance ....See Entry 100423

Pulsed ENDOR spectroscopy of the interior protons of free-base porphin in its lowest photoexcited triplet state, in an *n*-octane single crystal ....See Entry 100430

Note on a theoretical interpretation of the isotopic ratio $\bar{\nu}_{OH}/\bar{\nu}_{OD}$ versus $\bar{\nu}_{OH}$ in isotopically diluted HDO molecules in solid hydrates .... See Entry 100489

High-energy expansions for the phase shifts in screened Coulomb potentials ....See Entry 100503

Theoretical investigation of rotational rainbows in $K+N_2$ and $K+CO$ collisions ....See Entry 100523

Estimation of equilibrium structure and anharmonicity by use of changes in the r_z structure by isotopic substitution and vibrational excitation. I. General formulation and application to OCl_2 ....See Entry 100593

Prototropic charge migration in water. I. Rate constants in light and heavy water and in salt solution from oxygen-17 spin relaxation ....See Entry 103514

31.50 EXCITED STATES

100286 Molecular Rydberg transitions. A.N.Singh, R.S.Prasad (Dept. of Phys., Magadh Univ., Bihar, India).
Indian J. Phys. Part B, vol.57B, no.1, p.40-50 (Feb. 1983).
Rydberg states in molecules calculated under semi-empirical SCF-MO theoreis RCNDO/S and RINDO/S are presented. The most prominent Rydberg states as well as the admixture of valence and Rydberg states are discussed. In addition, the paper is provided with experimental correlation for these states. (33 refs.)

100287 Effect of crossed electric and magnetic fields on sodium Rydberg states. E.Korevaar, M.G.Littman (Dept. of Mech. & Aerospace Engng., Princeton Univ., Princeton, NJ, USA).
J. Phys. B (GB), vol.16, no.15, p.L437-42 (14 Aug. 1983).
The excitation spectrum for Rydberg states near $n=11$ of atomic sodium in crossed electric and magnetic fields has been recorded. The theoretical analysis of the spectroscopic data reveals degeneracies among some sublevels even though different sublevels are mixed by the external fields. The degeneracies are traced to a dynamical symmetry that is characteristic of the Coulomb potential. (19 refs.)

100288 Laser absorption measurements of atomic metastable densities. D.M.Kane, M.H.Dunn (Dept. of Phys., Univ. of St. Andrews, St. Andrews, Scotland).
J. Phys. B (GB), vol.16, no.15, p.2709-19 (14 Aug. 1983).
Helium triplet metastable densities have been calculated from measured absorption of resonant, CW, UV laser radiation on the 2^3S-5^3P transition at 294.511 nm. Gas temperatures have also been deduced by measuring the Doppler width of this transition. A 3 mm bore capillary tube filled to pres-

sures in the range 1-8 Torr and run at currents in the range 2.5-80 mA was studied. With constant discharge current (60 mA) at a maximum value for the triplet metastable density of 11×10^{12} cm^{-3} at about 2 Torr was obtained. The metastable densities show the expected saturation behaviour, saturating at currents above 40 mA. Experimental values are used in conjunction with the rate equation describing the metastable level population in order to estimate the rate coefficient for loss of metastables through electron collisions. Mention is made of the use of the visible laser radiation for measuring the UV laser wavelength in a Kowalski-type wavemeter. (16 refs.)

100289 Doubly excited states of the C^{3+} ion. A.V.Kuplyauskene, Z.J.Kuplyauskis.
Opt. & Spectrosc. (USA), vol.54, no.1, p.26-9 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.48-53 (Jan. 1983).
The energies of the 44 lowest doubly excited states of C^{3+} are determined by the method of superposition of configurations. The autoionization widths and the probabilities of autoionization of nine doublet terms are presented. A calculation of the wavelengths and transition probabilities of the satellites is carried out for the $1s^2\ {}^1S\text{-}1s2p\ {}^1P$ resonance line of the C^{4+} ion. (23 refs.)

100290 Capture of radiation in complex configuration volumes. V.I.Denisov, N.G.Preobrazhenskii.
Opt. & Spectrosc. (USA), vol.54, no.1, p.40-3 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.73-8 (Jan. 1983).
Radiative de-excitation of excited atoms from the volume occupied by gas or plasma which is not convex (a hollow cylinder, a torus) is considered. A method based on the self-modeling property of the Biberman-Holstein problem is used which allows the authors in calculating radiation characteristics, to express explicitly the dependence of the characteristics of radiation on the optical thickness of the layer. The geometrical form factor is found using statistical modeling. The systematic errors of the method and the correct choice of the assumed mean free path of a photon inside the radiating layer are studied. (8 refs.)

100291 Multichannel quantum-defect analysis of the bound even-parity spectrum of neutral barium. M.Aymar, P.Camus (Lab. Aime Cotton, CNRS, Orsay, France).
Phys. Rev. A (USA), vol.28, no.2, p.850-7 (Aug. 1983).
Extensive new data on the bound even-parity spectrum of neutral barium have been provided recently by two-step optogalvanic spectroscopy. Highly excited members of the Rydberg series 6sns $^3S_1$, 6snd $^3D_1$, $^3D_3$, and 6sng as well as perturbing levels of these series belonging to 5dnd configurations have been observed. By means of multichannel quantum-defect theory (MQDT), the authors have performed the analysis of all available energy data relevant to the J=1, 3, 4, 5 even-parity bound spectra of barium. The behaviour of 6sns $^3S_1$, 6snd $^3D_1$, $^3D_3$ series perturbed by levels pertaining to the 5dns (n=7, 8) and 5dnd (N=6, 7) configurations is clearly interpreted. The MQDT analyses of J=1 and 3 spectra complementary to that previously performed on the J=2 spectrum offer the possibility of studying the anomalous fine structures of highly excited 6snd configurations. The MQDT analyses of J=3-5 spectra explain the observed energies of 6sng $^3G_{3,4,5}$ and $^1G_4$ Rydberg levels; the fine structures of the 6sng series are only partially resolved in the vicinity of 5d7d J=3 to 5 perturbing levels. Since the J=0 and J=2 bound even-parity spectra of Ba have already been analyzed by MQDT, the authors have now a full MQDT description of the bound even-parity spectrum for J values ranging from 0 to 5. (22 refs.)

Analysis of a configuration interaction calculation for a charge transfer transition in MnO_4^- .... See Entry 100273

Density functional calculations for low-lying states of CO_2 ...See Entry 100295

Investigation of the Stark effect in krypton autoionizing Rydberg series with the use of two-step laser excitation .... See Entry 100306

Stark quenching of metastable 2S states in hydrogen and helium at high fields .... See Entry 100307

Power-dependent line shapes of transitions to autoionizing Rydberg states .... See Entry 100315

Monoenergetic atomic beam deflection by resonant light pressure .... See Entry 100319

Saturation behavior of a far-wing satellite .... See Entry 100321

Selective detection of ultra-low concentration of atomic cesium by laser radiation .... See Entry 100330

Theory of photoionisation at Rydberg states interacting with a broad state .... See Entry 100332

KLL Auger energies for boron atomic ions based on the saddle-point variational method .... See Entry 100336

Rotational and vibrational distributions of $N_2(C^3\Pi_u)$ excited by state-selected $AR(^3P_2)$ and $Ar(^3P_0)$ metastable atoms .... See Entry 100339

On vibrational energy localization at high levels of excitation. Vibrational excitons .... See Entry 100360

Flash photolysis electron spin resonance and CIDEP studies of radicals derived from nitrogen heterocyclics. I. The diazanaphthalenes .... See Entry 100428

Pulsed ENDOR spectroscopy of the interior protons of free-base porphin in its lowest photoexcited triplet state, in an *n*-octane single crystal .... See Entry 100430

Resonance Raman detected triplet state magnetic resonance .See Entry 100431

Laser-induced fluorescence excitation spectra of $NeCl_2$: evidence for a long-lived vibrationally excited van der Waals molecule .... See Entry 100447

K_2 Rydberg state analysis by two- and three-photon ionization .... See Entry 100465

Photodissociation processes in the OH molecule .... See Entry 100474

Resonances in molecular collisions: importance of mode decoupling in the exit channel of attractive potentials .... See Entry 100475

Yield of excited iodine atoms during many-photon dissociation of CF_3I and $(CF_3)_3CI$ .... See Entry 100478

Beam-gas collision system for excitation cross-section measurements .... See Entry 100526

Beam foil spectra, radiative lifetimes and transition probabilities of carbon .... See Entry 100528

Hermitean DIM model for potential energy surfaces relevant to chemiionization processes .... See Entry 100529

Electric field ionization of foil-excited Rydberg states of fast heavy ions .... See Entry 100538

Treatment of resonances with the dilated electron propagator: the ^2P shape resonance in *e*-Mg scattering .... See Entry 100565

Metastable decomposition of Ar_3^+ cluster ions into Ar_2^+ and Ar^+ .... See Entry 100571

Vibrational excitation of CH_4 by electron impact: 3-20 eV ...See Entry 100575

Dissociative recombination in low-energy e-H_2^+ collisions .....See Entry 100577

Observation of sub-Poissonian photon statistics .... See Entry 100711

The effect of molecular excitation on crystal packing. 9-cyano-and 9,10-dimethylanthracene as excited guest/host and host/guest pairs .... See Entry 101617

Crystal structure and electronic states of dithieno[3,2-*b*:2′,3′-*d*]thiophene .... See Entry 101683

Spin non-conservation in low-energy molecular charge-transfer reactions .... See Entry 103496

Quantum-chemical model for the photoisomerization of protonated Schiff bases of formaldehyde and acrolein .... See Entry 103542

31.70 EFFECTS OF MOLECULAR INTERACTIONS ON ELECTRONIC STRUCTURE

(see also 34. Atomic and molecular collision processes and interactions)

31.70D Environmental and solvent effects

Non-monotonic dependence of electronic relaxation rate on solvent viscosity .... See Entry 100293

Spectroscopic evidence for proton transfer within the bimolecular complex HI-NH_3 trapped in cryogenic matrices .... See Entry 100378

^{13}C NMR of arylgermanes and arylgermyl anions. Main-group elements as anionic π-donor substituents. II .... See Entry 100419

Solvent and pH dependence of fluorescence spectra of 9-phenanthrylamine .... See Entry 100438

31.70F Potential-energy surfaces for collisions

(see also 82.20K in chemical kinetics, 34.20 Intermolecular forces, 34.50L in beam studies)

Photofragment spectroscopy of N_2^{2+} .... See Entry 100480

Trajectory-surface-hopping study of $Na(3p^2P)+H_2 \rightarrow Na(3s^2S)+H_2(v',j',\theta)$ .... See Entry 100508

Hermitean DIM model for potential energy surfaces relevant to chemiionization processes .... See Entry 100529

A theoretical study of coherence effects in charge transfer collisions: application to Na-Li^+ .... See Entry 100542

Ab initio study of the hydration of ketenimine ($CH_2=C=NH$) by water and water dimer .... See Entry 103506

31.70H Time-dependent phenomena: excitation and relaxation processes, and reaction rates

(see also 34. Atomic and molecular collisions)

100292 Intramolecular energy redistribution in polyatomic ions. C.Lifshitz (Dept. of Phys. Chem., Hebrew Univ. of Jerusalem, Jerusalem, Israel).
J. Phys. Chem. (USA), vol.87, no.13, p.2304-13 (23 June 1983).
Experimental techniques are able to prepare polyatomic ions with well-defined amounts of internal energy. Recent studies utilizing these techniques indicate that internal conversion from excited electronic states and isomerization can lead to nonrandom dissociation paths by channeling vibrational energy into a limited number of degrees of freedom. Bimodal kinetic energy release distributions are obtained due to incomplete randomization of internal energy. (115 refs.)

Direct observation of picosecond relaxation of high-lying electronic states of certain dye molecules in solution .... See Entry 100453

31.70K Molecular solids

On vibrational energy localization at high levels of excitation. Vibrational excitons .... See Entry 100360

31.90 OTHER TOPICS IN THE THEORY OF ATOMS AND MOLECULES

(inc. properties other than energy)

100293 Non-monotonic dependence of electronic relaxation rate on solvent viscosity. B.Bagchi, S.Singer, D.W.Oxtoby (Dept. of Chem., Univ. of Chicago, Chicago, IL, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.3, p.225-31 (5 Aug. 1983).
Electronic relaxation processes in solution in which intramolecular potential barriers to reactive motion are absent are modelled by Brownian motion of a solute particle on a harmonic surface with a position-dependent sink. The resulting Fokker-Planck equation with the sink term is solved by generating stochastic trajectories. The authors find that the rate constant for population decay is a non-monotonic function of solvent friction. The Smoluchowski equation is found to overestimate the rate significantly in the low-friction regime. (16 refs.)

100294 Multireference many-body perturbation theory: application to O_2 potential energy surfaces. M.G.Sheppard, B.I.Schneider, R.L.Martin (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
J. Chem. Phys. (USA), vol.79, no.3, p.1364-8 (1 Aug. 1983).
A modification of multi-reference many-body perturbation theory is introduced and applied to potential surface calculations of the first $^3\Sigma_g^-$, $^1\Delta_g$, and $^1\Sigma_g^+$ bound states of O_2. The modification enhances the convergence and efficiency of both Rayleigh-Schrodinger and Brillouin-Wigner expansions by prediagonalizing the primary space and then contracting to a smaller dimension space before calculating perturbative corrections. (42 refs.)

100295 Density functional calculations for low-lying states of CO_2. R.O.Jones (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).
J. Chem. Phys. (USA), vol.79, no.4, p.1885-90 (15 Aug. 1983).
Density functional calculations have been performed for the potential energy surfaces of the $^1A_1$, $^3B_2$, and $^3A_2$ states of CO_2 and for the related singlet-triplet splittings. The geometry ($r_{CO}=2.38\ a_0$, $\alpha_{OCO}=118°$) and excitation energy (6.1 eV) of the lowest-lying $^1B_2$ state agree well with experimental

estimates. The energy surfaces are in accord with the qualitative predictions of Mulliken and Walsh. (30 refs.)

Theoretical study of the lowest states of CsH and Cs_2 .... See Entry 100272

The proton potential in short hydrogen bonds .... See Entry 100500

32.00 ATOMIC SPECTRA AND INTERACTIONS WITH PHOTONS

32.20 ATOMIC SPECTRA GROUPED BY WAVELENGTH RANGES

Atomic hydrogen and fundamental physical constants .... See Entry 98686

Emissive zones of complex atomic configurations in highly ionized atoms .... See Entry 100255

The 2^3S-2^3P_J, $J=0$, 1, 2 intervals in neutral helium .... See Entry 100281

Multichannel quantum-defect analysis of the bound even-parity spectrum of neutral barium .... See Entry 100291

Oscillator strengths in the gallium sequence .... See Entry 100310

Saturation behavior of a far-wing satellite .... See Entry 100321

32.20B Radiofrequency, microwave, and infrared spectra

(inc. magnetic resonance spectra)

100296 Infrared stimulated Raman scattering in rubidium vapor with a tunable pump frequency. N.V.Znamenskii, V.I.Odintsov.
Opt. & Spectrosc. (USA), vol.54, no.1, p.55-7 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.96-9 (Jan. 1983).
The threshold energy, and spectral characteristics of the IR stimulated Raman scattering from the $5^2P_{3/2}$ level of the rubidium atom have been studied. This level was populated through cascade transitions from higher levels produced by many-photon ionization of the atoms. The results are compared with the characteristics of the IR stimulated Raman scattering excited in the ordinary arrangement, in which the initial level is populated by the beam from an auxiliary laser. It is shown that the stimulated Raman scattering is excited at roughly the same efficiency in the two cases. (11 refs.)

Precision determination of the nuclear g factor of $^{39}K^+$ ion and diamagnetic shielding constant difference between a ^{39}K atom and a $^{39}K^+$ ion .... See Entry 100282

32.20J Visible and ultraviolet spectra

(for fluorescence and phosphorescence spectra, see 32.50)

100297 Absorption spectrum of Sr I betwen 1400 and 1900 Å. C.M.Brown (E.O. Hulbert Center for Space Res., Naval Res. Lab., Washington, DC, USA).
J. Opt. Soc. Am. (USA), vol.73, no.8, p.985-93 (Aug. 1983).
The high-dispersion absorption spectrum of Sr I is reported for the 1400-1900-Å region. Observations include transitions from $5s^2\ ^1S_0$ to the $J=1°$ channels of Sr I associated with the excited $4d\ ^2D$ and $5p\ ^2P°$ ion cores of Sr II. Autoionization and channel mixing of the observed $J=1°$ channels are correlated by using methods based on multichannel quantum-defect theory. (37 refs.)

100298 Analysis of the $4d^9$-$4d^85p$ transitions in eleven-times ionised barium (Ba XII). J.Sugar, J.L.Tech, V.Kaufman (NBS, Washington, DC, USA).
J. Opt. Soc. Am. (USA), vol.73, no.8, p.1077-9 (Aug. 1983).
The spectrum of eleven-times ionised barium was generated in a triggered, high-voltage, vacuum spark and photographed with the National Bureau of Standards 10.7-m grazing-incidence spectrograph. The spectral lines of the transition array $4d^9$-$4d^85p$ were identified in the range of 100-125 Å. Thirty-nine lines of this array have been classified as transitions from 32 levels of the $4d^85p$ configuration to the $4d^9\ ^2D$ ground term. Radial energy integrals were fitted to the observed levels of $4d^85p$, and the relative intensities in the array were calculated with fitted eigenvectors. These intensities were in good qualitative agreement with the relative intensities that had been visually estimated on the photographic plate. Least-squares-fitted values for the energy parameters and their ratios to the calculated Hartree-Fock (HF) values are given. (12 refs.)

100299 Atom in extremely strong magnetic fields. H.Ruder, H.Herold, W.Rosner, G.Wunner (Univ. Tubingen, Tubingen, Germany).
Phys. Bl. (Germany), vol.39, no.7, p.183-9 (July 1983). In German.
In extremely strong magnetic fields of flux densities up to 10^9 T even hydrogen atoms become deformed to a practically linear shape. The Lorentz forces then dominate the Coulomb forces. Magnetic fields of more than 10^4 T blur the hydrogen lines in the visible part of the spectrum. Only in high magnetic fields does the spectrum become clearer again after completion of the restructuring of the energy levels. The finite mass of the proton has a significant effect jon the Lamb shift. (9 refs.) *R.S.*

Calibration of wavelengths by optogalvanic spectroscopy .... See Entry 99072

Further studies of the promethium isoelectronic sequence .... See Entry 100284

Nuclear moments and isotope shifts of europium isotopes by hyperfine structure investigations with collinear laser-ion beam spectroscopy .... See Entry 100285

Effect of crossed electric and magnetic fields on sodium Rydberg states .... See Entry 100287

Laser absorption measurements of atomic metastable densities .... See Entry 100288

Electronic and magnetic circular dichroism spectra of matrix-isolated nickel atoms .... See Entry 100304

Lifetime measurements of some levels of singly ionised xenon .... See Entry 100308

Oscillator strengths of lines in the 20-80-nm range of the neon absorption spectrum .... See Entry 100312

Stabilization of a microwave oscillator using a resonance Raman transition in a sodium beam .... See Entry 100601

Line radiation from a hot, optically thin plasma: collision strengths and emissivities .... See Entry 104725

32.20R X-ray spectra

100300 Ultrasoft X-ray emission from atoms and molecules. J.Nordgren, C.Nordling (Inst. of Phys., Univ. of Uppsala, Uppsala, Sweden).
Comments At. & Mol. Phys. (GB), vol.13, no.5, p.229-49 (1983).
Ultrasoft X-ray (USX) emission has become a useful source of information on atoms and molecules. Experimental techniques for USX spectroscopy and its application to the study of molecular valence electronic structure, vibrational excitations, core electron binding energies, core state lifetimes and multiple excitation processes are reviewed. (69 refs.)

100301 Two-electron, one-photon transitions in nickel. S.I.Salem, A.Kumar, B.L.Scott (Dept. of Phys. Astron., California State Univ., Long Beach, CA, USA).
Phys. Lett. A (Netherlands), vol.97A, no.3, p.100-2 (15 Aug. 1983).
The two emission lines, $K\alpha_1\alpha_3{}^h$ and $K\alpha_2\alpha_3{}^h$ resulting from the two-electron transitions $1s^{-2}\rightarrow 2s^{-1}2p_{3/2}{}^{-1}$ and $1s^{-2}\rightarrow 2s^{-1}2p_{1/2}{}^{-1}$ were resolved for elemental nickel. Their measured energies agree well with calculations. Their relative intensity $I(K\alpha_1\alpha_3{}^h)/I(K\alpha_2\alpha_3{}^h)\approx 3/4$ and their intensity relative to that of the $K\alpha$ diagram lines is about 10^{-4}. This is some 10^4 times larger than both theoretical results and the results of ion-atom collision experiments. (16 refs.)

100302 Precise measurement of the widths of some L X-ray lines of tungsten. B.G.Gokhale, S.N.Shukla, Raman Nath Srivastava (Phys. Dept., Lucknow Univ., Lucknow, India).
Phys. Rev. A (USA), vol.28, no.2, p.858-62 (Aug. 1983).
The widths of the L X-ray lines $L\alpha_1$, $L\alpha_2$, $L\beta_1$, and $L\gamma_1$ of tungsten have been measured to an accuracy of 4-6% with a high-resolution 90-cm-radius bent crystal Cauchois spectrograph, with the use of the photographic-photometric method. The measured values have been compared with those of earlier workers as well as with those obtained from theoretical self-consistent-field calculations. The authors values of the $L\alpha_1$ and $L\alpha_2$ widths are in good agreement with those deduced from the recent Dirac-Hartree-Slater estimates of Chen et al. (1981) for the L and M subshells. Contrary to results of earlier workers, the width in eV of the $L\beta_1$ line is found to be larger than that of the $L\alpha_1$ line, a result which is in conformity with theoretical predictions. On the other hand, the authors measured value of the width of the $L\gamma_1(L_2N_4)$ line does not agree with the results of earlier workers, but is in fair agreement with the nonrelativistic estimate of McGuire (1974). The need for a relativistic calculation of the N subshell widths therefore seems to be indicated. (34 refs.)

Compton profiles and momentum expectation values, for atomic system gallium through krypton .... See Entry 100236

Analysis of the $4d^9$-$4d^85p$ transitions in eleven-times ionised barium (Ba XII) .... See Entry 100298

X-ray shifts for additional atomic vacancies .... See Entry 100318

Line radiation from a hot, optically thin plasma: collision strengths and emissivities .... See Entry 104725

32.50 FLUORESCENCE, PHOSPHORESCENCE

(inc. quenching)

Effect of crossed electric and magnetic fields on sodium Rydberg states .... See Entry 100287

Capture of radiation in complex configuration volumes .... See Entry 100290

Stark quenching of metastable 2S states in hydrogen and helium at high fields .... See Entry 100307

Polarization of an atomic sodium beam by laser optical pumping .... See Entry 100329

Time-dependent spectra of colliding atoms in an intense radiation field .... See Entry 100513

Superfluorescence in a cavity .... See Entry 100710

Observation of sub-Poissonian photon statistics .... See Entry 100711

Spatial-anisotropy and polarized-atomic-fluorescence measurements following molecular photodissociation .... See Entry 103568

Measurement of metastable atom microconcentrations in a molecular beam by resonant laser fluorescence .... See Entry 103623

32.60 ZEEMAN AND STARK EFFECTS

100303 Semiempiric method of estimating the energy levels splitting parameter due to the tunnel effect. A.A.Abdurakhmanov, R.A.Ragimova.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.5, p.94-8 (1982). In Russian.
Suggests semiempiric methods of estimating the energy levels splitting parameter due to tunnelling light atomic groups via low potential barriers. The possibility of estimating the splitting value with a precision sufficient for practical purposes by the Stark effect of the identified transitions is shown. (10 refs.)

100304 Electronic and magnetic circular dichroism spectra of matrix-isolated nickel atoms. R.Grinter, D.R.Stern (School of Chem. Sci., Univ. of East Anglia, Norwich, England).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.7, p.1011-20 (July 1983).
The absorption and magnetic circular dichroism spectra of nickel atoms isolated in argon, krypton and xenon matrices have been measured. Comparison of the these spectra with gas-phase data and with the results of calculations shows that the ground state of the nickel atom in these matrices is $3d^94s^1{:}^3D_3$, and not $3d^84s^2{:}^3F_4$ as it is in the gas phase. The spectra in the three matrices are correlated and, as far as possible, assigned. It is shown that some bands previously attributed to atoms are more probably due to small nickel molecules. (21 refs.)

100305 Theoretical calculation of the dependence of Zeeman-sublevel energies on the magnetic field for the $2p^54p$ Ne I, $3p^56p$ Ar I, and $1s3d$ He I configurations. G.P.Anisimova, R.I.Semenov.
Opt. & Spectrosc. (USA), vol.54, no.1, p.23-6 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.41-7 (Jan. 1983).
The dependence of the Zeeman-sublevel energies on the magnetic field is obtained in intermediate coupling in the single-configuration approximation and with the semiempirical method for the $1s3d$ He I (0-10000 Oe), $2p^54p$

Ne I, and $3p^5 6p$ Ar I (0-300000 Oe) configurations as a result of the diagonalization of the total energy matrix. (7 refs.)

100306 Investigation of the Stark effect in krypton autoionizing Rydberg series with the use of two-step laser excitation. C.Delsart, J.-C.Keller (Lab. Aime Cotton, CNRS, Orsay, France).
Phys. Rev. A (USA), vol.28, no.2, p.845-9 (Aug. 1983).
The first detailed observation of the perturbations by an electric field of the Rydberg autoionizing resonances of a rare-gas atom is reported. The Stark spectroscopy of autoionizing Rydberg states converging to the second ionization limit $4p^5\ {}^2P^o{}_{1/2}$ in Kr I is performed in an atomic beam with the use of a two-step laser excitation from the $4p^5 5s[3/2]_2^0$ metastable state. In addition to the verification of the $(n)^{-3}$ dependence of the zero-field width of two autoionizing series and of the linear dependence of the Stark-manifold splittings with the electric field, the authors have observed an $(n)^{0.7}$ law for the dependence of the Stark-manifold splitting along the series, an important narrowing and dissymmetrization of the nd' resonances, and a nonlinear-field behavior of Stark-manifold components in the vicinity of the first anticrossing. Discussions are carried out with the use of the recent work on Rydberg-Stark spectroscopy and on autoionizing states in two-electron atoms. (18 refs.)

100307 Stark quenching of metastable 2S states in hydrogen and helium at high fields. H.K.Holt (Center for Absolute Phys. Quantities, NBS, Washington, DC, USA).
Phys. Rev. A (USA), vol.28, no.2, p.1157-9 (Aug. 1983).
The time-dependent theory of the Stark quenching of $2S$ states in hydrogen and helium is developed for high electric fields, fields for which the Stark matrix element is large compared to the state separations. The metastable $2S$ state of an atom is mixed with two P states by the field, and the subsequent decay is described. (3 refs.)

Transverse optical pumping with modulated light in cesium vapour ....See Entry 100324

Level-crossing effects in optogalvanic spectroscopy ....See Entry 100325

Two-photon optical multistability ....See Entry 100833

Spectral line limiting and polarization shift in plasmas of high particle and energy density ....See Entry 101401

32.70 SPECTRAL LINE SHAPES AND INTENSITIES

100308 Lifetime measurements of some levels of singly ionised xenon. V.Fonseca, M.Ortiz, J.Campos (Catedra de Fisica Atomica, Facultad de Ciencias Fisicas, Ciudad Univ., Madrid, Spain).
J. Opt. Soc. Am. (USA), vol.73, no.8, p.1070-3 (Aug. 1983).
The lifetimes of 15 levels of Xe II have been measured by a delayed coincidence method through 31 transitions in the range from 2576.97-to 5339.38-Å wavelengths. The measured levels belong to the $5p^4 6p$, $5p^4 6d$, and $5p^4 7s$ configurations. For three levels the authors' values are the first ones reported to the authors' knowledge. Theoretical calculations in *LS* coupling have been performed, and a comparison is made with other experimental and theoretical values. (20 refs.)

100309 Intensity ratios of multipole lines of Bi II. J.Kwela, S.Zachara (Inst. of Phys., Univ. of Gdansk, Gdansk, Poland), M.Hults.
J. Opt. Soc. Am. (USA), vol.73, no.8, p.1074-6 (Aug. 1983).
The intensity ratios of the multipole lines corresponding to transitions between levels of the $6s^2 6p^2$ ground electronic configuration of Bi II have been measured. Two ratios were found to be $I_{368.3}/I_{324.1}=0.17\pm0.03$ and $I_{591.3}/I_{485.0}=0.65\pm0.13$. These values are compared with the theoretical predictions and other experimental results. The ratios found are used to calculate the value of the radial integral $s_2=e\int_0^\infty P_{nl}(r)r^2\ P_{n'l'}(r)dr$, which is found to be $8.5\pm0.8[ea_0^2]$. (14 refs.)

100310 Oscillator strengths in the gallium sequence. K.Aashamar (Inst. of Phys., Univ. of Oslo, Oslo, Norway), T.M.Luke, J.D.Talman.
J. Phys. B (GB), vol.16, no.15, p.2695-708 (14 Aug. 1983).
The multiconfiguration optimised potential model has been applied to the first six elements of the gallium sequence. The structure of the ^2P ground state as well as of the two lowest ^2S and ^2D terms has been calculated along with the *gf* values for the ^2P-^2S and ^2P-^2D transitions. Irregularities in the isoelectronic behaviour of the *gf* values owing to plunging terms of the $4s4p^2$ configuration are accounted for and comparison is made with recent experiments. Some discrepancies between theory and experiments have been cleared up but some still remain. (18 refs.)

100311 1.14-μm thulium line unbroadened by collisions. E.B.Aleksandrov, V.N.Kotylev, K.P.Vasilevskii, V.N.Kulyasov.
Opt. & Spectrosc. (USA), vol.54, no.1, p.1 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.3-4 (Jan. 1983).
Describes an attempt to measure the broadening by inert gases of the 1.14-μm forbidden line of thulium (the $^2F_{5/2}$-$^2F_{7/2}$ transition in the fine structure of the ground state). The 1.14-μm line corresponds to a magnetic-dipole transition within the confines of an inner filled $4f$ shell. (4 refs.)

100312 Oscillator strengths of lines in the 20-80-nm range of the neon absorption spectrum. Yu.M.Aleksandrov, P.F.Gruzdev, M.G.Kozlov, A.V.Loginov, V.N.Makhov, R.V.Fedorchuk, M.N.Yakimenko.
Opt. & Spectrosc. (USA), vol.54, no.1, p.4-7 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.7-13 (Jan. 1983).
The oscillator strengths of lines corresponding to electronic transitions in the p^6 subshell to levels of p^5ns and p^5nd (n=3-6) configurations have been measured by the total-absorption method. The spectra were obtained at the 680-MeV FIAN synchrotron. Concentrations were determined from the absorption of the ionization continuum at the ionization threshold. The radiative lifetimes and the oscillator strengths have been calculated. The computations were based on an intermediate-coupling scheme with the electrostatic, spin-orbit, and effective interactions induced in the energy matrices. Parameters of the autoionization lines corresponding to electronic transitions from the s^2 subshells and the two-electron excitation $2p^6$-$2p^4 3s^3 p$ were measured. The behavior of the oscillator-strength densities near the $^2P_{3/2,1/2}$ and $^2S_{1/2}$ thresholds was plotted. The relationships of the near-threshold photoionization cross sections at the $^2P_{3/2}$ and $^2P_{1/2}$ limits were measured. (10 refs.)

100313 Dielectronic satellites of the $1s^2\ {}^1S_0$-$1s2p\ {}^1P_1$ resonance line. Isoelectronic series of carbon. U.I.Safronova, A.S.Shlyaptseva, V.N.Shlyaptsev.
Opt. & Spectrosc. (USA), vol.54, no.1, p.7-10 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.14-19 (Jan. 1983).
Spectra of the isoelectronic series of carbon are calculated. The following states are treated: $1s2s^2 2p^3$; $1s2s2p^4$; $1s2p^5$; $1s^2 2s^2 2p^2$; $1s^2 2s2p^3$; and $1s^2 2p^4$. The atomic characteristics, the transition wavelengths λ, the radiative transition probabilities $A_{\gamma\gamma'}$, the nonradiative decay probabilities Γ_γ are calculated in the intermediate-coupling scheme using the theory of perturbations in $1/z$ and the Breit Hamiltonian for taking into account relativistic effects. The factor $Q_d=g_\gamma[(A_{\gamma\gamma'}+\Gamma_\gamma)/(\Gamma_\gamma+\Sigma_{\gamma'}A_{\gamma\gamma'})]$, determining the relative line intensity, is calculated. Numerical values of Q_d are given for the ions that have been most intensively studied at present: O III; Ne V; Mg VII; Si IX; S XI; Ca XV; Ti XVII; and Fe XXI. The theoretical spectra given for these ions are a clear graphical interpretation of the calculation. (8 refs.)

100314 Radiative lifetime measurement in the $5^2P_{1/2}$ state of silver by level crossing spectroscopy. M.Soltanolkotabi, R.Gupta (Dept. of Phys., Univ. of Arkansas, Fayetteville, AR, USA).
Phys. Lett. A (Netherlands), vol.96A, no.8, p.399-401 (25 July 1983).
The authors have measured the radiative lifetime of the $5^2P_{1/2}$ state of silver by level-crossing spectroscopy to be $\tau(5^2P_{1/2})=7.56$ (22) ns. (11 refs.)

100315 Power-dependent line shapes of transitions to autoionizing Rydberg states. S.A.Bhatti, W.E.Cooke (Phys. Dept., Univ. of Southern California, Los Angeles, CA, USA).
Phys. Rev. A (USA), vol.28, no.2, p.756-9 (Aug. 1983).
The line shapes of the 6sns, $^1S_0$-$6P_{1/2}$ns transitions in Ba as a function of the laser intensity are modeled with the use of two-channel multichannel quantum-defect theory and the isolated-core-excitation model. An analytical expression for the line shape is derived and used to obtain a value of $|\langle g|r|e\rangle|=4.1$ a.u. for the dipole transition moment of the Ba^+ ionic 6s-$6P_{1/2}$ transition, in agreement with a recent theoretical calculation. (11 refs.)

100316 Liouvillian Green's-function theory of spectral line shape. M.D.Girardeau, C.F.Hart (Dept. of Phys., Univ. of Oregon, Eugene, OR, USA).
Phys. Rev. A (USA), vol.28, no.2, p.1072-97 (Aug. 1983).
The general method of the preceding paper is applied to the theory of spectral line shape. Illustrative calculations of the transition-energy shift and width are carried out for a two-level atom interacting with the quantized electromagnetic field. In the thermal-equilibrium case, explicit results are given in terms of the digamma function and Bose-Einstein distribution, generalizing the standard Lamb-shift and Weisskopf-Wigner natural width results to nonzero temperature. In the nonequilibrium case expressions are obtained which exhibit the influence of nonequilibrium photon distributions on the shift and width. A general theory of the time-dependent power radiated in the decay of an excitation is developed for systems not necessarily at or near equilibrium, in terms of appropriate generalizations of the Liouvillian Green's functions of the preceding paper. This approach is illustrated by calculation of the time-dependent radiated power for the same two-level model. (40 refs.)

100317 Calibration of oscillator-strength measurements for the principal-series transitions of potassium. C.C.Wang (Ford Motor Co., Dearborn, MI, USA), B.Shirinzadeh.
Phys. Rev. A (USA), vol.28, no.2, p.1166-8 (Aug. 1983).
Oscillator-strength measurements have been calibrated against the radiative lifetime for the 4s-4p transition of potassium. This yields a value of $(8.1\pm0.5)\times10^{-21}$ cm^2 for the photoionisation cross section at the series limit, and implies a value for the cross-section minimum in good quantitative agreement with that calculated by Seaton. (10 refs.)

100318 X-ray shifts for additional atomic vacancies. S.K.Roy, D.K.Ghosh, B.Talukdar (Dept. of Phys., Visva-Bharati Univ., West Bengal, India).
Phys. Rev. A (USA), vol.28, no.2, p.1169-72 (Aug. 1983).
The simple analytical model of Burch et al. (1974) for the calculation of K X-ray and Auger energy shifts resulting from an additional vacancy in the $2p$ orbital is extended to arbitrary defect configurations. The energy shifts for K,L, and M X-ray series of ^{86}Rn are calculated for vacancies in $1s$, $2p$, $3d$, and $4f$ orbitals. The relative importance of inner- and outer-shell vacancies in producing the X-ray shifts is discussed. (8 refs.)

Measurement of isotropic variations in the charge radii of europium nuclei by the method of three-stepped laser photoionization of atoms .....See Entry 99500

Emissive zones of complex atomic configurations in highly ionized atoms ....See Entry 100255

Nuclear moments and isotope shifts of europium isotopes by hyperfine structure investigations with collinear laser-ion beam spectroscopy ....See Entry 100285

Atom in extremely strong magnetic fields ....See Entry 100299

Precise measurement of the widths of some *L* X-ray lines of tungsten ....See Entry 100302

Monoenergetic atomic beam deflection by resonant light pressure ....See Entry 100319

On the interaction of a radiation field with a nl^N type configuration ....See Entry 100323

Collision effects in velocity-selective optical pumping of sodium ....See Entry 100326

Analysis of $Ar3p^6$ and $Kr4p^6$ photoionization from photoelectron-spin-polarization data ....See Entry 100334

Theory of spontaneous-emission line shape in an ideal cavity ....See Entry 100337

Effect of the different parts of the interaction potential on the line profile in neutral atom-atom collisions ....See Entry 100512

Beam foil spectra, radiative lifetimes and transition probabilities of carbon ....See Entry 100528

Isoelectronic wavelength predictions for magnetic-dipole, electric-quadrupole, and intercombination transitions in the Mg sequence ....See Entry 100586

Superfluorescence in a cavity ....See Entry 100710

On the high power limit of the laser linewidth ....See Entry 100722

Spectral line limiting and polarization shift in plasmas of high particle and energy density ....See Entry 101401

32.80 PHOTON INTERACTIONS WITH ATOMS

100319 Monoenergetic atomic beam deflection by resonant light pressure. Wang Yuzhu (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, Shanghai, China).
Chin. Phys. (USA), vol.3, no.2, p.463-6 (April-June 1983).
The author has calculated the deflections of nearly monoenergetic atomic beams under resonant laser light pressure. These deflection experiments may be used to analyze the velocity distributions in atomic beams, to measure the lifetimes of excited states of atoms, and to verify the theory of photon statistics. (7 refs.)

100320 Quantum-mechanical spectral moments in collision-induced light scattering and collision-induced absorption in rare gases at low densities. M.Moraldi (Istituto di Elettronica Quantistica, CNR, Florence, Italy).
Chem. Phys. (Netherlands), vol.78, no.2, p.243-50 (15 July 1983).
A rigorous quantum-mechanical expression for the second spectral moment in both collision-induced light scattering and in collision-induced absorption is derived. The expression is easily evaluated when a quantum-mechanical radial distribution function is computed. (10 refs.)

100321 Saturation behavior of a far-wing satellite. W.Molander, M.Belsley, K.Burnett, D.Farrelly (Joint Inst. for Lab. Astrophys., Univ. of Colorado, Boulder, CO, USA).
J. Chem. Phys. (USA), vol.79, no.3, p.1297-300 (1 Aug. 1983).
The authors use a saddle point method to derive an asymptotic approximation to the adiabatic perturbation theory transition amplitude. This result is used to discuss the saturation of an 'optical' collision when the field is resonant at an extremum of the potential energy difference. They point out that although the onset of saturation in this satellite occurs for lower field strengths than those needed to saturate a linear crossing, the satellite saturates more slowly than a linear crossing as the field strength is increased. (18 refs.)

100322 Diffraction of an atomic beam by standing-wave radiation. P.E.Moskowitz, P.L.Gould, S.R.Atlas, D.E.Pritchard (MIT, Cambridge, MA, USA).
Phys. Rev. Lett. (USA), vol.51, no.5, p.370-3 (1 Aug. 1983).
Preliminary experimental results are reported for the deflection of Na atoms in an atomic beam by a transverse standing-wave laser field whose frequency is tuned between the two ground-state hyperfine components of the D_2 line. In contrast to the two experiments done previously, a splitting of the beam into two symmetric peaks whose separation increases with the electric-field is seen here. In addition, the data show evidence for atomic diffraction: a tendency for scattered atoms to acquire momentum in multiples of $2\hbar k$. (11 refs.)

100323 On the interaction of a radiation field with a nl^N type configuration. O.L.Malta (Dept. de Quimica, Univ. Federal de Pernambuco, Recife, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.3, p.413-30 (Sept. 1982).
A comparison is made between electric dipole matrix elements within a nl^N type configuration, as given by the length and velocity formulae. Within the approximation of considering each excited configuration as a degenerate one, it is shown that up to second order the matrix elements of the momentum operator are vanishing in contrast with the Judd-Ofelt theory. This conclusion shows that it is a serious error to use the Judd-Ofelt wave functions and the velocity formula. However, up to third order, in addition to even and odd rank tensors which enter on the same footing in the matrix elements, the velocity formula predicts the contribution of two- and three-particle operators which depend on the energy difference between configurations in the same way as the one-particle operators. A brief discussion of the results is given. (14 refs.)

Quantum theory of light. Second edition ....See Entry 98678

32.80B Level crossing and optical pumping

100324 Transverse optical pumping with modulated light in cesium vapour. K.Kolwas, K.Rosinski (Inst. of Phys., Polish Acad. of Sci., Warsaw, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.1, p.139-42 (July 1983).
The problem of the transverse optical pumping of alkalis by amplitude modulated light has been previously investigated theoretically by the dressed atom procedure. Here is reported an experimental verification of some results. For the first time in an experiment of this kind the shape of the Zeeman resonance in the ground state was found. The dependence of the resonance signal on the square of the light intensity was stated to be in good agreement with the theoretical prevision. (6 refs.)

100325 Level-crossing effects in optogalvanic spectroscopy. J.N.Dodd (Dept. of Phys., Univ. of Otago, Dunedin, New Zealand).
J. Phys. B (GB), vol.16, no.15, p.2721-31 (14 Aug. 1983).
Sub-Doppler width signals have been observed in the optogalvanic current when a magnetic field is altered through regions of Zeeman level crossings. It is shown that the signals can be interpreted as due entirely to population changes in the levels involved. (9 refs.)

100326 Collision effects in velocity-selective optical pumping of sodium. C.G.Aminoff, J.Javanainen, M.Kaivola (Dept. of Tech. Phys., Helsinki Univ. of Technol., Espoo, Finland).
Phys. Rev. A (USA), vol.28, no.2, p.722-37 (Aug. 1983).
Reports on a quantitative experimental investigation of velocity-changing collisions by means of velocity-selective optical pumping (VSOP). The authors calculated the VSOP line shape for an atom with hyperfine structure with the use of two phenomenological kernels for the collision effects: the Keilson-Storer kernel, and a two-term kernel consisting of a broad Keilson-Storer part and a narrower Gaussian component. Corrections were included to account for the finite absorption in the sample and the backward reflection of the pumping beam. The experiments were carried out in sodium vapor with neon as the perturber gas. The D_1 line of sodium was used for optical pumping, and the orientation of the ground state was detected. Free parameters of the theory were determined by fitting the predicted line shapes to experimental curves. The Keilson-Storer kernel proved unsatisfactory, but the two-term kernel reproduced well the observed line shapes over the entire collision profiles in the neon pressure range 0-57 mtorr. In an independent experiment using rapidly modulated VSOP the authors also measured directly the cross section of velocity-changing collisions: $\sigma=(1.13\pm0.10)\times10^{-14}$ cm^2. The large weight obtained for the narrow Gaussian from the fits, as well as the collision cross section which is three times as large as the cross section deduced from tabulated gas kinetic radii, may indicate the presence of collisions with relatively small velocity changes in addition to hard-sphere encounters. (30 refs.)

100327 Exactly soluble model of continuum-continuum transitions in strong laser beams. Z.Bialynicka-Birula (Inst. of Phys., Polish Acad. of Sci., Warsaw, Poland).
Phys. Rev. A (USA), vol.28, no.2, p.836-44 (Aug. 1983).
A model of continuum-continuum transitions induced by very intense laser beams is solved. The energy distribution of the photoelectrons is found and it exhibits the broadening and the splitting induced by the laser field. Similar effects are known for bound-bound transitions, but the author's model made it possible to study them systematically in the continuum. (10 refs.)

100328 Optical Hanle effect of Doppler-broadened transitions. V.P.Kaftandjian, Y.Botzanowski, B.Talin (Phys. des Interactions Ioniques et Moleculaires, Univ. de Provence, Marseille, France), L.Klein.
Phys. Rev. A (USA), vol.28, no.2, p.1173-5 (Aug. 1983).
The results obtained in a previous article [ibid., vol.23, p.1365, (1981)] for the optical Hanle effect of an atomic beam (no Doppler broadening) are extended to the case of a dilute gas with Doppler width greater than the collision or natural width. It is shown that the optical Hanle effect is independent of the Doppler width for the case where the strong-field detuning is larger than the Rabi frequency and the weak-field excitation detuning. Analytical results are obtained for a $J=0\rightarrow J=1$ transition. (7 refs.)

100329 Polarization of an atomic sodium beam by laser optical pumping. J.T.Cusma, L.W.Anderson (Dept. of Phys., Univ. of Wisconsin, Madison, WI, USA).
Phys. Rev. A (USA), vol.28, no.2, p.1195-7 (Aug. 1983).
A highly polarized ^{23}Na atomic beam is produced by optical pumping with the use of either a multimode CW dye laser or a single-mode ring dye laser followed by a double-passed acousto-optic modulator. Electron-spin polarizations of 0.72 to 0.90 are obtained. (8 refs.)

Precision determination of the nuclear *g* factor of ^{39}K$^+$ ion and diamagnetic shielding constant difference between a ^{39}K atom and a ^{39}K$^+$ ion ....See Entry 100282

Investigation of the Stark effect in krypton autoionizing Rydberg series with the use of two-step laser excitation ....See Entry 100306

Radiative lifetime measurement in the 5^{2}P$_{1/2}$ state of silver by level crossing spectroscopy ....See Entry 100314

Electron scattering from a potential in a radiation field ....See Entry 100504

Dynamics of long-lived states of strontium atoms and ions in a pulsed discharge in a mixture with helium ....See Entry 101493

32.80D Autoionization

Doubly excited states of the C^{3+} ion ....See Entry 100289

Absorption spectrum of Sr I betwen 1400 and 1900 Å ....See Entry 100297

Investigation of the Stark effect in krypton autoionizing Rydberg series with the use of two-step laser excitation ....See Entry 100306

Oscillator strengths of lines in the 20-80-nm range of the neon absorption spectrum ....See Entry 100312

Power-dependent line shapes of transitions to autoionizing Rydberg states ....See Entry 100315

Analysis of Ar3p^6 and Kr4p^6 photoionization from photoelectron-spin-polarization data ....See Entry 100334

Photoemission spectra from autoionizing states under recycling conditions ....See Entry 100335

32.80F Photoionization and photodetachment

100330 Selective detection of ultra-low concentration of atomic cesium by laser radiation. Zhang Zuren, Li Zhaolin, Feng Baohua, Li Shijie (Inst. of Phys., Acad. Sinica, Peking, China).
Chin. Phys. (USA), vol.3, no.2, p.467-72 (April-June 1983).
The two-photon resonance ionization experiment for the detection of ultra-low concentration of atomic cesium is described. Complete saturation of photoionization was achieved. The number of atoms detected with each laser pulse was measured to be 5.3×10^4. By using a tunable dye laser the authors have achieved the two-photon resonance ionizations the first photon excited cesium atom from ground state $6^2S_{1/2}$ to the excited state $7^2P_{1/2}$, and the second photon ionized the excited cesium atom. In this experiment they have used a homemade ablating-wall flashlamp pumped pulsed dye laser forced oscillator; the output linewidth was 0.5 Å, wavelength 4593 Å, pulse energy 300 mJ, and pulse width 2 μs. The laser beam was focused to the region where atomic beam interacted with it. The energy density in this region was always kept greater than 1 J/cm^2. The ionized ion-electron pair was detected by the electrometer. The experimental value was compared with a theoretical calculation which gave a simple calculation model. The experimental results agreed very well with the theoretical calculations. (4 refs.)

100331 Two-photon ionisation cross section calculations of noble gases: results for Ne and Ar. R.Moccia (Istituto di Chimica Fisica, Univ. of Pisa, Pisa, Italy), N.K.Rahman, A.Rizzo.
J. Phys. B (GB), vol.16, no.15, p.2737-51 (14 Aug. 1983).
Two-photon first ionisation cross sections were computed for Ne and Ar by exploiting the results of a random phase approximation calculation. The final states lying in the continuum were described in a static-exchange-type model. The calculations were performed with the length and velocity form of the perturbation operator for the differential and total cross sections. The results of the calculations are presented for linearly as well as for circularly polarised light. (37 refs.)

100332 Theory of photoionisation at Rydberg states interacting with a broad state. A.M.Lane (Theoretical Phys. Div., AERE, Harwell, England).
Phys. Lett. A (Netherlands), vol.96A, no.8, p.402-4 (25 July 1983).
If a Rydberg series interacts with a broad underlying state, the Fano parameters of the Rydberg states vary in a systematic way. The author gives the general theoretical form of the variation in the case of the asymmetry parameter q, and shows that this may change sign up to four times as a function of energy of the Rydberg state. In the case of one channel, there exists a simple function of q and energy that has the remarkable property of being linear in energy. This provides a test of purity of data, and is applied to data on TlI. (6 refs.)

100333 Resonance-enhanced multiphoton ionization: interference effects due to harmonic generation. D.J.Jackson, J.J.Wynne, P.H.Kes (IBM Thomas, J. Watson Res. Center, Yorktown Heights, NY, USA).
Phys. Rev. A (USA), vol.28, no.2, p.781-94 (Aug. 1983).
A general theoretical model for the treatment of multiphoton ionization is presented. In this treatment, the authors explicitly included coherent effects resulting from harmonic generation. The predictions of this model are in agreement with experimental observations that the authors present in this paper. In addition, the model is contrasted with much earlier theoretical treatments of multiphoton ionization and accounts for the anomalous multiphoton-ionization behavior reported by others in the literature. (22 refs.)

100334 Analysis of Ar3p^6 and Kr4p^6 photoionization from photoelectron-spin-polarization data. F.Schafers, G.Schonhense, U.Heinzmann (Fritz-Haber-Inst. der Max-Planck-Gesellschaft, Berlin, Germany).
Phys. Rev. A (USA), vol.28, no.2, p.802-14 (Aug. 1983).
Experimental data of the cross section and of the asymmetry parameter β in combination with photoelectron-spin-polarization results of Ar3p^6 and Kr4p^6 subshell photoionization were used to determine the bound-free matrix elements and phase-shift differences of the continuum wave functions in a photon-energy region from threshold to 41 eV. The paper includes a discussion of the first autoionization region between the $^2P_{3/2}$ and $^2P_{1/2}$ thresholds in the framework of the angular-momentum-transfer formalism. The experimental results are compared with semiempirical and ab initio calculations with the use of line positions and oscillator strengths in the discrete part extrapolated

to the continuum in application of the multichannel quantum-defect theory. (88 refs.)

100335 Photoemission spectra from autoionizing states under recycling conditions. G.S.Agarwal (School of Phys., Univ. of Hyderabad, Hyderabad, India), S.L.Haan, J.Cooper.
Phys. Rev. A (USA), vol.28, no.2, p.1154-6 (Aug. 1983).
Spectral features of the radiation emitted by autoionizing states in the presence of a strong laser field are calculated under the condition of multiple photon absorption and emissions. The method is based on the exact solution of the master equation for the recycled system. The decay spectra are found to exhibit sharp maxima at the laser frequency and for large values of the Fano q value sidebands which are reminiscent of the triplet which one finds in the context of a two-level atom. (8 refs.)

Measurement of isotropic variations in the charge radii of europium nuclei by the method of three-stepped laser photoionization of atoms .....See Entry 99500

Infrared stimulated Raman scattering in rubidium vapor with a tunable pump frequency ....See Entry 100296

Oscillator strengths of lines in the 20-80-nm range of the neon absorption spectrum ....See Entry 100312

Calibration of oscillator-strength measurements for the principal-series transitions of potassium ....See Entry 100317

32.80H Auger effect and inner-shell ionization

100336 KLL Auger energies for boron atomic ions based on the saddle-point variational method. W.L.Luken, J.M.Leonard (Paul M. Gross Chem. Lab., Duke Univ., Durham, NC, USA).
Phys. Rev. A (USA), vol.28, no.2, p.532-7 (Aug. 1983).
The unrestricted Hartree-Fock (UHF) method is shown to be a special case of the saddle-point variational method for atoms and molecules containing inner-shell vacancies. Numerical results determined by this method are presented for excited electronic states of B^+ and B^{2+} atomic ions. These results are compared to experimental Auger energies and to independently calculated results based on the saddle-point variational method without the UHF approximation. (24 refs.)

X-ray shifts for additional atomic vacancies ....See Entry 100318

32.80K Multiphoton processes

Multichannel quantum-defect analysis of the bound even-parity spectrum of neutral barium ....See Entry 100291

Selective detection of ultra-low concentration of atomic cesium by laser radiation ....See Entry 100330

Two-photon ionisation cross section calculations of noble gases: results for Ne and Ar ....See Entry 100331

Resonance-enhanced multiphoton ionization: interference effects due to harmonic generation ....See Entry 100333

Photoemission spectra from autoionizing states under recycling conditions ....See Entry 100335

Two-photon optical multistability ....See Entry 100833

32.90 OTHER TOPICS IN ATOMIC SPECTRA AND INTERACTIONS WITH PHOTONS

100337 Theory of spontaneous-emission line shape in an ideal cavity. J.J.Sanchez-Mondragon, N.B.Narozhny, J.H.Eberly (Dept. of Phys. & Astron., Univ. of Rochester, Rochester, NY, USA).
Phys. Rev. Lett. (USA), vol.51, no.7, p.550-3 (15 Aug. 1983).
The spontaneous-emission spectrum of an atom in an ideal cavity is calculated. (10 refs.)

Emissive zones of complex atomic configurations in highly ionized atoms ....See Entry 100255

33.00 MOLECULAR SPECTRA AND INTERACTIONS WITH PHOTONS

33.10 CALCULATION OF MOLECULAR SPECTRA

100338 Complete development of dipole moment of tetrahedral molecules. Application to triply degenerate band and to the ν_2 and ν_4 dyade. M.Loete (Lab. de Spectronomie Moleculaire, Univ. de Dijon, France).
Can. J. Phys. (Canada), vol.61, no.8, p.1242-50 (Aug. 1983).
Using a coupling scheme in the T_d group, the author determines all the vibration-rotation operators of the dipole moment of XY_4 molecules up to any order of approximation. The author gives the matrix elements for these operators and general formulas for the calculation of the infrared transition intensities. This general formalism is available for any transition between vibrational sublevels of any symmetry. It can be used for the analysis of isolated bands and for the simultaneous analysis of interacting bands as well. The author shows that this method can be applied to the calculation of Raman intensities and to XY_6 molecules. In some cases, it is possible to carry out a tensorial extension from the T_d group to the O(3) group. The author constructed the operators of the dipole moment adapted to this process using a coupling scheme in O(3). In particular, the author gives the matrix elements for a triply degenerate band. The author uses the contact transformation technique to explain the parameters introduced in the formal expansion of the dipole moment. The author defines the contact transformation operators in a tensorial form. The author applies this method in the case of the two interacting bands ν_2 and ν_4. (28 refs.)

100339 Rotational and vibrational distributions of $N_2(C^3\Pi_u)$ excited by state-selected $AR(^3P_2)$ and $Ar(^3P_0)$ metastable atoms. T.D.Nguyen, N.Sadeghi (Lab. de Spectrometrie Phys., Univ. Sci. et Medicale de Grenoble, Saint-Martin d'Heres, France).
Chem. Phys. (Netherlands), vol.79, no.1, p.41-55 (15 Aug. 1983).
The vibrational distributions of $N_2(C^3\Pi_u)$ and the rotational distributions of $N_2(C^3\Pi_u, \nu'=0)$ excited by energy transfer from state-selected argon metastable $^3P_2$ or $^3P_0$ atoms to nitrogen molecules were studied in the afterglow of a pulsed electrodeless discharge at 300 and 90K. Selective depopulation of one metastable argon species was achieved by optical pumping using a tunable CW dye later. The density of the metastable argon atoms and the intensity of the rotational lines or vibrational bands of the $N_2(C^3\Pi_u \rightarrow B^3\Pi_g)$ fluorescence were monitored in the afterglow. Results obtained at 90K clearly establish a two-component rotational distribution. Rate coefficients for the excitation of the individual vibrational levels of $N_2(C^3\Pi_u)$ by each argon metastable species were determined. The golden-rule model is unable to explain the vibrational distributions obtained by energy transfer; the vibrational population distribution of $N_2(C^3\Pi_u)$ excited by $Ar(^3P_0)$ clearly shows this point. (39 refs.)

100340 Substituted benzenes. V. Normal coordinate analysis of out-of-plane vibrations of mono iodonitrobenzenes. P.Muralidhar Rao, G.Ramana Rao (Dept. of Phys., Univ. Coll., Kakatiya Univ., Warangal, India).
Indian J. Pure & Appl. Phys., vol.21, no.6, p.332-5 (June 1983).
For pt.IV see ibid., vol.20, no.12, p.949 (1982). Normal coordinate analysis is made for the out-of-plane vibrations of ortho, meta and para iodonitrobenzenes using a 14-parameter modified valence force field. The force constants are refined by the method of least-squares employing the vibrational frequencies of the three molecules. The potential energy distributions are computed and the nature of the absorption bands is discussed. (8 refs.)

100341 Substituted benzenes. VI. Vibrational analysis of out-of-plane vibrations of mono bromonitrobenzenes. P.Muralidhar Rao, G.Ramana Rao (Dept. of Phys. Univ. Coll., Kakatiya Univ., Warangal, India).
Indian J. Pure & Appl. Phys., vol.21, no.6, p.336-8 (June 1983).
For pt.V see ibid., vol.21, no.6, p.332-5 (1983). Normal coordinate analysis of ortho, meta and para bromonitrobenzenes is made using a 14-parameter modified valence force field for the out-of-plane vibrations. The force constants are refined by the method of least-squares employing the vibrational frequencies of the three molecules. The potential energy distributions are computed and the nature of the absorption bands is discussed. (9 refs.)

100342 Molecular structure of N_2O_5 in the gas phase. Large amplitude motion in a system of coupled rotors. B.W.McClelland, L.Hedberg, K.Hedberg, K.Hagen (Dept. of Chem., Oregon State Univ., Corvallis, OR, USA).
J. Am. Chem. Soc. (USA), vol.105, no.12, p.3789-93 (15 June 1983).
The structure of dinitrogen pentoxide has been investigated in the gas phase at a temperature of $-11°C$. The molecules consist of two $-NO_2$ groups joined to a fifth oxygen atom by non-colinear bonds. The $-NO_2$ groups are undergoing large amplitude torsional motion about a point of minimum energy corresponding to C_2 symmetry for the molecule with the dihedral angles τ_1 and τ_2 between these groups and the N-O-N plane each about 30° The torsional motion was modeled by a potential representing a competition between bonding forces tending to stabilize the planar conformation and repulsive forces between oxygen atoms on different $-NO_2$ groups tending to destabilize it. The results suggest the motions of the $-NO_2$ groups are loosely coupled in a way such that one torsion angle tends to increase from the minimum energy points as the other decreases. Conversion of molecules between the equivalent conformations τ_1/τ_2 equal to $30°/30°$ and $-30°/-30°$ occurs most easily by a path that includes a saddle point at $90°/0°$ (or $0°/90°$). (24 refs.)

100343 Variational calculation of the rotational constants for acetylene and its isotopic derivatives. K.K.Lehmann, G.J.Scherer, W.Klemperer (Dept. of Chem., Harvard Univ., Cambridge, MA, USA).
J. Chem. Phys. (USA), vol.79, no.3, p.1369-76 (1 Aug. 1983).
A method is presented for calculation of rotational constants for a linear molecule by treating the vibrations variationally, but treating the vibration-rotation coupling perturbatively. The method is applied to the potential energy function for acetylene given by L. Halonen, M.S. Child, and S. Carter [Mol. Phys., vol.47, p.1097 (1982)]. It is found that even though the vibrational energy levels calculated from this potential are in excellent agreement with experiment, the calculated rotational constants are poorly predicted. The calculated ΔBs are systematically inaccurate by about 5% for C_2H_2 and 8% for C_2D_2. This indicates that the potential energy function is inaccurate even near equilibrium. (31 refs.)

100344 Vibrational levels in the self-consistent-field approximation with local and normal modes. Results for water and carbon dioxide. R.M.Roth, R.B.Gerber, M.A.Ratner (Dept. of Chem., Northwestern Univ., Evanston, IL, USA).
J. Phys. Chem. (USA), vol.87, no.13, p.2376-82 (23 June 1983).
Calculations are presented for vibrational energy levels of nonbending H_2O (at correct and linear geometries) and for linear HDO, DTO, $C^{16}O_2$, $C^{16}O^{18}O$. Results obtained from accurate numerical studies are compared to those generated by using the self-consistent-field (SCF) approximation in both normal and local coordinates. It is found that for all cases except H_2O, SCF corrections systematically and considerably improve the zero-order uncoupled normal-mode eigenvalues and render them superior to the local modes even for part of the vibrational overtone region of HDO and DTO. For H_2O, the local-mode picture remains better than SCF, due partly to the small size of the Wilson coupling in local modes (or equivalently to the near-degeneracy of the normal modes). These results demonstrate the quality of the SCF as the best independent-mode approximation. (16 refs.)

100345 On the use of 'effective normal coordinates' in computing the vibration-rotation energy levels of the CO_2 molecule. M.L.Grenier-Besson, A.Mahmoudi (Lab. de Spectroscopie Moleculaire, Univ. Pierre et Marie Curie, Paris, France).
J. Phys. (France), vol.44, no.8, p.923-33 (Aug. 1983). In French.
Perturbation calculations to obtain the vibration-rotation levels fo the CO_2 molecule do not converge well because of an accidentally large value of the coefficient k_{133} in the cubic potential. The convergence can be improved by introducing 'effective normal coordinates' depending on the quantum number ν_3. Relations between spectroscopic constants and molecular parameters have been derived for the symmetric molecule CO_2 in this new formalism. (14 refs.)

100346 Force field in the hydrazine molecule from ab initio MO calculation. N.Tanaka, Y.Hamada, Y.Sugawara, M.Tsuboi (Faculty of Pharmaceutical Sci., Univ. of Tokyo, Tokyo, Japan), S.Kato, K.Morokuma.
J. Mol. Spectrosc. (USA), vol.99, no.2, p.245-62 (June 1983).
Ab initio MO calculations were applied to hydrazine to obtain a reliable molecular force field and to clear up some complexities in the observed spectrum and contradictions in the assignments reported by previous investigators. Various levels of ab initio MO methods, namely the Hartree-Fock (HF) SCF methods with STO-3G, 4-31G, and 4-31G* (in which polarization functions of the nitrogen atoms were added) basis sets, and the configuration interaction (CI) method with a 6-31G* basis set were compared with one another with respect to the calculated molecular parameters. It has been concluded that the HFSCF-4-31G* is, in general, significant and useful, and the improvement caused by elevating the level of calculation up to CI-6-31G* is not very great. For instance, most of the off-diagonal force constant values calculated with HFSCF-4-31G* are already found to be reliable. On the other hand, however, with the 6-31G* CI method, and with anharmonic corrections, nearly perfect reproduction of the observed fundamental frequen-

cies of N_2H_4 has been achieved. Guided by this calculation, a few pieces of new interpretation of the N_2D_4 spectrum have been presented. (23 refs.)

100347 Ab initio rovibrational spectrum of LiNC and LiCN. G.Brocks, J.Tennyson (Inst. voor Theoretische Chem., Katholieke Univ., Toernooiveld, Nijmegen, Netherlands).
J. Mol. Spectrosc. (USA), vol.99, no.2, p.263-78 (June 1983).
Rovibrational calculations are performed on an ab initio potential energy surface for lithium cyanide. Vibrational states localized about both the isocyanide structure and the metastable cyanide structure are found. Calculated fundamental frequencies are LiNC 126.6 cm^{-1} (bend) and 754.3 cm^{-1} (stretch); LiCN 165.8 cm^{-1} (bend) and 688.8 cm^{-1} (stretch). Many states are found in the region of the barrier to isomerization, some of which are delocalized (polytopic). (35 refs.)

100348 Why are formaldehyde and (possibly) propynal nonplanar in their $S_1(\pi^*,n)$ electronic states?. K.K.Innes (Dept. of Chem., State Univ. of New York, Binghamton, NY, USA).
J. Mol. Spectrosc. (USA), vol.99, no.2, p.294-301 (June 1983).
Abnormally low frequencies observed for the out-of-plane vibration (b_12) of the $\tilde{A}^1A_2$ electronic state of formaldehyde (H_2CO) and for the analogous carbonyl hydrogen vibration (a'') of $\tilde{A}^1A''$ propynal (HCCCHO) are modeled by means of two-state calculations of vibronic coupling with higher singlet states, $^1B_2$ and $^1A'$, respectively. In each case, the active vibration is the out-of-plane hydrogen motion. The same vibronic calculations reproduce also the large positive anharmonicities of the active vibrations in the $\tilde{A}(\pi^*,n)$ states; for H_2CO the calculated vibrational spacing alternates as observed, consistent with the known nonplanar structure, while in propynal the calculated spacing increases regularly, thus predicting an effectively planar structure. The nonplanarity of H_2CO is caused mainly by a vibronic coupling constant nearly twice that of propynal. The H_2CO coupling constant is near the value estimated independently by means of the intensity 'borrowed' by the S_1-S_0 transition from the much stronger S_2-S_0 transition. Brief consideration is given to analogous vibrational levels of the $^1A_2$ state of H_2CS and of the $^3A_2$ state of D_2CO in the vibronic context of this paper. (20 refs.)

100349 Adequate representation of the dipole moment function for diatomic molecules and the matrices of vibration-rotation transition moments. I.I.Tugov (Service de Phys. Atomique, CENS, Gif-sur-Yvette, France), V.P.Chernyavsky.
J. Mol. Spectrosc. (USA), vol.99, no.2, p.302-20 (June 1983).
An exponential representation of perturbations is used as a basis of the perturbed Morse oscillator approach which is applied, in a matrix form, for calculating the radial matrix elements for diatomic molecules. An analytic procedure is developed to deduce an exponential-power series expansion for the dipole moment function $m(r)$ from experimental spectral intensities. It is shown that for real anharmonic molecules, the series expansion in powers of $e^{\alpha r}$ (α being the Morse parameter) is an adequate form for representing transition operators, just as the usual series expansion in powers of internuclear distance r is adequate for the case of a harmonic oscillator, and it is equivalent to a series expansion in vibrational wavefunctions. An exponential-power series expansion is derived as well for a model dipole moment function which has a correct long-range dependence and limit. To exemplify the accuracy and efficiency of the technique proposed, the (40×40) matrices of vibration-rotation transition moments $\langle vJ|M(r)|v'J'\rangle(v, v'=0, 1, ..., 39)$ have been calculated for the ground state of CO. Typical results of these computations are presented (up to $v=35$, $J=100$, and $v'-v=1$-4) to illustrate the dependence of vibration-rotation interaction functions on the vibrational and rotational quantum numbers. (26 refs.)

100350 The application of the nonrigid bender Hamiltonian to a quasilinear molecule. P.Jensen, P.R.Bunker (Herzberg Inst. of Astrophys., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
J. Mol. Spectrosc. (USA), vol.99, no.2, p.348-56 (June 1983).
The nonrigid bender Hamiltonian can be set up using only Van Vleck perturbation theory, for any triatomic molecule (linear, quasi-linear, or bent). It can be used to calculate the rotation-vibration energies of the molecule to high $J(\simeq 10)$ from the bending potential energy function and the stretch and stretch-bend force constants. (12 refs.)

100351 Vibration-rotational and rotational intensities for CO isotopes. C.Chackerian,Jr. (NASA Ames Res. Center, Moffett Field, CA, USA), R.H.Tipping.
J. Mol. Spectrosc. (USA), vol.99, no.2, p.431-49 (June 1983).
Dipole moment matrix elements have been computed for the five most abundant isotopes of CO. The wave functions utilized were obtained from a direct solution of the Schrodinger equation with an accurate RKR potential. The dipole moment function, in the form of a Pade approximant, was chosen to reproduce the experimental measurements near equilibrium, to have the proper united and separated atom limits, and to have the correct long-range asymptotic functional dependence on internuclear separation. Predictions for the 5-0 and 6-0 rotationless matrix elements and Herman-Wallis coefficients are given, and their dependence on the isotopic reduced mass is discussed. For the pure rotational band, $v=v'=0$, explicit Einstein A values and transition frequencies were calculated for the three most abundant isotopes for J up to 55. Because of the accuracy of the spectral frequencies, and the ubiquity of the CO molecule, it is reasonable to expect that some of these lines, in particular, in the fundamental band of $^{12}C^{16}O$, can serve as laboratory standards for intensity measurements. (29 refs.)

100352 The harmonic force field and absolute infrared intensities of butyne-2. T.Koops, T.Visser, W.M.A.Smit (Analytical Chem. Lab., Univ. of Utrecht, Utrecht, Netherlands).
J. Mol. Struct. (Netherlands), vol.100, p.95-123 (July 1983).
The frequencies, harmonic force field and absolute IR intensities for butyne-2-d_0 and butyne-2-d_6 are reported. The final set of 'harmonized' fundamental frequencies for butyne-2-d_0 and butyne-2-d_6 obeys the Teller-Redlich product rule very well. Starting values for the force constants were obtained from the harmonic force field of propyne, and diagonal force constants were adjusted in order to reproduce the experimental 'harmonized' frequencies for the d_0 and d_6 compounds. The integrated IR intensities were measured according to the Wilson-Wells-Penner-Weber method, using nitrogen as a broadening gas. Thirteen sets of $\delta u/\delta S$ values were obtained from the experimental intensities, using an iterative least-squares-fitting procedure. This number could be reduced to one by use of several selection criteria. The signs of the remaining set appeared to be in complete agreement with the best set for propyne as reported by both Kondo and Koga (1978) and by Bode et al. (1980). The final $\delta\mu/\delta S$ parameters were transformed into atomic polar tensors. Both kinds of intensity parameters are discussed and compared with corresponding parameters for related molecules. (42 refs.)

100353 Vibrational anharmonicity constants for PuF_6. K.C.Kim, W.B.Person, B.J.Krohn (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
J. Mol. Struct. (Netherlands), vol.100, p.125-8 (July 1983).
The fundamental vibrations of PuF_6 cluster are in two distinct group-vibrational modes, near-local modes at 589K ± 50 cm^{-1} for the stretching modes and 195 ± 15 cm^{-1} for the bending modes. This clustering results in a corresponding 'bunching up' of the density of states. One of the consequences of this behaviour is that 'hot band' absorption intensity pools into stronger absorption features appearing shifted at regular intervals from the fundamental. This observed structure in the 16-μm region for PuF_6 has been interpreted to yield values for two empirical anharmonicity constants $X_{3j}(j=1, 2, 3)$ and $X_{3k}(k=4, 5, 6)$. (4 refs.)

100354 Ethene thiol: a vibrational analysis. V.Almond, S.W.Charles, J.N.Macdonald, N.L.Owen (School of Phys. & Molecular Sci., Univ. Coll. of North Wales, Bangor, Wales).
J. Mol. Struct. (Netherlands), vol.100, p.223-39 (July 1983).
Describes a detailed study of the internal rotation and vibrational spectrum of ethene thiol, and complements a recent study of its microwave spectrum and rotational isomerism (see Taminoto, 1978 and 1979). (23 refs.)

100355 Conformational and vibrational analysis with the aid of normal coordinate calculations. G.A.Crowder (Dept. of Chem., West Texas State Univ., Canyon, TX, USA).
J. Mol. Struct. (Netherlands), vol.100, p.415-32 (July 1983).
Many organic compounds exist as equilibrium mixtures of two or more molecular conformations, and vibrational spectroscopy can be used to obtain information about the structure of those conformations. Normal coordinate calculations are often an aid to those conformational studies and to making vibrational assignments for the different conformers. Sometimes those calculations are partially inconclusive, and a few results are briefly discussed in which both conclusive and inconclusive results were obtained from calculations. Calculations are then applied to some 1,2-dichloro-and 1,2-dibromoalkanes. Previous calculations on 1,2-dichloropropane and 1,2-dichlorobutane are revised, and calculations are reported for 1,2-dibromopropane, 1,2-dibromopropane-d_6, and 1,2-dibromobutane. Spectra are given for the last two of these compounds. A modified valence force field was determined for each family of 1,2-dihaloalkane that should be transferable to other members of the family. (44 refs.)

100356 Vibrational spectra and chemical structure of hetero-metal complexes and clusters with thiometalate ligands. A.Muller, W.Jaegermann, W.Hellmann (Fakultat fur Chem., Univ. Bielefeld, Bielefeld, Germany).
J. Mol. Struct. (Netherlands), vol.100, p.559-70 (July 1983). In German.
The thioanions of the early transition metals, e.g. $MoOS_3^{2-}$, WOS_3^{2-}, MoS_4^{2-} and WS_4^{2-}, form hetero-metal complexes, which are interesting because of their electronic properties and their relevance to problems of bioinorganic chemistry. Their vibrational spectra are discussed in relation to the molecular structure of the compounds and especially to the wide variety of the coordination types of the thiometalate ligands. It is demonstrated that vibrational spectroscopy (especially Raman and resonance Raman) is a powerful tool for the determination of the local symmetry of the thioanions in polynuclear coordination compounds. (25 refs.)

100357 Vibrational structure of the $n\pi^*$-type quasiline phosphorescence spectra of solid solutions of organic molecules. E.A.Gastilovich, V.G.Klimenko.
Opt. & Spectrosc. (USA), vol.54, no.1, p.51-4 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.90-5 (Jan. 1983).
The question of the Franck-Condon and Herzberg-Teller mechanisms of electronic-vibrational interactions and the change in the configuration of molecules in the excited electronic state of $^3n\pi^*$ molecules containing one and two C=O groups (anthraquinone, xanthone, anthrone) has been discussed on the basis of the vibrational structure of the electronic-vibrational spectra of solutions in *n*-paraffins at 4.2K and also the symmetry and forms of the vibrations revealed in the phosphorescence spectra. Conclusions have been reached about the local character of the electronic-vibrational excitation of molecules in the lower triplet state $^3n\pi^*(A_2)$, and a numerical estimate of the change in the configuration of the molecules in this electronic state has been obtained. (12 refs.)

100358 Effect of isotope substitution on the shift of the centers of vibrational-rotational bands of polyatomic molecules. A.D.Bykov, Yu.S.Makushkin, O.N.Ulenikov.
Opt. & Spectrosc. (USA), vol.54, no.1, p.57-61 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.100-6 (Jan. 1983).
A method to calculate the shifts of the centers of vibrational-rotational bands of normal polyatomic molecules is presented in this paper; it is based on an application of perturbation theory. Formulas are derived for the shift of the band centers; to illustrate the usability of these formulas calculations are performed for water, ozone, and methane molecules. (15 refs.)

100359 Theoretical spectroscopy of small molecules. J.Romelt (Univ. Bonn, Bonn, Germany).
Phys. Bl. (Germany), vol.39, no.7, p.226-32 (July 1983). In German.
Based on the Schrodinger equation grass root calculations of the spectra of small molecules, such as O_2, were attempted. Computer programmes make the problem of multi-electron systems manageable. Systems with up to 25 correlated electrons (e.g. butadiene benzene, furane, pyrrol) at about 100 orbitals and up to 10^6 configurations can be handled. (16 refs.) *R.S.*

100360 On vibrational energy localization at high levels of excitation. Vibrational excitons. A.A.Ovchinnikov, N.S.Erikhman (L.Ya. Karpov Physicotech. Sci.-Res. Inst., Moscow, USSR).
Sov. Phys.-Usp. (USA), vol.25, no.10, p.738-55 (Oct. 1982). Translation of: *Usp. Fiz. Nauk (USSR)*, vol.138, no.2, p.289-320 (Oct. 1982).
This review discusses the properties of highly excited vibrational states of polyatomic molecules and molecular crystals. One can describe small vibrations of molecules with the concept of normal modes. In molecules having several identical valence bonds (C_6H_6, H_2O, etc.) the normal modes that describe the vibrational excitations of these bonds amount to vibrations whose energy is more or less uniformly distributed over all the bonds, with a degree of delocalization of the energy over the bonds that increases with increasing level of excitation. On the other hand, an extensive set of physical phenomena exists (e.g. dissociation of molecules) in which local excitations, a considerable fraction of which are spatially localized, play an important role. A localized state corresponds to a complicated superposition of normal modes. Hence the concept of normal vibrations is inadequate for describing vibrations (or, better expressed, movements) of a highly excited molecule. One can conveniently describe such movements of the molecule in the representation of local modes (LM). As a rule, one takes an LM to mean simply the coordinate of a valence bond of the molecule, e.g. O-H, C-H, etc. A large number of papers has been published recently on the experimental study of LM and infrared spectra, relaxation experiments, selective photochemistry, etc. This review

casts light on these experimental data on the basis of the theory of LM. (95 refs.)

The first valence states of the SO^+. Ion rotational analysis of the $A^2\Pi_i$-$X^2\Pi_r$ and $b^4\Sigma^-$-$a^4\Pi_i$ transitions. Comparison of experimental and ab initio calculated molecular parameters .... See Entry 100246

The vibrational numbering of bands in the spectra of polyatomic molecules .... See Entry 100363

Collisional selection rules in the rotational spectrum for asymmetric-top molecules .... See Entry 100365

Microwave spectra of ortho-cloroaniline .... See Entry 100366

Measurement of the $J=0\rightarrow1$ rotational transitions of three isotopes of ArD^+ .... See Entry 100368

The millimeter wave spectrum of silyl fluoride .... See Entry 100371

Intermediate infrared absorption of dianion $(2TCNQ)^{2-}$ .... See Entry 100373

Emission spectra of supersonically cooled methyldiacetylene cations .... See Entry 100375

Emission spectra of supersonically cooled dimethyldiacetylene cations .... See Entry 100376

A quantitative analysis of the ν_s (IR) bands of H-bonds. I. Theory .... See Entry 100377

Infrared intensities of H_3O^+, H_2DO^+, HD_2O^+, and D_3O^+ .... See Entry 100381

Diode laser spectrum of OCS in a DC discharge .... See Entry 100386

The infrared vibration-rotation spectrum of trans and cis nitrous acid .... See Entry 100387

Diode laser spectra of cis-HONO near 850 cm^{-1} and trans-HONO near 1700 cm^{-1} .... See Entry 100388

Molecular complexes of the hydrogen halides studied by matrix isolation infrared spectroscopy .... See Entry 100390

Vibrational spectra and vibrational states of simple gas-phase hydrogen-bonded dimers .... See Entry 100394

The conformation and vibrational spectra of isocyanato and isothiocyanatocyclohexane .... See Entry 100395

Infrared study of molecular rotation in liquids .... See Entry 100396

***l*-resonance effects in the hot bands $3\nu_5\leftarrow2\nu_5$, $(\nu_4+2\nu_5)\leftarrow(\nu_4+\nu_5)$ and $(2\nu_4+\nu_5)\leftarrow2\nu_4$ of acetylene** .... See Entry 100401

Detection of the hydronium ion (H_3O^+) by high-resolution infrared spectroscopy .... See Entry 100402

On the second rotational isomeric form of butadiene-1,3 .... See Entry 100404

The $B^2\Sigma^+$-$X^2\Sigma^+$ system of SrF: precise spectroscopic constants from a combined fit of microwave and sub-Doppler optical spectra .... See Entry 100408

A new spectrum of the PO_2 radical .... See Entry 100410

Rotational inelastic transitions in OCS using a tunable diode laser and a frequency doubled CO_2 laser .... See Entry 100429

Coriolis interactions and intramolecular vibrational redistribution in jet-cooled pyrimidine .... See Entry 100439

Viscosity dependence of internal conversion rates of polyatomic molecules .... See Entry 100444

Laser-induced fluorescence excitation spectra of $NeCl_2$: evidence for a long-lived vibrationally excited van der Waals molecule .... See Entry 100447

Nuclear hyperfine splittings for copper monofluoride in the $a^3\Sigma^+$ state .... See Entry 100451

High-resolution UV photoelectron spectrum of CO_2 .... See Entry 100456

Semiempirical approach to the determination of the probabilities of electronic-vibrational-rotational radiative transitions of diatomic molecules .... See Entry 100459

Semiclassical theory of predissociation induced by rotational (Coriolis) coupling .... See Entry 100469

Resonances in molecular collisions: importance of mode decoupling in the exit channel of attractive potentials .... See Entry 100475

Rotational predissociation of $H_2^{+\cdot}$ ions of different precursor origins .... See Entry 100477

Narrowing of a two-photon resonance due to elastic collisions .... See Entry 100482

The proton potential in short hydrogen bonds .... See Entry 100500

Electron scattering from supersonic jet-cooled molecules .... See Entry 100550

Estimation of equilibrium structure and anharmonicity by use of changes in the r_z structure by isotopic substitution and vibrational excitation. I. General formulation and application to OCl_2 .... See Entry 100593

The story of the ammonia molecule: ten years of investigation of molecular inversion .... See Entry 100594

A study of the first ionization potential of the $CrO(X^5\Pi)$ molecule with high-temperature photoelectron spectroscopy .... See Entry 100600

Ab initio energy calculations for the intramolecular rotational potential of polyacetylene .... See Entry 100609

Quantum interference in the IR-multiphoton excitation of small asymmetric-top molecules: ozone .... See Entry 103543

Classical trajectory study of the effects of parent-molecule bending and overall rotation in polyatomic direct photofragmentation. Model $ICN+h\nu\rightarrow CN+I$ .... See Entry 103546

33.20 MOLECULAR SPECTRA GROUPED BY WAVELENGTH RANGES

(for magneto-optical and electro-optical spectra, see 33.45; for fluorescence and phosphorescence spectra, see 33.50; for photoelectron spectra, see 33.65)

100361 The rate constant for the 'dimol' transition of singlet oxygen $O_2(a^1\Delta_g)$, and the likely symmetry of the emitting species. P.Borrell (Dept. of Chem., Keele Univ., Keele, England), N.H.Rich.
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.144-7 (29 July 1983).
A comparison has been made of the value of the rate constant for the simultaneous 'dimol' emission of $O_2(^1\Delta_g)$, calculated from the absorption spectrum, with those from emission measurements. It is suggested that the emitting $(O_2)_2$ species has D_{2h} symmetry and that the transition is $^1B_{2u}$-^1A_g. The best value is $k=(3.3\pm0.6)\times10^{-2}$ dm^3 mol^{-1} s^{-1} at 295K. The temperature dependence is also discussed. (12 refs.)

100362 Valence-shell photoabsorption by CO_2 and its connections with electron-CO_2 scattering. P.M.Dittman, D.Dill (Dept. of Chem., Boston Univ., Boston, MA, USA), J.L.Dehmer.
Chem. Phys. (Netherlands), vol.78, no.3, p.405-23 (1 Aug. 1983).
Photoabsorption cross sections and photoelectron asymmetry parameters, calculated with the multiple-scattering model (MSM), are reported for the $4\sigma_g$, $3\sigma_u$, $1\pi_u$ and $1\pi_g$ valence levels of CO_2. The results are discussed in the context of photoabsorption and electron energy-loss measurements and other theoretical calculations. Further comparisons are made with previously reported MSM calculations of elastic electron-CO_2 scattering. The close connection between the sets of shape resonances in the electron-scattering and photoabsorption by CO_2 is emphasized with plots of continuum eigenchannel wavefunctions for shape-resonant and nonresonant eigenchannels of σ_u symmetry. (75 refs.)

100363 The vibrational numbering of bands in the spectra of polyatomic molecules. J.C.D.Brand (Dept. of Chem., Univ. of Western Ontario, London, Ontario, Canada), J.H.Callomon, K.K.Innes, J.Jortner, S.Leach, D.H.Levy, A.J.Merer, I.M.Mills, C.B.Moore, C.S.Parmenter, D.A.Ramsay, K.Narahari Rao, E.W.Schlag, J.K.G.Watson, R.N.Zare.
J. Mol. Spectrosc. (USA), vol.99, no.2, p.482-3 (June 1983).
In vibrational assignments of bands of polyatomic molecules, extensive use has been made of the nomenclature introduced by Brand, Callomon, and Watson (1963), e.g. $2_0^2 4_0^1$, $6_0^1 16_1^1$. The principal numbers refer to the vibrations excited and the superscripts and subscripts refer to the number of quanta involved in the upper and lower states, respectively. No confusion has arisen when these symbols are written but there has been some confusion when these symbols are spoken. This unfortunate situation may have been caused by the need in some journals to stagger the superscripts and subscripts. The authors recommend that, when spoken, the superscript should precede the subscript in conformity with the recognized convention in molecular spectroscopy that the upper state precedes the lower state. The also recommend that, when staggering is necessary in print, the same order be followed, e.g. ${4^1}_0$. Reading from left to right, the assignment is then read as four-one-zero, in conformity with standard spectroscopic usage for molecules. (3 refs.)

100364 Towards numerical vibrational spectroscopy. L.A.Gribov (Vernadsky Inst. for Geochem. & Analytical Chem., Acad. of Sci., Moscow, USSR).
J. Mol. Struct. (Netherlands), vol.100, p.13-39 (July 1983).
From the mathematical standpoint, it is possible to reduce a spectral study to the solution of the so-called inverse spectral problems. In practice, the inverse problem is solved through consistent comparison of the spectrum of the model with the experimental spectrum, the degree of closeness between theoretical and experimental spectra providing a quality criterion for the solution. The model may be characterized by different levels of complexity. This paper discusses the course of recent developments in theoretical spectroscopy, the present state of the art, and forecasts future union of experimental and theoretical methods. (16 refs.)

100365 Collisional selection rules in the rotational spectrum for asymmetric-top molecules. V.K.Konyukhov.
Sov. Phys.-Lebedev Inst. Rep. (USA), no.10, p.17-20 (1982). Translation of: *Sb. Kratk. Soobshch. Fiz. AN SSSR Fiz. Inst. P.N. Lebedeva*, no.10, p.20-3 (1982).
The author classifies the energy levels and wave functions of a rigid asymmetric top by using the irreducible representations of the group D_{2h}. The collisional selection rules are estimated. (4 refs.)

Molecular Rydberg transitions .... See Entry 100286

Study of the additivity of internal and external potentials for simple complexes of the HDO molecule .... See Entry 100490

Rydberg states of van der Waals molecules—a comparison with Rydberg states of atoms and chemically bonded species .... See Entry 100493

33.20B Radiofrequency and microwave spectra

(for NMR spectra, see 33.25; for EPR spectra, see 33.30)

100366 Microwave spectra of ortho-cloroaniline. A.Nonat, A.Bouchy, G.Roussy (Univ. de Nancy, Vandoeuvre-les-Nancy, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.15, p.1147-50 (25 April 1983). In French.
Microwave spectra of the normal species of o-chloroaniline in the ground state and in the first excited state of vibration associated with the inversion of the amine group have been identified. The rotational constants obtained for the ground state are (MHz): $A=2340.031\pm0.017$, $B=1546.979\pm0.007$ and $C=1014.233\pm0.005$. The ^{35}Cl nuclear quadrupole coupling constants were fitted as (MHz): $\chi_+=67.68\pm0.04$ and $\chi_-=2.34\pm0.08$. (4 refs.)

100367 Microwave structures of cyanocyclopropane and cyclopropylacetylene. Effects of cyclopropyl π conjugation on structure. M.D.Harmony, R.N.Nandi, J.V.Tietz, Jong-In Choe (Dept. of Chem., Univ. of Kansas, Lawrence, KS, USA), S.J.E.Getty, S.W.Staley.
J. Am. Chem. Soc. (USA), vol.105, no.12, p.3947-51 (15 June 1983).
Microwave spectra of two isotopic forms of cyanocyclopropane and four isotropic forms of cyclopropylacetylene have been observed and analyzed. When these data were combined with previous measurements, complete heavy-atom substitution structures were determined. Among other parameters, the bond distances (Å) are as follows: for cyanocyclopropane, $C_1C_2=1.529\pm0.005$, $C_2C_3=1.500\pm0.003$, $C_1C_4=1.420\pm0.006$, $C_4N=1.161\pm0.004$; for cyclopropylacetylene, $C_1C_2=1.527\pm0.006$, $C_2C_3=1.503\pm0.007$, $C_1C_4=1.422\pm0.006$, $C_4C_5=1.211\pm0.004$, $C_5H=1.055\pm0.003$. The structural results have been compared to those in related molecules and are in accord with a simple theoretical model of π-electron donation from the cyclopropane ring to the π systems of the substituents. These data also point to the conclusion that cyclopropyl is a better donor than vinyl when these groups are conjugated with cyano or ethynyl. (32 refs.)

100368 Measurement of the $J=0\rightarrow1$ rotational transitions of three isotopes of ArD^+. W.C.Bowman, G.M.Plummer, E.Herbst, F.C.De Lucia (Dept. of Phys., Duke Univ., Durham, NC, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.2093-5 (15 Aug. 1983).
The authors report the observation of all three isotopic species of ArD^+ detected in samples containing the argon isotopes in their natural abundances. The absorption frequencies were measured using standard millimeter and submillimeter techniques. (14 refs.)

100369 Microwave substitution structure of the amine group in meta-chloroaniline $C_6H_4ClNH_2$. A.Nonat, A.Bouchy, G.Roussy (Lab. de Spectroscopie, Univ. de Nancy I, Vandoeuvre les Nancy, France).
J. Mol. Spectrosc. (USA), vol.99, no.2, p.407-14 (June 1983).
Microwave spectra of amine-deuterated species of 3-^{35}Cl-aniline, $C_6H_4ClNH_2$, have been observed. The two amino hydrogen atoms are found to be out of the plane of the aromatic ring, and appear to be farther out of the plane

when the amine group is deuterated. It has also been shown that the H_{trans} c coordinate (0.300 Å) is larger than the cis one (0.281 Å). (7 refs.)

100370 Microwave spectrum and selenol internal rotation of 2-propaneselenol. J.Nakagawa, A.Nagayama, M.Hayashi (Dept. of Chem., Hiroshima Univ., Hiroshima, Japan).
J. Mol. Spectrosc. (USA), vol.99, no.2, p.415-30 (June 1983).
Microwave spectra of 2-propaneselenol and its deuterated species were measured and assigned for the gauche and trans isomers. The double minimum splittings of the gauche isomers were directly observed from b-type transitions, which were assigned with the aid of a double resonance technique. Rotational constants and torsional splitting of the gauche isomer of the parent species were determined to be $A=7802.50\pm0.75$, $B=2847.68\pm0.04$, $C=2242.03\pm0.03$, $\Delta A=-2.52\pm0.74$, $\Delta B=0.02\pm0.05$, $\Delta C=-0.34\pm0.03$, and $\Delta\nu=368.91\pm0.94$ MHz, where ΔA, and ΔB, and ΔC are the differences of the rotational constants between the (+) and (−) states. From the torsional splittings and the energy differences of the two isomers of the parent and SeD species, Fourier coefficients of the selenol internal rotation potential function were determined to be $V_2=-88\pm15$, $V_3=1543\pm29$ cal/mole on the assumption of $V_1=0$. Dipole moments and their components were also obtained for the two isomers. (12 refs.)

100371 The millimeter wave spectrum of silyl fluoride. R.J.Butcher (Cavendish Lab., Univ. of Cambridge, Cambridge, England), J.H.Carpenter.
J. Mol. Spectrosc. (USA), vol.99, no.2, p.476-8 (June 1983).
The microwave spectrum of SiH_3F in its ground and several excited vibrational states has been investigated by Georghiou et al. (1976) have reinvestigated the $J=2$-1 transitions and measured some higher frequency millimeter-wave transitions. This work, which is complementary to a study of the infrared laser Stark spectrum had two aims: to obtain accurate experimental values of D_J and D_{JK} for all three isotopes and to identify lines of the ν_2 and ν_5 states, which are strongly coupled by Coriolis resonance. Measurements were made using the Newcastle millimeter-wave spectrometer. Harmonics were generated from a klystron at 29 GHz. (4 refs.)

100372 Microwave spectrum and structure of difluoro(trifluorosilyl)borane, SiF_3BF_2. P.R.R.Langridge-Smith, A.P.Cox (Dept. of Phys. Chem., Univ. of Bristol, Bristol, England).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.7, p.1089-106 (July 1983).
The microwave spectrum of $^{28}SiF_3{}^{11}BF_2$ has been thoroughly examined in the region 24-40 GHz. Transitions have been assigned with the five lowest-lying torsional states and the earlier analysis of the spectrum refined. An improved value for the barrier to internal rotation about the Si-B bond has been determined as $V_6=2.178\pm0.005$ cal mol^{-1} (9.11 ± 0.02 J mol^{-1}). The spectra of the isotopic species $^{28}SiF_3{}^{10}BF_2$ and $^{29}SiF_3{}^{11}BF_2$ have also been assigned allowing the zero-point average Si-B bond length to be determined as 2.027 ± 0.005 Å, significantly longer than that expected for a single bond. The remaining r_z structural parameters are determined to be: Si-F=1.567 ± 0.005 Å, B-F=1.312 ± 0.005 Å, ∠FBF=$118.5\pm0.5°$, ∠FSiB=$110.9\pm0.2°$. The structure and bonding of SiF_3BF_2 are compared with those of related molecules. (28 refs.)

The ab initio gradient revolution in structural chemistry: the importance of local molecular geometries and the efficacy of joint quantum mechanical and experimental procedures ....See Entry 100247

Structural determination of recalcitrant molecule (S_2F_4) ....See Entry 100249

Ethene thiol: a vibrational analysis ....See Entry 100354

Diode laser spectrum of OCS in a DC discharge ....See Entry 100386

The $B^2\Sigma^+$-$X^2\Sigma^+$ system of SrF: precise spectroscopic constants from a combined fit of microwave and sub-Doppler optical spectra ....See Entry 100408

33.20E Infrared spectra

100373 Intermediate infrared absorption of dianion $(2TCNQ)^{2-}$. K.Kral (Inst. of Phys., Czechoslovak Acad. Sci., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.7, p.791-801 (1983).
Quadratic electron-phonon coupling is implemented into the theory of the infrared absorption of the dianion $(2TCNQ)^{2-}$ and its importance is discussed. A simple rule for the energies of the vibrational transitions in the infrared spectra and their intensities is derived. (14 refs.)

100374 The use of ^{18}O substitution in the characterization of $MReO_4$ molecules. The IR spectrum of matrix-isolated $CsReO_4$. L.Bencivenni, H.M.Nagarathna, K.A.Gingerich (Dept. of Chem., Texas A&M Univ., College Station, TX, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.3, p.258-61 (5 Aug. 1983).
The molecular structure of gaseous $CsReO_4$ has been studied by matrix isolation IR spectroscopy. The ^{18}O substitution experiments indicate a bidentate structure of C_{2v} symmetry in which the perrhenate anion is slightly distorted from the tetrahedral geometry. (10 refs.)

100375 Emission spectra of supersonically cooled methyldiacetylene cations. S.Leutwyler, D.Klapstein, J.P.Maier (Phys.-Chem. Inst., Univ. Basel, Basel, Switzerland).
Chem. Phys. (Netherlands), vol.78, no.2, p.151-66 (15 July 1983).
The $\tilde{A}^2E\rightarrow\tilde{X}^2E$ ($\Sigma=+1/2, -1/2$) electronic transitions of rotationally/vibrationally cooled $CH_3-C\equiv C-C\equiv C-H^+$ cation, as well as the d_1-/d_3-/d_4-substituted species, were studied by emission spectroscopy. Ion emission was obtained by electron impact on the neutral species seeded in a helium supersonic free jet. Vibrational frequencies in both electronic states are inferred to within ±1 cm^{-1}. Spin-orbit splittings are observed and interpreted on the basis of nonlinear vibronic couplings. Rotational subbands are observed, yielding rotational and Coriolis parameters as well as rotational temperatures. (22 refs.)

100376 Emission spectra of supersonically cooled dimethyldiacetylene cations. D.Klapstein, R.Kuhn, S.Leutwyler, J.P.Maier (Phys.-Chem. Inst., Univ. Basel, Basel, Switzerland).
Chem. Phys. (Netherlands), vol.78, no.2, p.167-73 (15 July 1983).
The $\tilde{A}^2E_u\rightarrow\tilde{X}^2E_g$ emission spectra of 2,4-hexadiyne (dimethyldiacetylene) cation and its d_3- and d_6-deuterated analogues were excited by electron impact on a seeded helium supersonic free jet. Vibrational analyses are made and vibrational frequencies in both states are inferred to ±1 cm^{-1}. Spin-orbit splittings are observed especially in degenerate overtone bands. The observed rotational contours allow a partial rotational analysis. (15 refs.)

100377 A quantitative analysis of the ν_s (IR) bands of H-bonds. I. Theory. Y.Marechal (Dept. de Recherche Fondamentale, CENG, Grenoble, France).
Chem. Phys. (Netherlands), vol.79, no.1, p.69-83 (15 Aug. 1983).
The author establishes a simple relation between the experimental shape of the ν_s bands (X-H...Y) appearing in the IR spectra of H-bonds and the shape that these ν_s bands would exhibit after a complete elimination of their irrelevant features due to Fermi resonances. The author writes the Hamiltonian governing ν_s vibrations which are strongly modulated by low-frequency vibrations and interact at the same time with other modes whose binary combinations or overtones have energies comparable to ν_s. The analysis of the spectrum corresponding to such a Hamiltonian allows one to establish such a relation at the price of reasonable hypotheses which are discussed in detail. These hypotheses are the consequences of the two following statements: because ν_s bands are broad and smooth the high-resolution effects are ignored, because spectra without Fermi resonances exhibit no particular features it is unlikely that relaxation effects due to Fermi resonances may be significant. Such a relation is easily amenable to computation which will be made, for a definite example, in the following article. (33 refs.)

100378 Spectroscopic evidence for proton transfer within the bimolecular complex HI-NH_3 trapped in cryogenic matrices. L.Schriver, A.Schriver, J.P.Perchard (Lab. de Spectrochimie Moleculaire, Univ. Pierre et Marie Curie, Paris, France).
J. Am. Chem. Soc. (USA), vol.105, no.12, p.3843-8 (15 June 1983).
The infrared spectra for the 1:1 complexes of HI and either NH_3 or $N(CH_3)_3$ (TMA) isolated in four different matrices (Ar, O_2, N_2, C_2H_4) have been obtained at 10K. These complexes are mainly characterized by the stretching vibration (ν_s) of the proton along the I-N axis, the frequency of which strongly varies with the nature of the matrix: for HI-NH_3, 1255 (Ar), 1310 (O_2), 1847-1967 (N_2), and 2315 cm^{-1} (C_2H_4); for HI-TMA, 1889 (Ar), 1880-1920 (O_2), 2100-2132 (N_2), and 2315 cm^{-1} (C_2H_4). A comparison with the known spectra of HX-NH_3 (X=F, Cl, Br) and HX-TMA (X=Cl, Br) (1:1) complexes shows that the hydrogen bond is stronger with HI than with other hydro acids, in which the hydrogen atom of HI has tipped toward nitrogen. Thermodynamic arguments about the enthalpy of reaction of proton transfer within a NH_3/HX pair support this conclusion. The matrix frequency shift shows that the rate of proton transfer is strongly matrix dependent and is believed to be complete in an ethylene matrix, for which the ν_s frequencies are the same for both HI-NH_3 and HI-TMA complexes. Such a sensitivity of the proton potential curve to the surroundings had been predicted in recent theories of solvent effects. (24 refs.)

100379 Carbon dioxide activation by lithium metal. I. Infrared spectra of $Li^+CO_2{}^-$, $Li^+C_2O_4{}^-$ and $Li_2{}^{2+}CO_2{}^{2-}$ in inert-gas matrices. Z.H.Kafafi, R.H.Hauge, W.E.Billups, J.L.Margrave (Dept. of Chem., Rice Univ., Houston, TX, USA).
J. Am. Chem. Soc. (USA), vol.105, no.12, p.3886-93 (15 June 1983).
Lithium atoms react spontaneously with carbon dioxide to form $Li^+CO_2{}^-$ and $Li_2{}^{2+}CO_2{}^{2-}$ in inert gas matrices. Reaction of Li and CO_2 in an argon matrix leads also to the formation of $Li^+C_2O_4{}^-$. Two geometrical isomers of $Li^+CO_2{}^-$ have been isolated in solid argon. One has a ring structure in which the metal interacts symmetrically with the two oxygen atoms, while in the second isomer the lithium atom is bonded to only one of the two oxygens. $Li^+CO_2{}^-(C_s)$ rearranges upon photolysis with a Nernst glower IR source to the symmetric $Li^+CO_2{}^-(C_{2v})$. Similarly $Li^+C_2O_4{}^-$ photolytically converts to an $LiCO_2$:CO_2 adduct. $Li_2{}^{2+}CO_2{}^{2-}$ is produced under high concentration of the alkali metal as a result of the reaction of dilithium or two lithium atoms with carbon dioxide. Lithium oxalate ($Li_2C_2O_4$) is formed in concentrated matrices. All three expected intraionic infrared-active modes of $CO_2{}^-$ as well as a Li^+-$CO_2{}^-$ interionic mode have been identified for both $Li^+CO_2{}^-$ geometrical isomers. Isotopic shifts have been measured for lithium-6-, carbon-13-, and oxygen-18-enriched products. A $CO_2{}^-$ valence bond angle equal to 125.7° has been calculated. Normal coordinate analyses have been carried out on $LiCO_2(C_{2v})$ and $LiCO_2(C_s)$ by using 22 and 30 measured frequencies, respectively, for all the isotopomers of the two geometrical isomers. (35 refs.)

100380 Orientational ordering, site structure, and dynamics for octahedral molecules in low temperature matrices: SF_6 and SeF_6 in rare gas solids. L.H.Jones, B.I.Swanson (Los Alamos Lab., Univ. of California, Los Alamos, NM, USA).
J. Chem. Phys. (USA), vol.79, no.3, p.1516-22 (1 Aug. 1983).
From polarization studies of high resolution IR spectra of SF_6 and SeF_6 trapped in noble gas solids the authors show that much of the structure observed for the stretching mode represents site symmetry split components for low symmetry trapping sites, the triply-degenerate ν_3 mode being split into a doubly-and singly-degenerate mode. Most of the sites showing polarization are orientationally ordered with the singly-degenerate component perpendicular to the substrate. They attribute the driving force for ordering to guest-host interaction potentials which result in registry between the molecules and the (111) growth plane during deposition. The observed orientational ordering combined with high temperature annealing studies has allowed the identification of the symmetry of certain trapping sites and further analysis of vibrational dephasing dynamics. Several sites with the same nominal symmetry and structure can be tracked through the matrices discussed herein. The implications of the ordering of impurity structure in a host lattice formed by vapor deposition are discussed. (23 refs.)

100381 Infrared intensities of H_3O^+, H_2DO^+, HD_2O^+, and D_3O^+. M.E.Colvin, G.P.Raine, H.F.Schaefer,III. (Dept. of Chem., Univ. of California, Berkeley, CA, USA), M.Dupuis.
J. Chem. Phys. (USA), vol.79, no.3, p.1551-2 (1 Aug. 1983).
Saykally and co-workers have recently (1983) observed the infrared spectra of HCO^+ and $HN_2{}^+$ and their spectroscopic technique shows promise for the detection of a large number of other polyatomic molecular ions. An immediate target is H_3O^+, for which the subtleties of the rotation-inversion problem may make assignments difficult. In this respect, the availability of theoretical predictions for the infrared intensities may be of some help in unraveling the observed vibrational spectra. Moreover, since the deuterated molecules H_2DO^+ and HD_2O^+ remove the problems associated with C_{3v} symmetry, the identification of these species may in fact be simpler. The authors report infrared intensities for all four isotopic molecules H_3O^+, H_2DO^+, HD_2O^+, and D_2O^+. (12 refs.)

100382 IR spectroscopic study and characterisation of chlorine oxides, $(ClO)_2$, ClO_2, Cl_2O_4 and Cl_2O_3 produced in the chlorine-ozone reactions. R.C.Loupec, J.Potier (Univ. des Sci. & Tech. du Languedoc, Montepellier, France).
J. Chim. Phys. & Phys.-Chim. Biol. (France), vol.80, no.5, p.449-54 (May 1983).
The nonphotochemical reaction of (O_2+O_3) with Cl_2 at −78, −44, −40°C essentially gives chlorine chlorate which is characterized by ν(ClOCl) at 785 and 745 cm^{-1}. Water traces lead to ClO_2 but also to $HClO_3$, HCl and to small quantities of other chlorine oxides by a water catalysed process. In the darkness and in the gas phase, ($p=3$ atm and $t=15$°C), pure ozone reacts with chlorine and gives a ClO_2 rich mixture containing also a high proportion of chlorine chlorate with chlorine perchlorate traces; chlorine chlorate is characterized by $\nu_S(ClO_2)=1015$ cm^{-1} $\nu_{as}(ClO_2)=1280$ cm^{-1} and the two bridge vibrations νClOCl at 735 and 695 cm^{-1}. Reaction mechanisms are proposed. (31 refs.)

100383 Sequential two-photon spectroscopy of some ion-pair states of IBr. J.C.D.Brand, U.D.Deshpande, A.R.Hoy, S.M.Jaywant, E.J.Woods (Dept. of Chem., Univ. of Western Ontario, London, Ontario, Canada).
J. Mol. Spectrosc. (USA), vol.99, no.2, p.339-47 (June 1983).
Molecular constants of the first $E0^+$ ion-pair state of IBr vapor have been determined using polarization-labeling spectroscopy applied to the sequential transitions $E0^+ \leftarrow B'0^+ \leftarrow X0^+$, while the second $f0^+$ ion-pair state is reported and characterized for the first time. Preliminary data for the first $\Omega=1$ ion-pair state, accessed in the sequence $1(^3P_2) \leftarrow A(\Omega=1) \leftarrow X0^+$, indicate that T_e is $\lesssim 30$ cm^{-1} higher in energy than that of the E state. (18 refs.)

100384 Absolute frequency measurements of the 2-0 band of CO at 2.3 μm; calibration standard frequencies from high resolution color center laser spectroscopy. C.R.Pollock, F.R.Petersen, D.A.Jennings, J.S.Wells (Time Frequency Div., NBS, Boulder, CO, USA), A.G.Maki.
J. Mol. Spectrosc. (USA), vol.99, no.2, p.357-68 (June 1983).
The absolute frequencies of 20 lines of the 2-0 band of CO near 4260 cm^{-1} have been measured by heterodyne frequency measurement techniques. Eleven of the lines were measured by saturated absorption techniques which produced linewidths of about 3 MHz. New rovibrational constants have been fitted to these measurements. A table of calculated transition frequencies is given with estimated absolute uncertainties as small as 0.0000023 cm^{-1} (70 kHz) near the band center. The pressure shifts of three lines have been measured and fall in the range from -0.9 to -3 kHz/Pa (-122 to -400 kHz/Torr). It is suggested that the generally accepted frequencies of the 1-0 band of CO should be lowered by 7 MHz. (28 refs.)

100385 Laser Stark spectroscopy of silyl fluoride in the 10-μm region: analysis of the ν_2 and ν_5 bands. R.Escribano (Inst. de Estructura de la Materia, Madrid, Spain), R.J.Butcher.
J. Mol. Spectrosc. (USA), vol.99, no.2, p.450-75 (June 1983).
The $\nu_2=1$ and $\nu_5=1$ states of silyl fluoride are strongly mixed by Coriolis coupling. About 1100 Stark tuned resonances were measured in these bands using $^{12}CO_2$ and $^{13}CO_2$ lasers. These data were combined with 13 new millimeter wave measurements and 900 Fourier transform infrared measurements in a suitable model. Apart from the main Coriolis coupling ζ_{25}, it was necessary to include estimates of two further Coriolis terms to obtain a satisfactory interpretation of the data. Many vibration-rotation parameters and the dipole moments are determined. (18 refs.)

100386 Diode laser spectrum of OCS in a DC discharge. W.Klebsch, K.Yamada, G.Winnewisser (Phys. Inst., Univ. zu Koln, Koln, Germany).
J. Mol. Spectrosc. (USA), vol.99, no.2, p.479-81 (June 1983).
During the last few years unstable molecular species such as radicals, ions, and highly excited states were detected by both microwave and high-resolution infrared spectroscopy in plasmas excited by DC and RF discharges. The authors present new OCS spectra, observed in highly excited vibrational states, mostly assigned to the 20°0-10°0 'hot' band, centered around 2040 cm^{-1}. (6 refs.)

100387 The infrared vibration-rotation spectrum of trans and cis nitrous acid. C.M.Deeley, I.M.Mills (Dept. of Chem., Univ. of Reading, Reading, England).
J. Mol. Struct. (Netherlands), vol.100, p.199-213 (July 1983).
Infrared spectra of the trans and the cis isomers of nitrous acid, both HONO and DONO, have been observed in the gas phase using a Fourier transform interferometer with a resolution of about 0.05 cm^{-1} from 400 to 500 cm^{-1}. Rotational analyses are reported on eleven of the fundamentals and some overtones. (20 refs.)

100388 Diode laser spectra of cis-HONO near 850 cm^{-1} and trans-HONO near 1700 cm^{-1}. A.G.Maki, R.L.Sams (NBS, Washington, DC, USA).
J. Mol. Struct. (Netherlands), vol.100, p.215-21 (July 1983).
Tunable diode laser spectra have been measured for the ν_4 band of cis-HONO near 850 cm^{-1} and the ν_2 band of trans-HONO near 1700 cm^{-1}. The ν_4 band is completely unperturbed and 355 well-resolved transitions have been fit with a standard deviation of 0.0027 cm^{-1}. Rotational and centrifugal distortion constants are given for both bands. (19 refs.)

100389 Infrared and Raman spectra and normal coordinate calculations for methylisothiocyanate. J.R.Durig, J.F.Sullivan, H.L.Heusel (Dept. of Chem., Univ. of South Carolina, Columbia, SC, USA), S.Cradock.
J. Mol. Struct. (Netherlands), vol.100, p.241-57 110 19 (July 1983).
The infrared spectra (3200-50 cm^{-1}) of gaseous and solid CH_3NCS and CD_3NCS and the Raman spectra (3200-10 cm^{-1}) of the liquids and solids have been recorded. The spectra have been interpreted on the basis of a 'pseudo-symmetric top' with C_{3V} symmetry. An assignment of the fundamental vibrations in both molecules, based on their infrared band contours, depolarization values and group frequencies, is given and discussed. Particularly interesting is the low-frequency region where band maxima were observed at 152 and 80 cm^{-1} for CH_3NCS and 139 and 71 cm^{-1} for CD_3NCS in the infrared spectra of the gases. A normal coordinate analysis has also been carried out based on C_{3V} symmetry. Considerable mixing was found between the C_α-N stretch and NCS symmetric stretch in both isotopic species. The other normal modes in CH_3NCS are reasonably pure but, for the CD_3NCS molecule, considerable mixing was found between the CD_3 stretches and NCS antisymmetric stretch. The proposed vibrational assignment and the results of the normal coordinate calculations are discussed and compared with the results obtained for similar molecules. (9 refs.)

100390 Molecular complexes of the hydrogen halides studied by matrix isolation infrared spectroscopy. A.J.Barnes (Dept. of Chem. & Appl. Chem., Univ. of Salford, Salford, England).
J. Mol. Struct. (Netherlands), vol.100, p.259-80 (July 1983).
Spectroscopic studies of base-hydrogen halide complexes are reviewed, including previously unpublished data for complexes of hydrogen chloride and hydrogen bromide with a variety of bases in argon matrices. The variation of the HX stretching relative frequency shift with the hydrogen halide and with the medium (gas phase, argon matrix or nitrogen matrix) and correlations of the HX stretching and hydrogen bond bending frequencies with the proton affinity of the base and with the hydrogen bond stretching force constant or dissociation energy of the complex are discussed. (166 refs.)

100391 FTIR spectra of base-hydrogen fluoride hydrogen-bonded complexes in solid argon. L.Andrews (Dept. of Chem., Univ. of Southampton, Southampton, England).
J. Mol. Struct. (Netherlands), vol.100, p.281-303 (July 1983).
Hydrogen fluoride and base molecules ranging from CO_2 to NH_3 have been codeposited at 12K with excess argon. Fourier-transform infrared spectra of the samples before and after sample warming to allow reagent diffusion and association provide identification of 1:1 and 1:2 hydrogen-bonded complexes. Strong ν_s and ν_1 absorptions of the HF submolecule in the complexes vary with the proton affinity of the base and characterize the strength of the hydrogen-bonded interaction. Base submolecule modes show small displacements from the base molecule spectrum depending upon the structure of the complex. (37 refs.)

100392 Matrix isolation infrared spectra of the complexes between methylacetate and water or hydrochloric acid. G.Maes, Th.Zeegers-Huyskens (Dept. of Chem., Univ. of Leuven, Heverlee, Belgium).
J. Mol. Struct. (Netherlands), vol.100, p.305-15 (July 1983).
The hydrogen-bonded complexes between methylacetate (MeAc) and water or hydrochloric acid have been studied by infrared spectrometry in a low temperature Argon matrix. The $\nu_{C=O}$, $\nu_{C\text{-}O}$ and $\nu_{C\text{-}C}$ vibrational modes of MeAc show a splitting to the low and to the high frequency side of the free molecule. This suggests that water and HCl interact with the keto and either oxygens. This conclusion is supported by the appearance of two main absorptions in the ν_{HCl} region. These results are discussed as a function of the gas-phase basicity of the two oxygen atoms, derived from the O(1s) core electron binding energies and from the ionization potentials. (23 refs.)

100393 Matrix-isolation infrared and ultraviolet spectroscopic studies of less stable conformers of 1,3,5-hexatriene. Y.Furukawa, H.Takeuchi, I.Harada, M.Tasumi (Dept. of Chem., Univ. of Tokyo, Tokyo, Japan).
J. Mol. Struct. (Netherlands), vol.100, p.341-50 (July 1983).
The infrared spectra of the 3-trans and 3-cis isomers of 1,3,5-hexatriene in low-temperature Ar matrices deposited from a high-temperature nozzle or deposited under irradiation of the Hg 253.7 nm light show a number of new bands. Correspondingly, the ultraviolet spectra of the 3-trans isomer observed under similar experimental conditions show a new absorption at 276 nm. Most of these new infrared bands and the new ultraviolet absorption are attributable to less stable isomers which have the planar s-cis conformation [or gauche conformation(s) close to the planar s-cis] about either one or both of the two C-C bonds. (24 refs.)

100394 Vibrational spectra and vibrational states of simple gas-phase hydrogen-bonded dimers. D.J.Millen (Dept. of Chem., Univ. Coll. London, London, England).
J. Mol. Struct. (Netherlands), vol.100, p.351-77 (July 1983).
Outlines the growth of evidence and ideas about infrared band broadening for simple, gaseous, moderately strong, hydrogen bonded dimers B...H-A, to draw attention to areas in need of further development and to collect together experimental information available at the present time about vibrational states associated with such dimers. The band associated with the modified H-A stretching mode, ν_s, is observed for several dimers not only to be broad, but to have sub-band structure, which is satisfactorily interpreted as arising from combination bands of ν_s with the low frequency stretch-mode ν_σ, giving a progression $\nu_s \pm n\nu_\sigma$ as a result of strong anharmonic coupling. For weaker dimers with lower values of ν_σ the sub-band structure is less evident, and may appear only as shoulders, while for still weaker dimers the sub-bands may be merged into a featureless broad band. A major factor contributing to the breadth of the individual sub-bands in the band structure is the presence of hot-bands, especially a long series based on successive excited states of the low-frequency bending mode ν_β. A link is indicated with the interpretation of band-broadening for moderately strong hydrogen-bonded complexes in the liquid state. The anharmonic coupling of ν_s and ν_σ is again a central feature but there is a new factor, namely the coupling of ν_σ through a fluctuating potential with the surroundings, which has the result that the ν_s mode rapidly loses phase coherence resulting in a broad structureless band. (61 refs.)

100395 The conformation and vibrational spectra of isocyanato and isothiocyanatocyclohexane. C.E.Sjogren, P.Klaeboe (Dept. of Chem., Univ. of Oslo, Oslo, Norway).
J. Mol. Struct. (Netherlands), vol.100, p.433-52 (July 1983).
The IR spectra of isocyanato and isothiocyanatocyclohexane ($C_6H_{11}NCX$) as liquids and as amorphous and crystalline solids at low temperatures have been recorded in the region 4000-50 cm^{-1}. High pressure (0-30 kbar) IR spectra of the neat samples were obtained in a diamond anvil cell and various high-pressure solid phases were studied. Raman spectra of the compounds as liquids and as low-temperature solids were obtained. Isocyanatocyclohexane crystallized directly as anisotropic solids containing equatorial molecules at low temperature and axial molecules at high pressure. isothiocyanatocyclohexane formed a possibly plastic phase between 225 and 260K where both equatorial and axial conformers are present. A solid high-pressure phase (1-3 kbar) at ambient temperature appeared anisotropic and contained both the *e* and *a* conformers. Below 225K (atmospheric pressure) and above 10 kbar (ambient temperature) anisotropic crystals were formed which both contained equatorial conformers only. Normal coordinate analyses were carried out for the equatorial and axial conformers of the two molecules with different orientations (C_s and C_1 symmetries) of the side chain. Force constants were transferred from various halo and pseudohalocyclohexanes. Tentative assignments of the fundamentals belonging to both the *e* and *a*-conformers are presented. (28 refs.)

100396 Infrared study of molecular rotation in liquids. J.Vincent-Geisse (Lab. de Recherches Phys., Univ. Pierre et Marie Curie, Paris, France).
J. Mol. Struct. (Netherlands), vol.100, p.539-57 (July 1983).
The study of molecular rotation in liquids by infrared spectroscopy performed in the author's laboratory is reviewed. A number of examples are presented, showing the variety of phenomena encountered in the study of rotational motion of molecules in the liquid state. Many of these phenomena are well understood in simple cases and the nature of the rotation involved may be correctly identified. Problems which remain to be clarified are discussed. (60 refs.)

100397 Spectroscopy of two-photon transitions in C_2H_4 using the degenerate four-photon interaction method. V.N.Varakin, V.M.Gordienko (M.V. Lomonosov State Univ., Moscow, USSR).
JETP Lett. (USA), vol.37, no.4, p.224-6 (20 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.4, p.188-90 (20 Feb. 1983).
Two-photon resonances with the overtone modes νex_7 and ν_8 of C_2H_4 are investigated by the degenerate four-photon interaction (DFI) method in an amplitude-polarization variant. The spectrum of multiphoton absorption (MPA) onthe lines of the *P* branch of the (00°1-10°0) band of the CO_2 laser is interpreted. (4 refs.)

100398 Infrared spectroscopic studies of hydrogen bonding in triethylammonium salts. II. Association of triethylammonium salts with bases. A.A.Mashkovsky, A.A.Nabiullin, S.E.Odinokov (Pacific Inst. of Bio-organic Chem., Far East Sci. Centre, Acad. of Sci., Vladivostok, USSR).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.7, p.951-60 (July 1983).
For pt.I see ibid., vol.75, p.629 (1979). Parameters of the i.r. $\nu(N^+H)$ stretching mode bands of triethylammonium perchlorate, fluoroborate and iodide dissolved in pure (base B) and binary (B+chloroform) solvents have been measured. A dynamic equilibrium $Et_3N^+H...A^- + B \rightleftharpoons [Et_3N^+H...B]A^-$ is shown to exist in the solutions. Association constants K_a and enthalpies $-\Delta H$ of this process have been determined by measuring the total areas of the i.r. absorption $\nu(N^+H)$ bands in both hydrogen-bonded complexes. The dependence of K_a values on the strength of the base B and its dipole moment is discussed. Electrostatic interactions are shown not to contribute to the enthalpy of transition from the ionic pair $Et_3N^+H...A^-$ to the ion-molecular

complex $Et_3N^+H...B$, the latter forming a contact pair with the anion A^-. The results do not reveal any differences in the spectral manifestations of hydrogen bonding in intermolecular, ion-molecular complexes and ionic pairs. (12 refs.)

100399 Spectrophotometric investigation of fluorinated neodymium β-diketonates. V.S.Khomenko, T.A.Rasshinina, M.O.Lozinskii, Yu.A.Fialkov.
J. Appl. Spectrosc. (USA), vol.37, no.4, p.1169-73 (Oct. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.4, p.618-23 (Oct. 1982).
In the case of complex formation in the series of rare earth elements (REE), especially Nd^{3+}, Ho^{3+}, and Er^{3+}, under the influence of ligands, changes in the intensity, position and splitting of the absorption bands are observed in the spectra. An investigation of this phenomenon permits a study of the mutual influence of ligands in heteroligand complexes and an elucidation of the change in the nature of the bond of the ligand in o-diketonate complexes of the REE. The work is devoted to an investigation of the nephelauxetic effect, which is expressed in a shift of the bands in the absorption spectra of complexes of the REE on account of a decrease in the interelectronic repulsion in the 4f-electron shell as a result of its expansion during the formation of partially covalent metal-ligand bonds. The parameter of covalency of the bond was estimated chiefly according to the transition $^4I_{9/2}$-$^2P_{1/2}$ of the Nd^{3+} ion, which is not split in fields of any symmetry. It was of interest to bring in the data of mass spectrometric investigation to determine the mutual influence of ligands on the properties of the complexes. A measurement of the diffuse reflection spectra of polycrystalline neodymium compounds was performed. The mass spectra were recorded on a mass spectrography at an energy of ionizing electrons 70 eV. The spectra of the ions were recorded from 200 up to 1000 m/e. (11 refs.)

100400 Enthalpies of the association of pentachlorophenol and several carboxylic acids with bases. A.A.Mashkovskii, A.A.Nabiullin, S.E.Odinokov.
J. Appl. Spectrosc. (USA), vol.37, no.4, p.1174-8 (Oct. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.4, p.623-8 (Oct. 1982).
The enthalpies of the H-complexes of polychlorosubstances (PCIS) and of several strong H-complexes of carboxylic acids have been measured by making use of the total integral intensities of the ν(OH) bands for the measurement of the temperature dependence of the association constants (K_a). The values of $-\Delta H_T$ measured encompass a range from 2 to 14 kcal/mole and show that the spectral method is applicable to the determination of the energy of the H-bond ($-\Delta H_s$) in up to the strongest (up to the limits of protonation of the base) H-complexes. (13 refs.)

100401 *l*-resonance effects in the hot bands $3\nu_5 \leftarrow 2\nu_5$, $(\nu_4+2\nu_5) \leftarrow (\nu_4+\nu_5)$ and $(2\nu_4+\nu_5) \leftarrow 2\nu_4$ of acetylene. J.Hietanen (Dept. of Phys., Univ. of Oulu, Oulu, Finland).
Mol. Phys. (GB), vol.49, no.5, p.1029-38 (10 Aug. 1983).
In the infrared spectrum of C_2H_2 around the fundamental ν_5, the hot bands starting from the levels $2\nu_5$, $2\nu_4$ and $\nu_4+\nu_5$ have been investigated. From the analysis of about 20 different bands, 40 molecular constants describing the bending modes ν_4 and ν_5 have been derived. (6 refs.)

100402 Detection of the hydronium ion (H_3O^+) by high-resolution infrared spectroscopy. M.H.Begemann, C.S.Gudeman, J.Pfaff, R.J.Saykally (Dept. of Chem., Univ. of California, Berkeley, CA, USA).
Phys. Rev. Lett. (USA), vol.51, no.7, p.554-7 (15 Aug. 1983).
The first high-resolution measurement of the ν_3 vibration (doubly degenerate asymmetric stretch) of the hydronium ion (H_3O^+) is reported. An analysis of sixty transitions in the symmetric and antisymmetric inversion states yields effective band origins of 3530.165(55) and 3513.840(47) cm^{-1}, respectively. (9 refs.)

A suggested revised conformation of methylthionitrite as seen by its spectra and preliminary ab initio calculations ....See Entry 100250

The harmonic force field and absolute infrared intensities of butyne-2 ....See Entry 100352

Vibrational anharmonicity constants for PuF_6 ....See Entry 100353

Vibrational study of strong C-H...X hydrogen bonds in solid complexes of boron decachlorocarboranes ....See Entry 100405

Mossbauer and infrared studies of matrix-isolated iron-carbonyl complexes ....See Entry 100434

Cluster spectroscopy ....See Entry 100472

He-Ne laser frequencies near 2.4 μm and their application to hydrogen fluoride detection ....See Entry 100732

Enhancement by polar solute of interaction-induced IR absorption in liquid CS_2 ....See Entry 102861

Why are perturbations of HCl by N_2 and CO so different? II. Matrix isolation experiments ....See Entry 103513

Quantum interference in the IR-multiphoton excitation of small asymmetric-top molecules: ozone ....See Entry 103543

33.20F Raman and Rayleigh spectra

(inc. scattering)

100403 Raman spectroscopic studies on the dynamics of a molecular 'probe' (methyl iodide) in hydrocarbon solvents. W.F.Pacynko, J.Yarwood (Dept. of Chem., Univ. of Durham, Durham, England), D.J.Gardiner.
Chem. Phys. (Netherlands), vol.78, no.3, p.319-22 (1 Aug. 1983).
The authors report the rates of rotational and vibrational relaxation as a function of chain length in a series of model lubricants (*n*-alkanes from C_6 to C_{16}) and in an industrially important traction fluid (Santotrac-40). The 'probe' molecule (CH_3I) dynamics reflect the changes of microstructure of these fluids as the chain length increases. The methyl iodide molecules can rotate rather freely between the hydrocarbon chains (for relatively short chains) but tend to form more continuous regions of 'pure' liquid for the longest chains. The dynamic properties do not follow the macroscopic viscosity of the solvent but can be correlated instead with the effective 'free' volume available in the fluid. It is suggested that such measurements could lead to valuable information about the desired properties of these industrially important fluids. (6 refs.)

100404 On the second rotational isomeric form of butadiene-1,3. Yu.N.Panchenko, A.V.Abramenkov, V.I.Mochalov, A.A.Zenkin (Dept. of Chem., M.V. Lomonosov Moscow State Univ., Moscow, USSR), G.Keresztury, G.Jalsovszky.
J. Mol. Spectrosc. (USA), vol.99, no.2, p.288-93 (June 1983).
Eleven lines of the 'hot' band progression of the torsional overtone $2\nu_{13}$ have been measured in the Raman spectra of cis, cis-1,4-d_2-butadiene-1,3 and d_6-butadiene-1,3. The potential of Carreira (J. Chem. Phys. 62, 3851-3854 (1975)) ($V_1=600$, $V_2=2068$, $V_3=273$, and $V_4=-49$ cm^{-1}) and that of Bock et al. (J. Chem. Soc. Perkin II, 26-34 (1979)) ($V_1=347.3$, $V_2=1790.0$, $V_3=612.8$, and $V_4=179.8$ cm^{-1}) have been used to interpret the results obtained. For the accepted expansion of the Pitzer function $F(\phi)$, it is shown that the potential of Bock et al. reproduces the frequencies of the torsional overtones of these two molecules and h_6-butadiene-1,3 more closely. The importance of data on isotopic molecules in the calculation of potential curves from spectroscopic information is emphasized. (19 refs.)

100405 Vibrational study of strong C-H...X hydrogen bonds in solid complexes of boron decachlorocarboranes. L.A.Leites, L.E.Vinogradova (Inst. of Organo-Element Compounds, Acad. of Sci., Moscow, USSR), J.Belloc, A.Novak.
J. Mol. Struct. (Netherlands), vol.100, p.379-92 (July 1983).
Solid complexes of boron decachloro-*o*-carborane and boron decachloro-*m*-carborane ($B_{10}Cl_{10}C_2H_2$) with some oxygen and nitrogen bases have been investigated by infrared and Raman spectroscopy. Complexes containing C-H . . O hydrogen bonds are characterized by a relative CH stretching frequency shift up to 12% and a halfwidth of the νCH band up to 220 cm^{-1}. C-H . . N hydrogen bonds, with trimethylamine for example, are stronger with a relative shift of about 18% and $\nu_{1/2}$ of about 500 cm^{-1}. Triethylamine complexes, however, form a NH^+ . . C^- proton transfer hydrogen bond while pyridine can give either C-H . . N or C^- . . ^+HN hydrogen-bonded adducts depending on the solvent and temperature. the CH . . $N \leftrightarrows C^-$ . . ^+HN equilibrium appears to be shifted towards ion-pair formation at considerably smaller enthalpy values compared to the O-H . . $N \leftrightarrows O^-$ . . ^+HN system. CH and NH stretching frequencies are correlated with the acidity of the donor and the basicity of acceptor molecules. (23 refs.)

100406 Collision induced light scattering in gaseous H_2S. G.Briganti, V.Mazzacurati, G.Ruocco, G.Signorelli (Dipartimento di Fisica, Univ. La Sapienza, Roma, Italy), M.Nardone.
Mol. Phys. (GB), vol.49, no.5, p.1179-86 (10 Aug. 1983).
Rotational and interaction induced contributions in the light scattering spectrum of gaseous H_2S are identified and discussed as a function of density. The intensity of the latter is shown to obey a density squared dependence and to be in agreement with that predicted by the first order dipoled induced dipole (DID) model for point polarizable scatterers. (25 refs.)

100407 The nature of scattering centers in resonance stimulated Raman scattering by dyes and shape of the emitted spectra. V.I.Petrov, Ya.S.Bobovich.
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.139-43 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.264-72 (Feb. 1983).
An investigation was made of the resonance stimulated Raman scattering (RSTRS) spectra of the polymethine dye 3, 3′-diethylthiatricarbocyanine iodide when the pump frequency was scanned along the long-wavelength edge of the absorption band. A change in the relative intensities of the 505 and 510 cm^{-1} RSTRS lines was observed near the purely electronic transition. The character of this change suggests that this line may be assigned to scattering by unexcited dye molecules. The mechanism for enhancement of RSTRS and the shape of the bands in the spectra due to interference between two types of secondary radiation—RSTRS and stimulated luminescence—are discussed. Experimental data illustrating the different cases of formation of the RSTRS line profile are discussed. An analysis is made of the criteria that can be used to determine the electronic state in which RSTRS takes place. (16 refs.)

A suggested revised conformation of methylthionitrite as seen by its spectra and preliminary ab initio calculations ....See Entry 100250

Vibrational spectra and chemical structure of hetero-metal complexes and clusters with thiometalate ligands ....See Entry 100356

Infrared and Raman spectra and normal coordinate calculations for methylisothiocyanate ....See Entry 100389

Resonance Raman detected triplet state magnetic resonance .See Entry 100431

Optical Stark effects on pure-spin Raman transitions in molecular oxygen ....See Entry 100437

Light scattering from gaseous nitrous oxide: effects of correlation between molecular and intermolecular axes upon the depolarization ratio in terms of the anisotropic potential choice ....See Entry 100462

Beam-gas collision system for excitation cross-section measurements ....See Entry 100526

The dependence of SERS on the vibrational mode, exciting radiation and applied potential ....See Entry 102859

Why are perturbations of HCl by N_2 and CO so different? II. Matrix isolation experiments ....See Entry 103513

Photofragment spectroscopy and dynamics of the visible photodissociation of ozone ....See Entry 103550

Resonance Raman spectra of benzene adsorbed on Cu^{2+}-montmorillonite. Formation of poly(*p*-phenylene) cations in the interlayer of the clay mineral ....See Entry 103581

Surface enhanced Raman spectra of benzotriazole adsorbed on a copper electrode ....See Entry 103583

33.20K Visible spectra

100408 The $B^2\Sigma^+$-$X^2\Sigma^+$ system of SrF: precise spectroscopic constants from a combined fit of microwave and sub-Doppler optical spectra. W.E.Ernst, J.O.Schroder (Inst. fur Molekulphys., Freie Univ. Berlin, Berlin, Germany).
Chem. Phys. (Netherlands), vol.78, no.3, p.363-8 (1 Aug. 1983).
Doppler-free polarization spectroscopy has been used to measure 295 lines in the (0,0), (1,1) and (2,2) bands of the $B^2\Sigma^+$-$X^2\Sigma^+$ system of SrF. These optical data were combined with the results of separate microwave measurements of the $X^2\Sigma^+$ state in a weighted least-squares fit. The accuracy of spectroscopic constants of the $B^2\Sigma^+$ state is remarkably improved by the reduction of the upper-state-lower-state correlations. A more reliable determination of the vibrational dependence of rotational and spin-rotation parameters became possible. (13 refs.)

100409 Anion radicals of bacteriochlorophylls c, d, and e. Likely electron acceptors in the primary photochemistry of green and brown photosynthetic bacteria. J.Fajer, I.Fujita, A.Forman, L.K.Hanson (Dept. of Energy & Environment, Brookhaven Nat. Lab., Upton, NY, USA), G.W.Craig, D.A.Goff, L.A.Kehres, K.M.Smith.
J. Am. Chem. Soc. (USA), vol.105, no.12, p.3837-43 (15 June 1983).
Representative redox, optical, ESR and ENDOR data and molecular orbital calculations are reported for the anion radicals of the homologous bacteriochlorophylls and bacteriopheophorbides c, d, and e. The chromophores (Chlorobium chlorophylls) have previously been identified or are suspected to exist in the reaction centers of green (c and d) and brown (e) photosynthetic bacteria which appear to straddle green plants and purple bacteria on an evolutionary

scale. An early role in the light-driven electron-transport chain of these bacteria is proposed for the Chlorobium chlorophylls. Diagnostic optical and electron paramagnetic spectral signatures are presented for the anion radicals which distinguish them from subsequent acceptors and would identify them in vivo. (46 refs.)

Scanning pulsed-polarization spectrometer applied to Na_2 .... See Entry 99204

Electronic spectra of n-aminoazo dyes adsorbed on surfaces of alumosilicate catalysts and their quantum chemical interpretation .... See Entry 100411

Magnetic circular dichroism and anomalous fluorescence spectra of azulenothiophenes .... See Entry 100436

Study of spectra of carbon-containing compounds behind a shock wave front. Determination of the oscillator strength of the $A^1\Pi$-$X^1\Sigma$ transition of the C_3 molecule .... See Entry 100460

Ultrafast physical effects in cyanine dyes subjected to tunable picosecond excitation .... See Entry 100464

A discussion of the problem of determining multiple lifetimes from picosecond absorption recovery data as encountered in two carbocyanine dyes .... See Entry 100829

A pulse radiolysis study of the formation of the XeBr exciplex in electron beam irradiated xenon-bromine mixtures .... See Entry 103544

33.20L Ultraviolet spectra

100410 A new spectrum of the PO_2 radical. R.D.Verma, C.F.McCarthy (Dept. of Phys., Univ. of New Brunswick, Fredericton, NB, Canada).
Can. J. Phys. (Canada), vol.61, no.8, p.1149-59 (Aug. 1983).
A new spectrum in the region 3115-2680 Å has been obtained in absorption by a flash discharge technique, and is attributed to the PO_2 radical. Vibronic and *K* structure analyses are performed which show conclusively that the new spectrum is analogous to the 2490 Å system of NO_2, and thus represents the $2^2B_2 \leftarrow \tilde{X}^2A_1$ transition of the PO_2 radical. The vibronic assignments are confirmed by an isotopic study of the spectrum using oxygen-18. The various frequencies obtained are: $\omega_1^{0,}=936\pm1$ cm^{-1}, $\omega_2^{0,}=396\pm1$ cm^{-1}, and $v_2''=505\pm4$ cm^{-1}. A predissociation is observed from which an upper limit to the energy of dissociation into $P+O_2$ is set at 35500 ± 100 cm^{-1}. (11 refs.)

100411 Electronic spectra of n-aminoazo dyes adsorbed on surfaces of alumosilicate catalysts and their quantum chemical interpretation. V.V.Goncharuk, A.G.Grebenyuk, L.I.Savranskii.
J. Appl. Spectrosc. (USA), vol.37, no.4, p.1160-5 (Oct. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.4, p.607-13 (Oct. 1982).
The elucidation of the rules for selection of active acid-base catalysts requires knowledge of the nature of the acid centers at which one reaction or another takes place. The most widely applied technique for the study of the nature of the acid centers is electronic spectroscopy of dye molecules adsorbed on the catalyst surface, which undergo significant changes in their optical properties due to the interaction with the acid centers on the surface. Application of electronic spectroscopy is limited by the difficulties in the interpretation of the absorption bands. On the basis of the experimental data alone it is not possible to give a strict and unique interpretation of the observed spectra, since one and the same type of center on the catalyst surface may be manifested by spectral phenomena which differ greatly from one another when the centers interact with different functional groups of the dye. Therefore, the role of quantum chemistry is increased, which, by operating on the experimental data, may provide a universal method for the description of the elementary steps of adsorption and catalysis. The authors have performed an experimental spectrophotometric study of the interaction of p-aminoazobenzene, o-tuluolazotoluidine, and phenylazonaphthylamine with the surface of catalysts consisting of opaque kaolinite in the forms monocation-substituted with Mg, Ca, Sr, and Ba, and they have carried out quantum chemical calculations for various models of the interaction of the dyes with the acid centers, in particular with protons of various types. (30 refs.)

Matrix-isolation infrared and ultraviolet spectroscopic studies of less stable conformers of 1,3,5-hexatriene .... See Entry 100393

Circular dichroism studies on azole nucleosides. The solution conformation of 5-amino-1-β-D-ribofuranosylimidazole-4-carboxamide, bredinin, pyrazofurin, ribavirin, and related nucleosides .... See Entry 100435

Photoinduced electron transfer between aromatic hydrocarbons and arene diazonium salts in micellar solutions .... See Entry 100442

A pulse radiolysis study of the formation of the XeBr exciplex in electron beam irradiated xenon-bromine mixtures .... See Entry 103544

33.20N Vacuum ultraviolet spectra

100412 Investigation of $\pi\pi^*$ absorption bands of pyridine, pyrazine, and pyrimidine dissolved in liquefied gases. 270-185-nm region. G.Ya.Zelikina, T.B.Mamchenko, T.G.Meister.
Opt. & Spectrosc. (USA), vol.54, no.1, p.48-50 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.85-9 (Jan. 1983).
The $\pi\pi^*$ absorption bands of solutions of pyridine, pyrazine (1,4-diazine), and pyrimidine (1, 3-dyazine) in liquefied krypton, xenon, and Freon-14 (CF_4) have been recorded for the first time at different temperatures. Because of the similarity of the π electronic systems of the molecules investigated and benzene in the ground electronic state, the resulting spectra are compared with the spoectra of benzene. It was concluded, on the basis of this comparison, that the π electron systems of pyridine molecules in $\pi\pi^*$ excited states $^1B_{2u}$ and $^1B_{1u}$ as well as of pyrazine and pyrimidine in the $^1B_{1u}$ state are similar to that of benzene. On excitation of the diazines to the $^1B_{2u}$ state their π electronic systems differ markedly from that of benzene (in the corresponding electronic states). (15 refs.)

Production of $O(^1D)$ and $O(^3P)$ by vacuum ultraviolet photodissociation of molecular oxygen .... See Entry 100473

33.20R X-ray spectra

100413 Molybdenum K-edge extended X-ray absorption fine structure (EXAFS) studies of synthetic Mo-Fe-S clusters containing the MoS_4 unit: development of a fine adjustment technique based on models. Boon-Keng Teo (Bell Labs., Murray Hill, NJ, USA), M.R.Antonio, B.A.Averill.
J. Am. Chem. Soc. (USA), vol.105, no.12, p.3751-62 (15 June 1983).
The Mo K-edge extended X-ray absorption fine structure (EXAFS) spectra of the binuclear dianionic complexes $[S_2MoS_2FeL_2]^{2-}$ (1, L=SPh; 2, L=Cl; 3, L=OPh; Et_4N^+ salts), the trinuclear complexes $[S_2MoS_2FeS_2Fe(S\text{-}p\text{-}CH_3C_6H_4)_2]^{3-}$ (4, Et_4N^+ salt), $[S_2MoS_2FeS_2MoS_2]^{3-}$ (5, Et_4N^+ salt) and $[Cl_2FeS_2MoS_2FeCl_2]^{2-}$ (6, Ph_4P^+ salt), as well as the NH_4^+ salt of $[MoS_4]^{2-}$ (7), have been measured in the transmission mode. Data analysis using theoretical amplitude and phase functions provided better than 1 and 2% accuracy for the Mo-S and Mo-Fe distances, respectively. To improve the accuracy as well as to provide a reliable measure of the number of neighbors, a technique for fine adjustment based on models (FABM) was developed. The FABM technique relies upon a detailed exploration of the multidimensional parameter correlation space in the curve fitting, from which a simple method has been devised to alleviate parameter correlation problems. Terminal and bridging Mo-S distances for 1-5 can also be determined quite accurately from the average M0-S distance and the distance spread estimated from the Debye-Waller factor as determined by EXAFS. The EXAFS technique also allows accurate determination of metal-ligand distances in $[S_2MoS_2FeCl_2]^{2-}$, for which a twofold static disorder results only in average distances being obtainable from single-crystal X-ray crystallography. (46 refs.)

100414 X-ray spectroscopic studies of copper compounds and complexes in aqueous solution and polycrystalline form. P.N.Koul (Dept. of Phys., Regional Engng. Coll., Kashmir, India), B.D.Padalia.
X-ray Spectrom. (GB), vol.12, no.3, p.128-31 (July 1983).
K-absorption edge-shifts of copper in $CuCl_2$-$2H_2O$ $CuSO_4$-$5H_2O$, $Cu(NO_3)_2$-$3H_2O$, $Cu(en)_3Cl_2$, $Cu(en)_3SO_4$ and $Cu(en)_3(NO_3)_2$ in aqueous solutions as well as in polycrystalline form were measured using the X-ray absorption spectroscopic techniqiue. Effective charge on copper ions are estimated using the method of Gianturco and Coulson. The study reveals interesting results regarding the nature of chemical bonding. An attempt is made to interpret the results in the light of the available data on these samples. (21 refs.)

On a site-selective EXAFS experiment using optical emission .... See Entry 102992

33.25 NUCLEAR MAGNETIC RESONANCE AND RELAXATION; NUCLEAR QUADRUPOLE RESONANCE (NQR)

100415 Molecular solutes in nematic liquid crystals: orientational order and electric field gradients. G.N.Patey, E.E.Burnell (Dept. of Chem., Univ. of British Columbia, Vancouver, BC, Canada), J.G.Snijders, C.A.de Lange.
Chem. Phys. Lett. (Netherlands), vol.99, no.3, p.271-4 (5 Aug. 1983).
The difference between liquid-crystal and gas-phase values for the nuclear quadrupole coupling constant in D_2 and HD is used to obtain the mean electric field gradient in various liquid crystals. Order parameters for small molecules dissolved in liquid crystals are calculated assuming that the orientational order arises from the interaction of the molecular quadrupole moment with the average field gradient. The results obtained are in good agreement with experimental values for hydrogen and several other solutes. (26 refs.)

100416 Empirical force field calculations. XXII. Preferred conformations and barriers, to rotation in (2,2-dimethylpropyl)benzene and (1-tert-butyl-2,2-dimenthylpropyl)benzene. J.M.A.Baas, J.B.Vergouwe, M.A.Hoefnagel, B.van de Graaf (Lab. of Organic Chem., Delft Univ. of Technol., Delft, Netherlands).
Delft Prog. Rep. (Netherlands), vol.8, no.2, p.139-46 (June 1983).
The conformational preference of (2,2-dimethylpropyl)benzene (1) and (1-tert-butyl-2,2-dimethylpropyl)benzene (2) has been studied by ^{13}C NMR spectroscopy and by molecular mechanics. It appears that the aliphatic side chain of 2 is located asymmetrically with respect to the ortho and meta positions of the aromatic ring and exchanges slowly between equivalent positions ($\Delta G_{445}^{\neq}=99$ kJ mol^{-1}). The $\Delta H^{\neq}$-values of the barriers to rotation around the aryl-alkyl bonds in 1 and 2 are estimated with molecular mechanics calculations using two empirical force fields: 1: 24.8 and 20.3 kJ mol^{-1}; 2: 96.5 and 98.9 kJ mol^{-1}. (20 refs.)

100417 Solid-state NMR studies of the reactions of silica surfaces with polyfunctional chloromethylsilanes and ethoxymethylsilanes. D.W.Sindorf, G.E.Maciel (Dept. of Chem., Colorado State Univ., Fort Collins, CO, USA).
J. Am. Chem. Soc. (USA), vol.105, no.12, p.3767-76 (15 June 1983).
The silylation of silica surfaces by dimethyldichlorosilane, methyltrichlorosilane, dimethyldiethoxysilane, and methyltriethoxysilane has been studied by solid-state ^{29}Si and ^{13}C NMR, by use of cross polarization (CP) and magic-angle spinning (MAS). An earlier formalism for the quantitative analysis of the NMR data has been extended for use with polyfunctional silylating agents and applied in detail to dimethyldichlorosilane reactions. Silylation with ethoxysilane reagents is less amenable to quantitative interpretation but appears to parallel closely the behavior of analogous chlorosilane reagents. With ethoxysilane reagents ^{13}C NMR is quite useful, especially for determining the fate of ethoxy groups. In all of the cases studied, the products are characterized primarily by single silane-to-surface attachments of each silane silicon atom. The presence of adsorbed water is found to play an important role in the course and rate of the silylation reactions, especially those employing ethoxysilane reagents. The NMR data are used to address the question of 'horizontal' and 'vertical' polymerization within the 'silane phase' on the silica surface. (18 refs.)

100418 EPR evidence on molecular and electronic structure of nitrogen trifluoride radical cation. A.M.Maurice, R.L.Belford (School of Chem. Sci., Univ. of Illinois, Urbana, IL, USA), I.B.Goldberg, K.O.Christe.
J. Am. Chem. Soc. (USA), vol.105, no.12, p.3799-802 (15 June 1983).
Computer simulations of the EPR spectra of rigid $^{14}NF_3^+$. and $^{15}NF_3^+$. trapped in powdered NF_4AsF_6 at 25K show characteristics of a trigonal pyramid with the following principal values for the coupling matrices: $|g(\|,\perp)|=2.003$; $|A(^{14}N)(\|,\perp)|=324$, 187 MHz; $A(^{15}N)(\|,\perp)|=451$, 260 MHz; $A(^{19}F)(z,x,y)=880$, 340, 360 MHz; α, the angle between parallel axes for A_F and A_N, $=15°$. The nitrogen p:s spin-density ratio (computed from the nitrogen hyperfine splittings) is consistent with $sp^{2.5}$ nitrogen hybrids in the NF bonds and with a pyramid angle of about 105°. Although the same pyramid angle appears to agree with the orientation of the principal axis of the fluorine hyperfine coupling matrix ($|\alpha|=15°$, pyramid angle$=90°+|\alpha|$), electronic structure computations imply that α is negative and that the agreement is fortuitous. Some comparisons are made with isoelectronic radicals BF_3^- and CF_3—the latter being essentially tetrahedral with sp^3 hybridization. (19 refs.)

100419 ^{13}C NMR of arylgermanes and arylgermyl anions. Main-group elements as anionic π-donor substituents. II. R.J.Batchelor, T.Birchall (Dept. of Chem., McMaster Univ., Hamilton, Ontario, Canada).
J. Am. Chem. Soc. (USA), vol.105, no.12, p.3848-52 (15 June 1983).
^{13}C NMR spectra of the compounds $(C_6H_5)_nGeH_{4-n}$ and $(C_6H_5)_nGeH_{3-n}Na$ (*n*-1, 2, 3) as well as $(p\text{-}CH_3C_6H_4)_3GeM$ (M=H, Na) have been recorded and assigned. Comparison of the chemical shifts with those of analogous group 5B compounds demonstrates that the extent of delocalization of the negative charge of the germyl anions into the aromatic rings is significantly less than that found in the anions of phenyl-substituted phosphines and arsines. The distribution of π electrons in monosubstituted benzenes whose

substituents are anionic centers appears to be the result of the balance between mesomeric effects and a polarization dependent upon the degree to which the negative charge is localized on the substituent atom. The magnitudes of these effects depend somewhat on the extent and nature of solute-solvent interaction, ion pairing, and association in the solutions of these salts which in turn are a function of the polarity of the solvent. (22 refs.)

100420 Carbon-13 magnetic resonance of hydroaromatics. II. Conformation of tetralin and tetrahydroanthracene and their methyl derivatives. F.G.Morin, W.J.Horton, D.M.Grant, D.K.Dalling, R.J.Pugmire (Dept. of Chem. & Fuels Engng., Univ. of Utah, Salt Lake City, UT, USA).
J. Am. Chem. Soc. (USA), vol.105, no.12, p.3992-8 (15 June 1983).
For pt.I see ibid., vol.103, p.4817 (1981). Carbon-13 chemical shift data have been acquired for 36 methylated tetralines and tetrahydroanthracenes. A least-squares regression analysis has been undertaken on the ring carbons of compounds of unequivocal conformation to determine methyl substituent paramters for the two distinct aliphatic positions and the results have been used to estimate the position of equilibrium of conformationally mobile compounds. 1-methyltetralin exists in essentially equally populated conformers, at room temperature but that the 2-methyl derivative is dominated by the conformation with an equatorial methyl group. Substituent parameters are compared with those previously determined for methylated cyclohexanes. A similar analysis of the methyl chemical shifts was unsuccessful owing, in part, to the highly flexible nature of the saturated ring. (38 refs.)

100421 Multiple conformational states of a Pro-Pro peptide. Solid-state and solution conformations of Boc-Aib-Pro-Pro-NHMe. H.Balaram, B.V.V.Prasad, P.Balaram (Molecular Biophys. Unit, Indian Inst. of Sci., Bangalore, India).
J. Am. Chem. Soc. (USA), vol.105, no.12, p.4065-71 (15 June 1983).
The solid-state and solution conformations of the model peptide Boc-Aib-Pro-Pro-NHMe have been studied by X-ray diffraction and NMR. The peptide adopts a poly(proline II) conformation in the solid state. Two molecules are observed in the asymmetric unit differing in the geometry (cis/trans) of the urethane group. The molecules are held together in the crystal by a complex network of hydrogen bonds involving three molecules of water, which cocrystallize. Dissolution of single crystals at low temperature (~233K) permits NMR observation of the solid-state conformer. In solution, the peptide undergoes a trans-cis isomerization of the Pro-Pro bond. Low-temperature NMR measurements allow the detection of three conformational states of the Pro-Pro segment. Both cis′ and trans′ rotational isomers about the C^{α}-CO (ψ) bond of Pro-3 are detectable at low temperatures. Theoretical calculations suggest an appreciable activation barrier to ψ rotation. Temperature and solvent dependence of NH chemical shifts provide evidence for an intramolecular hydrogen bond, involving the NHMe group in the cis Pro-Pro conformer. Energy calculations suggest the possibility of a type VI β-turn conformation stabilized by a 4→1 hydrogen bond between the Aib-1 CO and NHMe groups. (37 refs.)

100422 Calculation of the diamagnetic spin-orbit contribution to the nuclear spin-spin coupling tensors in the water molecule. V.Galasso (Istituto di Chimica, Univ. di Trieste, Trieste, Italy), P.Lazzeretti, E.Rossi, R.Zanasi.
J. Chem. Phys. (USA), vol.79, no.3, p.1554-6 (1 Aug. 1983).
The note is aimed at investigating some previously unexplored aspects of the basis dependence of the theoretical estimates. This is performed by retaining a Gaussian set of expansion for the case of ^{1}J(O,H) and ^{2}J(H,H) in the water molecule, with particular attention to size, flexibility, contraction, and role of polarization functions. (22 refs.)

100423 Tensorial analysis of the hyperfine interaction operator by extensive use of Racah algebra and of translational invariance. L.Brehamet (IRF DB/SBPh, CENS, Gif-sur-Yvette, France).
J. Math. Phys. (USA), vol.24, no.8, p.1968-72 (Aug. 1983).
Strict application of Racah algebra gives an efficient way of deriving the tensorial form of the hyperfine interaction one-electron operator involved in NMR spin coupling effects. In particular, this procedure avoids the use of classic explicit arguments of integration around the origin to find the Fermi-contact term. The linear momentum is retained in its explicit translationally invariant form as long as possible during the calculations. This allows the tensorial expansion of the operator to be obtained rapidly at any origin of coordinates. The reduced matrix elements of interest are given by new general closed expressions in the *j-j* coupling scheme. (27 refs.)

100424 Evaluation of ^{1}H nuclear magnetic resonance spin-lattice relaxation times facilitated by analogous ^{13}C studies, illustrated by studies of 1,3,5-trimethylbenzene. J.Homer, E.R.V.Cedeno (Chem. Dept., Univ. of Aston, Birmingham, England).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.7, p.1021-9 (July 1983).
It is shown that in certain situations ^{13}C n.m.r. spin-lattice relaxation time and n.O.e. studies may be used to separate ^{1}H relaxation times into intra- and inter-molecular components. The approach, which applies only when the carbon and hydrogen atoms are considered subject to the same overall molecular motion, does not depend on the theoretical evaluation of any parameters intrinsically involved in the characterization of the relaxation times. However, it is shown that simple geometrical calculations can facilitate the evaluation of equivalent rotational correlation times from both ^{13}C and ^{1}H intramolecular relaxation rates and that the constituents of the latter can be readily isolated. The overall approach is illustrated by studies of the aryl carbon and hydrogen nuclei of 1,3,5-trimethylbenzene dissolved in carbon tetrachloride and in mixtures of cyclohexane and tetramethyl silane. (17 refs.)

100425 The determination of absolute configuration using nuclear magnetic resonance techniques. R.L.Rinaldi (Dept. of Chem., Case Western Reserve Univ., Cleveland, OH, USA).
Prog. Nucl. Magn. Resonance Spectrosc. (GB), vol.15, pt.4, p.291-352 (1982).
This review of NMR techniques for determining absolute configurations of chiral organic compounds covers the literature extensively through to the end of 1981. It is not intended to be an exhaustive compilation of NMR studies, and for this apologies are made to the many authors whose worthwhile achievements are not included. After a brief description of the primary technique used for absolute configurational assignments, measurement of optical activity, short summaries of the major NMR reagents utilized for configurational assignments are given. These NMR reagents include diamagnetic chiral solvating agents (CSA), chiral lanthanide shift reagents (CLSR), chiral derivatizing agents (CDA), and the use of both archiral and chiral paramagnetic shift reagents to enhance the observed chemical shift differences of diastereomeric derivatives. The main section of this review is the organized according to the major functional group categories which have been studied. To limit the size of this review to an acceptable length, studies involving the determinations of relative configurations of diastereomeric compounds are not included; only diastereomeric derivatives which have been prepared specifically for the purpose of assigning absolute configurations of enantiomeric compounds are considered. (130 refs.)

100426 Study of the structure of branched oligoesters by NMR spectroscopy method. P.P.Sukhanov, V.S.Minkin, V.I.Kimel'blat, V.V.Zykova, V.P.Dorozhkin.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.7, p.1370-6 (July 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The structure of branched oligoesters synthesized by polycondensation using a trifunctional branching agent—1,1,1-trimethylpropane—is analysed basing on the high resolution NMR data. Features of chemical structure related to various densities of branching points and compositions of reaction mixture are shown. (11 refs.)

100427 ^{19}F NMR study of direction of opening of epoxide ring in non-catalytic interaction of α-oxides with phenols and alcohols. B.A.Komarov, V.P.Volkov, G.N.Boiko, E.S.Naidovskii, B.A.Rozenberg.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.7, p.1431-5 (July 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
Trifluoroacetates of products of non-catalytic interaction of phenylglycidyl ester with phenol and alcohols have been studied by ^{19}F NMR. Reactions were performed in the absence of solvent at 140 and 180°. Independently of conditions and degree of conversion besides the normal opening of epoxide cycle the abnormal one was shown to proceed with the ratio of these processes being 4:3. (15 refs.)

T_1, nuclear Overhauser effects measurements in ^{13}C NMR spectroscopy: analytic relations for short equilibration delays See Entry 99140

Separate measurements of heteronuclear *J* coupling constants by manipulated polarization transfer in two-dimensional NMR See Entry 99141

Microwave spectra of ortho-cloroaniline See Entry 100366

Intramolecular unsymmetrical OHO bonds. Thermochemistry [NMR in acetylacetones] See Entry 100497

Hydrogen bonding and conformational effects on ^{13}C NMR chemical shifts of hydroxybenzaldehydes in the solid state See Entry 102767

Prototropic charge migration in water. I. Rate constants in light and heavy water and in salt solution from oxygen-17 spin relaxation See Entry 103514

Prototropic charge migration in water. II. Interpretation of nuclear magnetic resonance and conductivity data in terms of model mechanisms See Entry 103515

33.30 ELECTRON PARAMAGNETIC RESONANCE AND RELAXATION

100428 Flash photolysis electron spin resonance and CIDEP studies of radicals derived from nitrogen heterocyclics. I. The diazanaphthalenes. S.Basu, K.A.McLauchlan, A.J.D.Ritchie (Phys. Chem. Lab., Univ. of Oxford, Oxford, England).
Chem. Phys. (Netherlands), vol.79, no.1, p.95-103 (15 Aug. 1983).
Radicals formed by hydrogen abstraction from suitable quenchers by the excited states of four isomeric diazanaphthalene molecules have been identified and their chemically-induced electron spin polarization (CIDEP) behaviour studied. Quinoxaline and quinazoline react via their spin-polarized triplet states, phthalazine via its unpolarized triplet state and cinnoline through both its singlet and polarized triplet states. The phase of the latter polarization was not as expected. A feature has been the deliberate generation of a phenoxy radical with a clearly-resolved hyperfine structure for use as a probe of complex CIDEP behaviour. Its analysis has been significant in elucidating the reactions of both excited states and radicals. (19 refs.)

Anion radicals of bacteriochlorophylls c, d, and e. Likely electron acceptors in the primary photochemistry of green and brown photosynthetic bacteria See Entry 100409

A comparison of the carbon-13 hyperfine constants of carboxylated cyclohexadienyl and hydroxycyclohexadienyl radicals See Entry 103554

33.35 DOUBLE RESONANCES AND OTHER MULTIPLE RESONANCES

100429 Rotational inelastic transitions in OCS using a tunable diode laser and a frequency doubled CO_2 laser. A.Picard-Bersellini, B.J.Whitaker, Ph.Brechignac (Lab. de Photophysique Moleculaire, CNRS, Orsay, France).
J. Chem. Phys. (USA), vol.79, no.3, p.1556-7 (1 Aug. 1983).
The self-perturbation of the OCS molecule in the gas phase has been extensively studied by line broadening measurements in the MW and IR regions for a large number of rotational levels. MW-MW double resonance has also been widely used and more recently IR-MW double resonance. Other types of experiment which analyze transient optical coherences have provided information on the dephasing relaxation time of MW transitions T_2. The authors report the first observation of transient IR-IR double resonance in this molecule. (20 refs.)

100430 Pulsed ENDOR spectroscopy of the interior protons of free-base porphin in its lowest photoexcited triplet state, in an *n*-octane single crystal. W.A.J.A.van der Poel, D.J.Singel, J.Schmidt, J.H.van der Waals (Huygens Lab., Univ. of Leiden, Leiden, Netherlands).
Mol. Phys. (GB), vol.49, no.5, p.1017-28 (10 Aug. 1983).
Through the use of the pulsed ENDOR technique, the authors have obtained the magnetic resonance spectra of the interior protons of free-base porphin in its lowest photoexcited triplet state in a single crystal of *n*-octane. The values of the components, in the fine structure principal axis system, of the proton-electron hyperfine interaction have been ascertained, and clearly illustrate a departure from D_{2h} molecular symmetry. The measured tensors have been used to obtain the spin densities at the porphin nitrogen atoms, and the locations of the protons within the ring. (35 refs.)

Anion radicals of bacteriochlorophylls c, d, and e. Likely electron acceptors in the primary photochemistry of green and brown photosynthetic bacteria See Entry 100409

33.35H MODR and PMDR (microwave optical double resonance and phosphorescence microwave double resonance)

100431 Resonance Raman detected triplet state magnetic resonance. R.H.Clarke, D.J.Graham, E.B.Hanlon, P.Mitra (Dept. of Chem., Boston Univ., Boston, MA, USA).
J. Chem. Phys. (USA), vol.79, no.3, p.1549-50 (1 Aug. 1983).
The authors have recorded the zero-field magnetic resonance transitions of the photoexcited triplet state of chlorophyll *b* (chl *b*) by monitoring the microwave induced changes of the resonance Raman spectral band intensities. This

experiment offers an extension of optically detected magnetic resonance (ODMR) techniques whose applicability to investigations of the triplet states of organic molecules has been widely recognized. Resonance Raman detected ODMR is expected to offer an advantage over the traditional phosphorescent and nonphosphorescent ODMR techniques in cases involving large, complex molecular systems, where the utilization of Raman scattering bands may provide high resolution, optical filtering capabilities superior to alternative methods detecting on broadband emissive or absorptive features. (2 refs.)

100432 Laser spectroscopy and microwave-optical double resonance ICL $A^3\Pi(1)$ $\nu=19$ of a supersonic expansion. S.G.Hansen, J.D.Thompson, C.M.Western, B.J.Howard (Phys. Chem. Lab., Univ. of Oxford, Oxford, England).
Mol. Phys. (GB), vol.49, no.5, p.1217-29 (10 Aug. 1983).
The 19-0 band of the $I^{35}Cl$ $A^3\Pi(1)$-$X^1\Sigma^+$ system is examined at sub-Doppler resolution using a single mode dye laser and a supersonic jet. Complex hyperfine structure is resolved and assigned with the aid of microwave-optical double resonance spectroscopy. Twenty-two microwave transitions were observed within the excited vibronic state and the subsequent analysis results in values for the rotational constant, Ω-doubling constant, two electric quadrupole constants and a magnetic hyperfine constant. (23 refs.)

Precise determination of the $^{171}Yb^+$ ground state hyperfine separation ....See Entry 100588

33.40 MÖSSBAUER SPECTRA

100433 Hartree-Fock-Slater LCAO calculation of the Mossbauer parameters of some antimony compounds. W.Ravenek, J.W.M.Jacobs, A.van der Avoird (Inst. of Theoretical Chem., Univ. of Nijmegen, Nijmegen, Netherlands).
Chem. Phys. (Netherlands), vol.78, no.3, p.391-404 (1 Aug. 1983).
Describes a (non-empirical) Hartree-Fock-Slater ($X\alpha$) LCAO study of the Mossbauer parameters in a series of thirteen Sb compounds: SbX_3(X=F, Cl, Br, I), $Sb(CH_3)_NCl_{3-N}$(N=1, 2, 3), SbX_5 (X=F, Cl) and $Sb(CH_3)_3X_2$(X=F, Cl, Br, I), in relation with the chemical bonding in these compounds. The calculated isomer shifts agree very well with the experimental data: correlation coefficient 0.99, $\Delta R/R=-1.08\times10^{-3}$. The quadrupole splitting for the Sb(III) compounds is consistently (correlation coefficient 0.97) too small by a factor of 2.7, for the Sb(V) compounds the results are more scattered and even smaller. The proportionality factor could be partly due to the uncertainty in the ^{121}Sb nuclear quadrupole moment and partly to the neglect of core polarization effects in the (frozen core) HFS LCAO calculations. Test calculations on HCl, which are also reported, show that the HFS LCAO method can yield accurate core polarization corrections to the quadrupole splitting (Sternheimer factors), but only at the cost of an expensive numerical integration scheme. The results suggest further that the structures of some of the Sb compounds might be different from what has previously been proposed. (68 refs.)

100434 Mossbauer and infrared studies of matrix-isolated iron-carbonyl complexes. C.H.F.Peden, S.F.Parker (Dept. of Chem., Univ. of California, Santa Barbara, CA, USA), P.H.Barrett, R.G.Pearson.
J. Phys. Chem. (USA), vol.87, no.13, p.2329-36 (23 June 1983).
The matrix-isolated binary carbonyls, $Fe(CO)_x$, $x\leq5$, and $Fe_2(CO)_y$, $y=8,9$, formed upon cocondensation of iron atoms with noble gas/CO gas mixtures have been investigated by infrared and Mossbauer spectroscopies. Assignments for the Mossbauer absorptions of these species are made. New information on the C-O stretching frequencies of $Fe(CO)_2$ has been obtained. The very low infrared stretching frequency (1898 cm^{-1}) and the negative Mossbauer isomer shift (−0.60 mm/s) of Fe(CO) are evidence for a large $d\pi\rightarrow\pi^*$ interaction for this fragment. (50 refs.)

33.45 MAGNETO-OPTICAL AND ELECTRO-OPTICAL SPECTRA; DICHROISM

100435 Circular dichroism studies on azole nucleosides. The solution conformation of 5-amino-1-β-D-ribofuranosylimidazole-4-carboxamide, bredinin, pyrazofurin, ribavirin, and related nucleosides. D.W.Miles (Dept. of Chem., Univ. of Utah, Salt Lake City, UT, USA), G.R.Revankar, R.K.Robins.
J. Phys. Chem. (USA), vol.87, no.13, p.2444-50 (23 June 1983).
The circular dichroism (CD) and UV absorption spectra of certain five-membered heterocycles are reported. The study includes 5-amino-1-β-D-ribofuranosylimidazole-4-carboxamide (AICAR) and important nucleoside chemotherapeutic agents such as bredinin, pyrazofurin, and ribavirin. Certain other closely related imidazole and triazole nucleoside analogues are included. The glycosidic conformations are determined by the comparison of the CD data with theoretical predictions of rotational strength as a function of the glycosidic conformation. The optically active electronic transitions are characterized by the effects of substituent perturbation on their structure as reflected by transition monopole maps and the signed character of the rotational strength-torsion angle wheels. (31 refs.)

100436 Magnetic circular dichroism and anomalous fluorescence spectra of azulenothiophenes. H.Yamaguchi, H.Shimoishi, M.Ata (Dept. of Chem., Kumamoto Univ., Kumamoto, Japan), H.Baumann, C.Morini, K.Yamane.
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.7, p.1155-63 (July 1983).
The magnetic circular dichroism and electronic absorption spectra of azuleno[1,2-*b*]thiophene and azuleno[2,1-*b*]thiophene, which are iso-π-electron systems of benz[*a*]azulene, have been measured. The absorption bands of both azulenothiophenes are interpreted by using these observed spectra and the results of molecular-orbital calculations. The anomalous fluorescence spectra have been observed for both azulenothiophenes and benz[*a*]azulene. From the assignment of the absorption spectra, it has been concluded that these compounds emit the fluorescence from the second excited singlet state. (32 refs.)

33.45B Zeeman and Stark effects

100437 Optical Stark effects on pure-spin Raman transitions in molecular oxygen. A.Owyoung, R.A.Hill, P.Esherick (Sandia Nat. Labs., Albuquerque, NM, USA).
Opt. Lett. (USA), vol.8, no.8, p.425-7 (Aug. 1983).
Fully resolved pure-spin Raman transitions near 2 cm^- have been observed in $^3\Sigma_g$ gound-state molecular oxygen using stimulated Raman techniques. Anomalous differences between polarized and depolarized spectra are fully explained in terms of optical Stark effects. (13 refs.)

Vacuum-ultraviolet stimulated emission from two-photon-excited molecular hydrogen ....See Entry 100463

Resonant multiphoton interaction of noise radiation with a generalized two-level system ....See Entry 100486

Two-photon optical multistability ....See Entry 100833

33.50 FLUORESCENCE, PHOSPHORESCENCE; RADIATIONLESS TRANSITIONS (INTERSYSTEM CROSSING, INTERNAL CONVERSION)

100438 Solvent and pH dependence of fluorescence spectra of 9-phenanthrylamine. M.Swaminathan, S.K.Dogra (Dept. of Chem., Indian Inst. of Technol., Kanpur, India).
Can. J. Chem. (Canada), vol.61, no.6, p.1064-6 (June 1983).
Fluorimetric titrations were carried out for various forms of 9-phenanthrylamine and pK_a* values were determined. An unusual behaviour observed in the fluorimetric titration of the neutral form at moderate proton concentration is due to the quenching of the S_1 state of PNH_2 by H^+. (12 refs.)

100439 Coriolis interactions and intramolecular vibrational redistribution in jet-cooled pyrimidine. K.T.Chen, B.E.Forch, E.C.Lim (Dept. of Chem., Wayne State Univ., Detroit, MI, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.98-100 (29 July 1983).
Evidence is presented which indicates that the second-order Coriolis interactions play an important role in intramolecular vibrational redistribution. (6 refs.)

100440 Kinetics of excited-state proton transfer of doubly protonated 3-aminoacridine. B.S.Vogt, S.G.Schulman (Coll. of Pharmacy, Univ. of Florida, Gainesville, FL, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.157-60 (29 July 1983).
3-aminoacridine has been used to extend the quantitation of excited-state proton-transfer kinetics in concentrated acid media to ≈13 M sulfuric acid. The hydration requirement of the reaction and the reasons for its not attaining equilibrium within the lifetime of the excited state are discussed. (13 refs.)

100441 Oscillatory continuum emission from IBr. M.MacDonald, J.P.T.Wilkinson, C.Fotakis, M.Martin, R.J.Donovan (Dept. of Chem., Univ. of Edinburgh, Edinburgh, Scotland).
Chem. Phys. Lett. (Netherlands), vol.99, no.3, p.250-2 (5 Aug. 1983).
Optical excitation of IBr at 193 nm (ArF laser) leads to strong fluorescence in the region 280-460 nm. This fluorescence is dominated by two oscillatory continua resulting from bound-free radiative transitions. (10 refs.)

100442 Photoinduced electron transfer between aromatic hydrocarbons and arene diazonium salts in micellar solutions. H.-J.Timpe, G.Israel, H.G.O.Becker (Tech. Univ. Carl Schorlemmer Leuna-Merseburg, Merseburg, Germany), I.R.Gould, N.J.Turro.
Chem. Phys. Lett. (Netherlands), vol.99, no.3, p.275-80 (5 Aug. 1983).
In micellar sodium dodecylsulfate (SDS) solution ground-state charge-transfer complexes between aromatic hydrocarbons and diazonium salts can be detected by UV absorption. The hydrocarbon fluorescence quenching occurs by both static and dynamic mechanisms and can be described by an established kinetic scheme. (20 refs.)

100443 Non-Condon scheme of radiationless transitions for the Morse oscillator model. A.L.Sobolewski (Inst. of Phys., Polish Acad. of Sci., Warsaw, Poland).
Chem. Phys. (Netherlands), vol.78, no.2, p.265-78 (15 July 1983).
The nonadiabatic coupling matrix elements responsible for radiationless deactivation of an electronically excited molecule are calculated without invoking the Condon approximation. Assuming the Morse potential surfaces for vibrational motion along the local and totally symmetric normal coordinates, the vibronic part of the radiationless rate constant is calculated. It is shown that the rate constant in the non-Condon scheme exceeds that obtained in the Condon approximation by about two orders of magnitude. The calculated dependence of the radiationless rate constant in the energy gap is in good agreement with the experimentally observed energy gap law for intersystem crossing $T_1\rightarrow S_0$ rate constants in aromatic hydrocarbons. (35 refs.)

100444 Viscosity dependence of internal conversion rates of polyatomic molecules. K.-E.Susse, D.-G.Welsch, I.Madzgalla (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Chem. Phys. (Netherlands), vol.78, no.3, p.443-62 (1 Aug. 1983).
A microscopic theory of the dependence of internal conversion rates (R) on viscosity (η) is developed by extending usual theories of vibronic energy relaxation. The viscosity dependence of R is assumed to arise from the viscosity dependence of the damping rates γ of soft (torsional) modes of intramolecular vibration (frequencies ω). From the theory developed R is found to increase with η when $\gamma\ll\omega$. Then $\gamma\gtrsim\omega$ the rate R is found to decrease with η. In this case the dependence of R on η can often be approximated in a wide range of η according to $R\propto\eta^{-\alpha}$. The value of α depends on certain microscopic parameters, and $0\leq\alpha<1$ and $\alpha\geq1$ might be found. In particular, the oster-Nishijima result ($\alpha=1$) (1956) is included as a limiting case. A comparison between theory and experiment is given, which shows the theoretical results to be in full agreement with the experimental ones. (30 refs.)

100445 Nonexponential fluorescence decay of tryptophan, tryptophyglycine, and glycyltryptophan. M.C.Chang, J.W.Petrich, D.B.McDonald, G.R.Fleming (Dept. of Chem., Univ. of Chicago, Chicago, IL, USA).
J. Am. Chem. Soc. (USA), vol.105, no.12, p.3819-24 (15 June 1983).
The photophysics and spectroscopy of tryptophyglycine, tryptophylalanine, glycyltryptophan, alanyltryptophan, glycyltryptophylglycine, and tryptophan itself has been investigated by using steady-state and subnanosecond spectroscopy. For tryptophan and the peptides where the tryptophyl residue is N-terminal the authors demonstrate the involvement of the state of protonation on both the excited-state dynamics and the absorption and emission spectra. The deprotonated amino group gives rise to red-shifted absorption and emission spectra and to a longer fluorescence decay time compared with the protonated form. pK_a values over a range of temperatures were determined for tryptophan (23°C, 9.50), tryptophylglycine (23°C, 7.84), and tryptophylalanine (23°C, 7.79). The temperature dependence of the amplitude of the long-decay component in tryptophylglycine is attributable to the temperature dependence of the ground-state pK_a. Examination of the Arrhenius plots for tryptophan, tryptophylglycine, and glycyltryptophan clarifies the role of the protonated amino group in fluorescence quenching. The authors suggest that the role of the protonated amino group in the fluorescence quenching of the N-terminal tryptophyl compounds is not proton transfer to the indole ring but an enhancement of charge transfer from the indole ring to the adjacent carbonyl group. (45 refs.)

100446 On the origin of nonexponential fluorescence decay in tryptophan and its derivatives. J.W.Petrich, M.C.Chang, D.B.McDonald, G.R.Fleming (Dept. of Chem., Univ. of Chicago, Chicago, IL, USA).
J. Am. Chem. Soc. (USA), vol.105, no.12, p.3824-32 (15 June 1983).
The nonexponential fluorescence decay of tryptophan and its derivatives is discussed in terms of a simple model based on conformers about the C^{α}-C^{β} bond and the relative rates of charge transfer from indole to various electrophiles. Accurate predictions concerning the relative fluorescence lifetimes and the form of the fluorescence decay law are made for tryptophan and 17 of its derivatives, including three new derivatives synthesized specifically to test the model. (52 refs.)

100447 Laser-induced fluorescence excitation spectra of $NeCl_2$: evidence for a long-lived vibrationally excited van der Waals molecule. D.E.Brinza, B.A.Swartz, C.M.Western, K.C.Janda (Arthur Amos Noyes Lab. of Chem., California Inst. of Technol., Pasadena, CA, USA).
J. Chem. Phys. (USA), vol.79, no.3, p.1541-2 (1 Aug. 1983).
The authors report the fluorescence excitation spectra of $NeCl_2$ associated with the (9-1), (10-1), and (11-1) vibrational bands of the $B^3\Pi(0_u{}^+)$-$X^1\Sigma_g{}^+$ electronic transition of Cl_2, as well as with bands originating from vibrationally 'cold' Cl_2. They believe this to be the first observation of spectra in which the lower level is a metastable, vibrationally excited van der Waals molecule. (8 refs.)

100448 Collisional quenching of $A\ {}^2\Sigma^+$ OH at elevated temperatures. P.W.Fairchild, G.P.Smith, D.R.Crosley (Molecular Phys. Lab., SRI Internat., Menlo Park, CA, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.1795-807 (15 Aug. 1983).
Thermally averaged cross sections σ_Q for collisional quenching of the $A\ {}^2\Sigma^+$ state of the OH molecule have been measured near 1100K. The OH was produced and detected in a laser pyrolysis/laser fluorescence experiment, in which a mixture of SF_6, H_2O_2, and the collision partner M was heated by a pulsed CO_2 laser. Thermal decomposition of the peroxide produces OH which is then excited by a tunable laser; the real-time decay of the fluorescence signal at different pressures of M furnishes σ_Q. These σ_Q at elevated temperatures are generally less than the room temperature values. This result, the size of σ_Q, and its variation with M suggest the importance of attractive forces in the collisional quenching. The experimental results have been compared with a theoretical calculation of σ_Q based on multipole attractive forces with a repulsive centrifugal barrier. Good correlation is obtained for eight of the 11 quenchers studied: the experimental values of σ_Q for N_2 and SF_6 are conspicuously low. (22 refs.)

100449 Coriolis effects on intramolecular vibrational relaxation: rotational contour dependence of pyrimidine fluorescence. B.E.Forch, K.T.Chen, H.Salgusa, E.C.Lim (Dept. of Chem., Wayne State Univ., Detroit, MI, USA).
J. Phys. Chem. (USA), vol.87, no.13, p.2280-2 (23 June 1983).
The rotational contour dependence of the fluorescence of pyrimidine indicates that the second-order Coriolis interactions play an important role in intramolecular vibrational relaxation. (16 refs.)

100450 K_2 ground-state relaxation studies from transient process kinetics. M.P.Auzin'sh, R.S.Ferber, I.Ya.Pirags (Latvian State Univ., Riga, Latvian SSR).
J. Phys. B (GB), vol.16, no.15, p.2759-71 (14 Aug. 1983).
Relaxation parameters of the optically depopulated $(\nu'', J'')X^1\Sigma_g{}^+$ level of the K_2 molecule with $\nu''=1$ and $J''=72$ have been determined for thermal collisions with He, Ne, Ar, Kr and Xe atoms, using the method of laser-induced fluorescence kinetic monitoring. Rate constants of about 10^{-9} cm^3 s^{-1} and effective cross sections between 0.5×10^{-14} and 1.6×10^{-14} cm^2 have been obtained. Rectangular modulation of the He-Ne laser 628.8 nm intensity, exciting the transition $(1,72)X^1\Sigma_g{}^+\rightarrow(8,72)B^1\Pi_u$, was employed making it change periodically from depopulating to probing. The time dependence of the probe-beam-induced fluorescence directly reflects the transient process restoring the thermally equilibrated populations of the lower level (ν'', J''). The kinetic equations were solved in the classical-limit $J''\rightarrow\infty$ approximation, allowing for participation of two relaxation processes, namely collisions and collisionless exchange of molecules inside and outside the laser beam in their thermal motion. It is shown that the assumption of additive rates for both processes can lead to distortion of the concentration dependence of total relaxation rate. A description of the transient process is also given within the framework of irreducible tensor operators, permitting the authors to consider separately the contribution of population relaxation and of alignment. For the rovibronic state $(8,72)B^1\Pi_u$ from measurements of the degree of polarisation of the fluorescence it was found that cross sections for population and alignment relaxation coincide within 3% and would fit into the limits of the experimental error. (15 refs.)

100451 Nuclear hyperfine splittings for copper monofluoride in the $a^3\Sigma^+$ state. C.R.Brazier, J.M.Brown, M.R.Purnell (Dept. of Chem., Southampton Univ., Southampton, England).
J. Mol. Spectrosc. (USA), vol.99, no.2, p.279-87 (June 1983).
Lines in the (0,0) band of the $a^3\Sigma^+$-$X^1\Sigma^+$ system of CuF have been recorded at Doppler-limited resolution by laser-induced fluorescence. Nuclear hyperfine structure associated with the Cu nucleus is clearly resolved in many rotational lines. The features have been measured and used to determine molecular parameters for ^{63}CuF in the $a^3\Sigma^+$ state. The implications of the hyperfine parameters for the electronic wavefunction are discussed and are shown to be consistent with recent theoretical calculations. (13 refs.)

100452 Contraction of, and hole burning in a phosphorescence line corresponding to the forbidden $T_1 \Leftarrow S_0$ transition in the spectrum of pyrene in a glassy matrix. A.A.Gorokhovskii, V.V.Pal'm (Inst. of Phys., Acad. of Sci., Estonian SSR).
JETP Lett. (USA), vol.37, no.5, p.237-41 (5 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.5, p.201-4 (5 March 1983).
For the first time, a hole has been burned photochemically in the inhomogeneously broadened O-O spectrum of the $T_1 \leftarrow S_O$ transition of a complex organic molecule, specifically, the system of pyrene in a glassy matrix of butyl bromide (Py-BrBu), at 1.8 and 4.2K. The results are compared with the resonant laser excitation of the phosphorescence spectrum. (8 refs.)

100453 Direct observation of picosecond relaxation of high-lying electronic states of certain dye molecules in solution. A.M.Freiberg, K.E.Timpmann (Inst. of Phys., Acad. of Sci., Estonian SSR).
JETP Lett. (USA), vol.37, no.5, p.247-50 (5 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.5, p.209-12 (5 March 1983).
The picosecond decay times of the fluorescence from the second excited electronic state have been measured directly for certain polymethine dyes in solution. The decay times depend on the excitation conditions. (8 refs.)

100454 Anisotropy in light emission by Zn porphin molecules in n-octane single crystals. S.M.Arabei, K.N.Solov'ev, G.D.Egorova, S.F.Shkirman.
J. Appl. Spectrosc. (USA), vol.37, no.4, p.1154-7 (Oct. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.4, p.600-4 (Oct. 1982).
A method has been developed of determining the polarizations of individual vibronic transitions in a polyatomic molecule and the symmetries of the corresponding vibrations from the anisotropy in emission and absorption of Shpolskii single crystal systems. It is of interest to apply the method to porphin metal complexes, which represent simple model compounds for the biologically important tetrapyrrole pigments. The authors present results for Zn porphin obtained from the fluorescence anisotropy. The method involves analyzing the behavior of the relative intensities of the quasilines when the orientation of the n-alkane single crystal is varied. This intensity behavior occurs because of the identical orientations of the molecules in the impurity centers of a particular type together with certain features of the electric dipole anisotropy. The intensities of the components in the head multiplet may be reduced on rotating the crystal, and the same applies to the corresponding quasilines for the totally symmetric vibrations whose transition moments are polarized parallel to the purely electronic one. At the same time there will be an increase in the intensity for the quasilines for the vibrations lacking total symmetry, whose transition moments are polarized perpendicular to the purely electronic one. One can also obtain the converse picture: an increase in intensity for the totally symmetric vibration and weakening for the others. These experiments enable one to classify the vibrations by symmetry type. (10 refs.)

100455 Liquid-crystalline solvents as mechanistic probes. X. Dynamics of intramolecular quenching of pyrenyl fluorescence in the liquid-crystalline and isotropic phases of a cholesteric solvent. V.C.Anderson, B.B.Craig, R.G.Weiss (Dept. of Chem., Georgetown Univ., Washington, DC, USA).
Mol. Cryst. & Liq. Cryst. (GB), vol.97, no.1-4, p.351-63 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
For pt.IX see J. Phys. Chem., vol.86, p.4642 (1982). The effect of cholesteric order in a 59.5/15.6/24.9 (w/w/w) mixture of cholesteryl oleate/cholesteryl nonanoate/cholesteryl chloride (*C/M*) on the intramolecular fluorescence quenching of 1,3-bis(1-pyrenyl) propane (*P3P*) has been explored. A comparison with fluorescence quenching of N,N-dimethyl-4-[3-(1-pyrenyl)propyl]aniline (*P3D*) in *CM* is made. From the Arrhenius activation parameters for quenching in the cholesteric and isotropic phases, it is concluded that the motions which take the ground state conformers of *P3P* to their quenching transition state are nearly impervious to macroscopic *CM* mesophase order: in the cholesteric phase, $E_a{}'=10.5\pm0.4$ kcal mol^{-1} and $\Delta S^{\ddagger}=1\pm1$ eu; in the isotropic phase, $E_a{}'=10.0\pm0.2$ kcal mol^{-1} and $\Delta S^{\ddagger}=0\pm0.5$ eu. (27 refs.)

Intramolecular energy redistribution in polyatomic ions .... See Entry 100292

Rotational and vibrational distributions of $N_2(C^3\Pi_u)$ excited by state-selected $AR(^3P_2)$ and $Ar(^3P_0)$ metastable atoms .... See Entry 100339

Vibrational structure of the $n\pi^*$-type quasiline phosphorescence spectra of solid solutions of organic molecules .... See Entry 100357

Laser spectroscopy and microwave-optical double resonance ICL $A^3\Pi(1)$ $\nu=19$ of a supersonic expansion .... See Entry 100432

Magnetic circular dichroism and anomalous fluorescence spectra of azulenothiophenes .... See Entry 100436

Trajectory-surface-hopping study of $Na(3p^2P)+H_2\rightarrow Na(3s^2S)+H_2(\nu',j',\theta)$ .... See Entry 100508

Lasing and fluorescent characteristics of nine, new, flashlamp-pumpable, coumarin dyes in ethanol and ethanol:water .... See Entry 100746

Deactivation of singlet oxygen $O_2{}^*(^1\Delta_g)$ on gold surfaces .... See Entry 102154

Br_2 light emission from CW CO_2-laser-induced CF_3Br pyrolysis .... See Entry 103498

Picosecond laser-spectroscopy measurement of hydroxyl fluorescence lifetime in flames .... See Entry 103527

Steady-state kinetic studies on the exciplex formation between indoles and n-butyl alcohol .... See Entry 103553

Magnetic effects in glyoxal photodecomposition .... See Entry 103564

Delayed fragmentation of acetonitrile upon short-pulse UV irradiation: possible role of long-lived superexcited intermediates .... See Entry 103565

Simultaneous one- and two-photon processes in the photodissociation of NCNO using a tunable dye laser .... See Entry 103566

Spatial-anisotropy and polarized-atomic-fluorescence measurements following molecular photodissociation .... See Entry 103568

33.65 PHOTOELECTRON SPECTRA

100456 High-resolution UV photoelectron spectrum of CO_2. I.Reineck, C.Nohre, R.Maripuu, P.Lodin, S.H.Al-Shamma, H.Veenhuizen, L.Karlsson, K.Seigbahn (Inst. of Phys., Uppsala Univ., Uppsala, Sweden).
Chem. Phys. (Netherlands), vol.78, no.3, p.311-18 (1 Aug. 1983).
The highly-resolved HeI photoelectron spectrum of CO_2 is presented and its vibrational structure studied in detail. In the $\tilde{X}^2\Pi_g$ ionic state the ν_3 antisymmetric mode is excited in double quanta (ν_1, ν_2, $\nu_3=0$, 0, 2) with energy $h\nu_3=181$ meV. In the $\tilde{C}^2\Sigma_g{}^+$ state a single quantum of the same mode is excited ($h\nu_3=189$ meV) in combination with a ν_1 excitation. Vibronic interaction with vibrational levels in the $\tilde{B}^2\Sigma_u{}^+$ state of the ion is suggested to promote this (1, 0, 1) excitation. It is established that inelastic scattering processes contribute to the vibrational structure in the $\tilde{C}^2\Sigma_g{}^+$ band. The spin-orbit splitting in the $\tilde{X}^2\Pi_g$ is 19 ± 1 meV and 10 ± 2 eV in the $\tilde{A}^2\Pi_u$ state. Vibronic structure is resolved in the $\tilde{X}^2\Pi_g$ band where the Renner-Teller coupling constant is $\varepsilon=0.21\pm0.02$ and the vibrational energy of the ν_2 mode as 60 ± 7 meV. In the $\tilde{A}^2\Pi_u$ state the ν_2 energy is found to be $h\nu_2\approx60$ meV from the observed hot-band structure. (21 refs.)

Novel spectrometer for time-angle resolved ultraviolet photoemission .... See Entry 99242

Valence-shell photoabsorption by CO_2 and its connections with electron-CO_2 scattering .... See Entry 100362

Calculation of the vertical ionization potentials of XBO and XBS molecules (X=H, F and Cl) by perturbation corrections to Koopmans' theorem .... See Entry 100599

A study of the first ionization potential of the $CrO(X^5\Pi)$ molecule with high-temperature photoelectron spectroscopy .... See Entry 100600

33.70 INTENSITIES AND SHAPES OF MOLECULAR SPECTRAL LINES AND BANDS

100457 On the Franck-Condon factor evaluation in harmonic approximation. B.P.Zapol'.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.3, p.41-5 (1983). In Russian.
Analytical expressions for Franck-Condon factor's amplitude in the harmonic approximation (i.e. for overlap integral of two linear harmonic oscillator wave functions) have been obtained. These expressions are useful for arbitrary values of oscillator's quantum numbers, frequencies and equilibrium positions; unlike Ansbacher's (1959) formula they never lead to any divergencies in intermediate results. (19 refs.)

100458 Line shape and moment analysis in depolarized induced light scattering. U.Bafile, R.Magli (Istituto di Fisica Superiore, Firenze, Italy), F.Barocchi, M.Zoppi, L.Frommhold.
Mol. Phys. (GB), vol.49, no.5, p.1149-66 (10 Aug. 1983).
The authors compare the two methods of deriving interaction-induced pair polarizabilities from collision-induced, depolarized spectra, namely classical line shape and moment analysis. They discuss their limitations and show that the joint use of line shape and moment analysis leads to the determination of an empirical pair polarizability anisotropy model which has maximal consistency with the available experimental results. They have applied the combined method to the pair spectrum of argon at room temperature (298K) as an example. (25 refs.)

100459 Semiempirical approach to the determination of the probabilities of electronic-vibrational-rotational radiative transitions of diatomic molecules. B.P.Lavrov, M.V.Tyutchev, V.I.Ustimov.
Opt. & Spectrosc. (USA), vol.54, no.1, p.2-3 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.4-6 (Jan. 1983).
The rigorous quantum-mechanical calculation and the correct purely experimental determination of the probabilities of electronic-vibrational-rotational radiative transitions (EVR RT) are extremely difficult. The authors therefore propose a new semiempirical approach to the problem. In this approach, a more or less theoretical analysis is used to express the complete set of probabilities being considered in terms of a finite (usually small) number of parameters describing the perturbation of the combining states and the vibrational-rotational interaction. The parameters appearing in the theoretical equations are determined using a limited amount of experimental data on the relative probabilities of the transitions and the radiative lifetimes of the levels. (3 refs.)

100460 Study of spectra of carbon-containing compounds behind a shock wave front. Determination of the oscillator strength of the $A^1\Pi$-$X^1\Sigma$ transition of the C_3 molecule. A.P.Monyakin, L.A.Kuznetsova.
Opt. & Spectrosc. (USA), vol.54, no.1, p.44-7 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.79-84 (Jan. 1983).
Absorption spectra of carbon-containing compounds behind the front of a shock wave (SW) propagated in a (C_3F_6+Ar) or (CH_4+Ar) mixture have been studied. Behind both the incident and the reflected SW, bands of the Swan system of the C_2 molecule and the pseudocontinuum of the $A^1\Pi$-$X^1\Sigma$ transition of the C_3 molecule were observed, superposed on the continuous absorption which increased in the short-wavelength region. It is shown that the continuous absorption was due to condensed carbon formed in the wall layer. It was also established that condensed carbon can exist in the flow core behind the reflected SW owing to the absence of chemical equilibrium in the system. On the basis of quantitative measurements of the intensity of the pseudocontinuum, the oscillator strength of the $A^1\Pi$-$X^1\Sigma$ transition of the C_3 molecule was determined, $f_e=0.044\pm0.020$. (14 refs.)

Can the H_5 molecule be observed? .... See Entry 100235

The harmonic force field and absolute infrared intensities of butyne-2 .... See Entry 100352

Effect of isotope substitution on the shift of the centers of vibrational-rotational bands of polyatomic molecules .... See Entry 100358

Spectroscopic evidence for proton transfer within the bimolecular complex HI-NH_3 trapped in cryogenic matrices .... See Entry 100378

Infrared intensities of H_3O^+, H_2DO^+, HD_2O^+, and D_3O^+ .... See Entry 100381

Absolute frequency measurements of the 2-0 band of CO at 2.3 μm; calibration standard frequencies from high resolution color center laser spectroscopy .... See Entry 100384

Vibrational spectra and vibrational states of simple gas-phase hydrogen-bonded dimers .... See Entry 100394

Vibrational study of strong C-H...X hydrogen bonds in solid complexes of boron decachlorocarboranes .... See Entry 100405

The nature of scattering centers in resonance stimulated Raman scattering by dyes and shape of the emitted spectra .... See Entry 100407

Nonexponential fluorescence decay of tryptophan, tryptophyglycine, and glycyl-tryptophan .... See Entry 100445

On the origin of nonexponential fluorescence decay in tryptophan and its derivatives .... See Entry 100446

Contraction of, and hole burning in a phosphorescence line corresponding to the forbidden $T_1 \Leftarrow S_0$ transition in the spectrum of pyrene in a glassy matrix .... See Entry 100452

Coherence in the quasi-continuum model .... See Entry 100461

Shape resonances and the photodissociation cross section of MgH near threshold .... See Entry 100471

Rotational predissociation of $H_2^{+\cdot}$ ions of different precursor origins .... See Entry 100477

Narrowing of a two-photon resonance due to elastic collisions .... See Entry 100482

Resonant multiphoton interaction of noise radiation with a generalized two-level system .... See Entry 100486

Surface hopping trajectory calculations for electronic rotational and vibrational inelastic collisions for the Na-N_2 system .... See Entry 100521

A study of the first ionization potential of the CrO($X^5\Pi$) molecule with high-temperature photoelectron spectroscopy .... See Entry 100600

On the high power limit of the laser linewidth .... See Entry 100722

A discussion of the problem of determining multiple lifetimes from picosecond absorption recovery data as encountered in two carbocyanine dyes .... See Entry 100829

A quantitative analysis of the ν_s(IR) bands of H-bonds. II. Adipic acid crystals .... See Entry 102862

33.80 PHOTON INTERACTIONS WITH MOLECULES

100461 Coherence in the quasi-continuum model. B.W.Shore (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.3, p.240-3 (5 Aug. 1983).
It is shown that the diagonalization of internal molecular couplings to produce a photoabsorption quasicontinuum does not produce an incoherent absorption coefficient but maintains phase coherence in dipole moments. (35 refs.)

100462 Light scattering from gaseous nitrous oxide: effects of correlation between molecular and intermolecular axes upon the depolarization ratio in terms of the anisotropic potential choice. A.Chave, B.Dumon, A.Idrissi, M.Thibeau (Lab. d'Optique des Fluides, Univ. d'Angers, Angers, France).
Opt. Commun. (Netherlands), vol.47, no.1, p.36-41 (1 Aug. 1983).
The Rayleigh depolarized ratio of light scattered from gaseous nitrous oxide has been measured at pressure up to 50 bar and 293K with a 30 mW He-Ne laser (632.8 nm). The molecular specific scattering of this polar gas (including the effects of the orientational pair correlations (OPC), the collision induced scattering (CIS), and their interferences) are estimated in the DID approximation, assuming a Stockmayer intermolecular potential. The authors stress the importance of the conditions of symmetry. (20 refs.)

Quantum theory of light. Second edition .... See Entry 98678

Multiple photon echoes in molecular iodine .... See Entry 100866

Mutarotation of glucose solution under ultrasonic irradiation .... See Entry 102850

33.80B Level crossing and optical pumping

100463 Vacuum-ultraviolet stimulated emission from two-photon-excited molecular hydrogen. H.Pummer, H.Egger, T.S.Luk, T.Srinivasan, C.K.Rhodes (Dept. of Phys., Univ. of Illinois, Chicago, IL, USA).
Phys. Rev. A (USA), vol.28, no.2, p.795-801 (Aug. 1983).
Intense vacuum-ultraviolet stimulated emission in molecular hydrogen, on both the Lyman and Werner bands, following excitation by two-quantum absorption at 193 nm on the $X^1\Sigma_g^+ \rightarrow E,F^1\Sigma_g^+$ transition, has been observed. The shortest wavelength seen in the stimulated-emission spectrum was 117.6 nm corresponding to the $C^1\Pi_u \rightarrow X^1\Sigma_g^+$ (2-5) Q(2) transition. The $C^1\Pi_u$ state appears to be populated with a mechanism involving electron collisions. The radiative cascade mechanism found to lead to the vacuum-ultraviolet emissions on the Lyman band also causes strong infrared stimulated emission to occur on the $E,F^1\Sigma_g^+ \rightarrow B^1\Sigma_u^+$ band. Two entirely separate radiative excitation channels are observed to play important roles in the state-selective molecular population of the $E,F^1\Sigma_g^+$ level. One involves two 193-nm quanta in the $X \leftarrow E,F$ amplitude while the other process combines a 193-nm quantum with a first Stokes-shifted photon in H_2. The optical Stark effect was seen to play a significant role in the excitation process with shifts of molecular resonances as large as $\sim$45 cm^{-1}. Substantial deviations from Born-Oppenheimer behavior, resulting in a dramatic shift of the stimulated spectrum depending upon the excited-state rotational quantum number, were clearly observed for molecular levels close to the potential maximum separating the inner and outer wells of the $E,F^1\Sigma_g^+$ state. The maximum energy observed in the strongest stimulated line was $\sim$100 μJ, a value corresponding to an energy conversion efficiency of $\sim$0.5%. The pulse duration of the stimulated emission is estimated from collisional data to be $\sim$10 ps, a figure indicating a maximum converted vacuum-ultraviolet power of $\sim$10 MW. (34 refs.)

100464 Ultrafast physical effects in cyanine dyes subjected to tunable picosecond excitation. R.Gadonas, R.Danelyus, A.Piskarskas, S.Rentsch (V. Kapsukas State Univ., Vilnius, Lithuanian SSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.186-9 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.341-6 (Feb. 1983).
An analysis is made of the possibility of employing picosecond absorption spectroscopy based on continuously tunable excitation and probe sources in the investigation of complex kinetic processes. The results are presented of an investigation of various cyanine dyes. Calculations are made of the extinction coefficient of the excited state of one of the dyes. It is shown that the photoisomer 1,1′-diethyl-2,2′-monocarbocyanine, not observed previously, is formed within less than 50 psec. (12 refs.)

K_2 ground-state relaxation studies from transient process kinetics .... See Entry 100450

Mode-selective multiphoton excitation in a model system .... See Entry 100485

Surface hopping trajectory calculations for electronic rotational and vibrational inelastic collisions for the Na-N_2 system .... See Entry 100521

Optically pumped molecular laser utilizing C_2H_5Br and C_2H_5I halogen derivatives of ethane .... See Entry 100742

Lasing and fluorescent characteristics of nine, new, flashlamp-pumpable, coumarin dyes in ethanol and ethanol:water .... See Entry 100746

Low temperature operation of an S_2 laser using radio frequency simmer discharges .... See Entry 100817

33.80E Autoionization, photoionization, and photodetachment

100465 K_2 Rydberg state analysis by two- and three-photon ionization. M.Broyer, J.Chevaleyre, G.Delacretaz, S.Martin, L.Woste (Inst. de Phys. Experimentale, Ecole Polytech. Federale de Lausanne, Lausanne, Switzerland).
Chem. Phys. Lett. (Netherlands), vol.99, no.3, p.206-12 (5 Aug. 1983).
The technique of resonant two- and three-photon ionization has been used to determine highly excited Rydberg states Ryb_n beyond and below the ionization limit. The extrapolation $n \rightarrow \infty$ yielded the K_2^+ molecular constants $\omega_e=73.4$ cm^{-1}, $\omega_e x_e=0.2$ cm^{-1}, IP=32775.5 cm^{-1} and $B_e=0.041$ cm^{-1}. Phenomena like rotational autoionization and field ionization of Ryb_n states are discussed. (14 refs.)

100466 Studies of the photoionization cross section of the 2π level of nitric oxide. M.E.Smith, R.R.Lucchese, V.McKoy (Arthur Amos Noyes Lab. of Chem. Phys., California Inst. of Technol., Pasadena, CA, USA).
J. Chem. Phys. (USA), vol.79, no.3, p.1360-3 (1 Aug. 1983).
The authors present photoionization cross sections and asymmetry parameters for the 2π level of nitric oxide which are obtained from the direct solution of the $e+NO^+$ collisional equations at the static-exchange level. These cross sections differ significantly from those obtained previously using a moment theory approach [J.J. Delaney, I.H. Hillier, and V.R. Saunders, J. Phys. B,

vol.15, p.1477 (1982)]. The calculated cross sections show a broad nonresonant feature at a photon energy of 29 eV which is not as pronounced as observed experimentally. The σ shape resonance in our cross section occurs at 14 eV which is about 5 eV below the feature in the measured cross sections attributed to this shape resonance. The probable role of autoionization and vibrational averaging on these cross sections is also discussed. (14 refs.)

100467 Zero-core-contribution calculation of a polyatomic photodetachment cross section: NO_2^-. W.B.Clodius, R.M.Stehman, S.B.Woo (Phys. Dept., Univ. of Delaware, Newark, DE, USA).
Phys. Rev. A (USA), vol.28, no.2, p.760-5 (Aug. 1983).
The zero-core-contribution method is extended to polyatomic anions and applied to the calculation of the photodetachment cross section of NO_2^-. Good agreement with experiment is found except near the threshold. The results near threshold are sensitive to the approximations used in the calculations. (15 refs.)

100468 Zero-core-contribution calculation of photodetachment characteristics of heteronuclear diatomic anions. W.B.Clodius, R.M.Stehman, S.B.Woo (Phys. Dept., Univ. of Delaware, Newark, DE, USA).
Phys. Rev. A (USA), vol.28, no.2, p.1160-3 (Aug. 1983).
The zero-core-contribution method is extended to study the photodetachment of heteronuclear diatomic molecules. Total photodetachment cross sections are calculated for the ions OH^-, SH^-, and SeH^-. The anisotropy factor β is also calculated for OH^-. The agreement with measured values of these quantities is good. (21 refs.)

Observation of proton and electron detachment from an anthracene molecule during pronounced IR many-photon superexcitation ....See Entry 100484
Photoionization measurements on isolated iron-atom clusters ....See Entry 100622

33.80G Diffuse spectra; predissociation, photodissociation

100469 Semiclassical theory of predissociation induced by rotational (Coriolis) coupling. H.Nakamura (Div. of Theoretical Studies, Inst. for Molecular Sci., Okazaki, Japan).
Chem. Phys. (Netherlands), vol.78, no.2, p.235-41 (15 July 1983).
The dynamical-state representation and the multichannel quantum-defect theory of predissociation are used to formulate a semiclassical theory of predissociation of a diatomic molecule induced by Coriolis coupling. It is demonstrated that the simple perturbation theory becomes invalid when the rotational angular momentum quantum number is large, and that the nonperturbative formula developed in this paper should be employed. (18 refs.)

100470 Separation of deuterium by IR multiphoton decomposition of chlorodifluoromethane. IR multiphoton absorption by and decomposition of CF_2DCl/CF_2HCl mixture. K.O.Kutschke, M.Gauthier, P.A.Hackett (Div. of Chem., Nat. Res. Council of Canada, Ottawa, Canada).
Chem. Phys. (Netherlands), vol.78, no.3, p.323-30 (1 Aug. 1983).
IR multiphoton absorption by various pressures of CF_2HCl or of 1% CF_2DCl in CF_2HCl was studied at several 9P and 10R lines of the CO_2 laser using temporally unmodified pulses. Values of $\langle n \rangle$ for the individual molecules, and thus the optical selectivities, obtained from these data indicate that the molecule is not a promising candidate for deuterium separation in these frequency ranges. A measurement of D-isotope depletion during the multiphoton decomposition of the same mixture at 9P42 (1025.2 cm^{-1}) gave a minimum estimate of the isotopic selectivity of the dissociation process of 35. (36 refs.)

100471 Shape resonances and the photodissociation cross section of MgH near threshold. S.S.Bhattacharyya, D.Basu (Dept. of General Phys. & X-rays, Indian Assoc. for the Cultivation of Sci., Calcutta, India).
Chem. Phys. (Netherlands), vol.79, no.1, p.129-35 (15 Aug. 1983).
The photodissociation cross section of MgH has been calculated from the $\nu=0$ level of the ground electronic state $X\ {}^2\Sigma^+$ through the transition to the $B'\ {}^2\Sigma^+$ electronic state. The structure of the photodissociation cross-section curve against wavelength has been investigated near the theshold. It is shown that the shape resonances arising from the quasi-bound states play an important part in determining the form of the photodissociation cross-section curve near the threshold. (17 refs.)

100472 Cluster spectroscopy. J.Geraedts, S.Stolte, J.Reuss (Dept. of Phys., Catholic Univ. Nijmegen, Nijmegen, Netherlands).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.529-40 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The authors study pre-dissociation of dimers in a molecular beam which is irradiated by IR lasers, e.g. Co_2-lasers or colour center lasers. Pre-dissociation spectra generally yield broad lines with little or no structure; with respect to the monomer band origins there occur apparently random lineshifts to the blue and/or to the red, which they explain. (36 refs.)

100473 Production of $O(^1D)$ and $O(^3P)$ by vacuum ultraviolet photodissociation of molecular oxygen. G.A.Germany, G.J.Salamo, R.J.Anderson (Dept. of Phys., Univ. of Arkansas, Fayetteville, AR, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4573-7 (Aug. 1983).
A pulsed fluorine excimer laser operating at 1576Å wavelength, 10 ns pulse width, 10 Hz repetition rate, and ~0.2 MW average output power is used to photodissociate ground state molecule oxygen, $O_2(X^3\Sigma_g^-)$. The dissociation products, $O(^1D)$ and $O(^3P)$, are produced with unit quantum efficiency and ~0.4 eV translation energy. Time-resolved techniques are used to monitor the $O(^1D_2) \rightarrow O(^3P_2)$ radiative transition over the O_2 pressure range 10-400 m Torr. The $O(^1D)$-O_2 quenching rate constant is determined to be $(3.7\pm0.3)\times10^{-11}$ $cm^3\ s^{-1}$. The $O(^1D)/O_2$ dissociation fraction is estimated to be 0.4% to ~50% corresponding to $O(^1D)$ densities as high as 3×10^{15} cm^{-3}. (18 refs.)

100474 Photodissociation processes in the OH molecule. E.F.van Dishoeck (Center for Astrophys., Cambridge, MA, USA), A.Dalgarno.
J. Chem. Phys. (USA), vol.79, no.2, p.873-88 (15 July 1983).
A systematic investigation of the excited states that may participate in the photodissociation of the OH molecule has been carried out by ab initio calculations which use two different self-consistent field with configuration-interaction methods. Potential energy curves for states of ${}^2\Sigma^+$, ${}^2\Sigma^-$, ${}^2\Pi$, and ${}^2\Delta$ symmetries have been computed and the transition dipole moments connecting the states have been obtained. Photodissociation cross sections for absorption from the $v''=0$ vibrational level of the ground $X^2\Pi$ state into the repulsive $1^2\Delta$, $B^2\Sigma^+$, and $2^2\Pi$ states are reported. It is shown that the $1^2\Delta$ and $B^2\Sigma^+$ states, together with the $1^2\Sigma^-$ state considered in an earlier study, are important channels for photodissociation. Photodissociation may take place also following absorption into bound electronic states and absorption oscillator strengths for these transitions have been determined. The mechanisms by which the bound states can be dissociated are discussed and estimates of the dissociation efficiencies of the mechanisms are made. Absorption into the bound $3^2\Pi$ state may be an important dissociation channel. Calculations of the interstellar photodissociation rate have assumed that photodissociation proceeds by absorption into the $C^2\Sigma^+$ state for which a large oscillator strength had been adopted. The authors find that the $C^2\Sigma^+$ channel is not significant in photodissociation and they present new estimates of the interstellar photodissociation rates. Their calculations demonstrate that OH is dissociated by the absorption of Lyman alpha radiation, a channel of particular significance in shocked interstellar gas and in cometary atmospheres. (22 refs.)

100475 Resonances in molecular collisions: importance of mode decoupling in the exit channel of attractive potentials. K.C.Kulander (Max-Planck-Inst. fur Quantenoptik, Garching, Germany).
J. Chem. Phys. (USA), vol.79, no.3, p.1279-85 (1 Aug. 1983).
Two model, collinear triatomic systems are investigated in which the intrafragment vibrational modes are decoupled from the interfragment bond distance in the dissociation channel. Resonances are found in both systems whose amplitudes are predominately outside the interaction region. The consequences of the existence of such resonances on reaction probabilities, dissociation rates, and absorption properties of states near the dissociation limit are discussed. (22 refs.)

100476 Dissociation dynamics of vibrationally excited van der Waals clusters: $I_2XY \rightarrow I_2X+Y$ (X, Y=He, Ne). G.C.Schatz, V.Buch, M.A.Ratner, R.B.Gerber (Dept. of Chem., Northwestern Univ., Evanston, IL, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.1808-22 (15 Aug. 1983).
The dynamics of sequential dissociation processes of the type $XI_2(\nu)Y \rightarrow X+I_2(\nu')Y \rightarrow X+Y+I_2(\nu'')$ (X,Y=Ne,He) are studied using classical trajectory calculations and a recently presented classical version of the time-dependent self-consistent field (TDSCF) method. The results obtained indicate the presence of significant dynamical correlation effects of the rare-gas atoms on each other despite the negligible direct interaction between them; this is in qualitative agreement with experimental findings. Good agreement is found for the rate constants and the variation with rare gas as well as the branching ratios ($NeI_2He \rightarrow NeI_2+He$ vs. $\rightarrow I_2He+Ne$) calculated from TDSCF and from classical trajectories. Both classical trajectories TDSCF show an essentially impulsive dissociation mechanism, in which dissociation typically follows a considerable number of vibrations, and is due to a relatively rare internal hard collision between an I atom and the rare gas. As in the three-body I_2X case, this mechanism differs from that in the RRKM strong coupling model. Energy- and momentum-gap relations, based on the weak-coupling picture, are found to be relatively successful but fail to describe the dynamics quantitatively. (27 refs.)

100477 Rotational predissociation of $H_2^{+\cdot}$ ions of different precursor origins. A.G.Brenton, J.H.Beynon (Royal Society Res. Unit, Univ. Coll. of Swansea, Swansea, Wales), E.G.Richard, P.G.Fournier.
J. Chem. Phys. (USA), vol.79, no.4, p.1834-45 (15 Aug. 1983).
The rovibronic state of ground state $(1s\ \sigma_g)H_2^{+\cdot}$ that can fragment by the mechanism of rotational predissociation have been predicted theoretically and so have the lifetimes of these states. Six of these predicted quasibound states have previously been detected using a mass spectrometric method in which states are characterized by determining the translational energy released during the fragmentation process. In the present investigation, $H_2^{+\cdot}$ has been prepared, not from hydrogen gas itself, but from a number of organic molecules by electron bombardment. It is shown that by this method, H_2^+ appears in highly rotationally excited states and that the relative population densities of the states varies from compound to compound. The relative lifetimes of the fragmenting states have been investigated by varying the time after formation of the $H_2^{+\cdot}$ ions in which observations of fragmentation are made. A total of nine quasibound states in $H_2^{+\cdot}$ from methane were observed and assigned from theoretical calculations. Bound and quasibound states of $H_2^{+\cdot}$ molecular ions have been calculated in the framework of the Born-Oppenheimer approximation. The energy levels and lifetimes with respect to predissociation of these quasibound states are determined. The effect of adiabatic corrections are estimated and discussed. (54 refs.)

100478 Yield of excited iodine atoms during many-photon dissociation of CF_3I and $(CF_3)_3CI$. I.A.Boriev, A.M.Velichko, E.B.Gordon, A.A.Nadeikin, A.I.Nikitin, V.L.Tal'roze (Inst. of Chem. Phys., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.5, p.259-61 (5 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.5, p.218-20 (5 March 1983).
The yield of iodine atoms in the ${}^2P_{1/2}$ and ${}^2P_{3/2}$ states has been measured directly for the first time during many-photon dissociation of CF_3I and $(CF_3)_3Ci$ by the beam from a CO_2 laser. The yield of excited iodine $I^*({}^2P_{1/2})$ is essentially the same for the two molecules to comparable degrees of dissociation. (7 refs.)

100479 Photodissociation of polymethine dye solutions under laser excitation. A.V.Kazymov, E.N.Kaliteevskaya, T.K.Razumova, E.P.Shchelkina.
Opt. & Spectrosc. (USA), vol.54, no.1, p.63-7 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.111-17 (Jan. 1983).
The general laws of irreversible photodissociation of polymethine dyes under high-power excitation within the longwave absorption band are studied. It is shown that the ratio of the number of dissociated molecules to the number of absorbed photons (B) differs from the photodissociation yield (ϕ) determined by the absorption of radiation by unexcited molecules. This difference is mainly tied to processes of light quenching and transitions with absorption between excited states. In the Stokes region of excitation $B\leq\phi$, while B can be larger than ϕ in the anti-Stokes region. (19 refs.)

100480 Photofragment spectroscopy of N_2^{2+}. P.C.Cosby, R.Moller, H.Helm (Molecular Phys. Lab., SRI Internat., Menlo Park, CA, USA).
Phys. Rev. A (USA), vol.28, no.2, p.766-72 (Aug. 1983).
N_2^{2+} ions, produced by electron impact of N_2, are observed to predissociate into N^++N^+ when irradiated by a dye laser at photon energies between 14900 and 19500 cm^{-1}. Five structured bands in the spectrum are associated with absorptions from $X^1\Sigma_g^+$ (v=0, 1, 2,) into three predissociated levels of the $1^1\Pi_u$ state. The two highest levels of the $1^1\Pi_u$ are believed to dissociate by tunneling through the Coulombic barrier in its potential-energy curve, whereas the lowest level is predissociated by the $1^1\Sigma_u^-$ state. Kinetic-energy analysis of the N^+ photofragments establishes the energy of $X^1\Sigma_g^+$ (v=0) at 4.8 ± 0.2 eV above the N^++N^+ dissociation asymptote and yields an adiabatic appearance potential of 43.6 ± 0.2 eV. Molecular constants for the $X^1\Sigma_g^+$ and $1^1\Pi_u$ states are determined. (27 refs.)

100481 Dissociation of SF_6 molecules in an infrared laser field under gasdynamic cooling conditions. S.S.Alimpiev, G.S.Baronov, S.M.Karavaev, V.A.Martsynk'yan, A.V.Merzlyakov, S.M.Nikiforov, B.G.Sartakov, E.M.Khokhlov, A.L.Shtarkov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.208-12 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.376-83 (Feb. 1983).
The method of HF* luminescence was used to measure the energy and spectral dependences of the dissociation yield of SF_6 gas under conditions of gasdynamic cooling to a temperature of ~30°K. Single- and two-frequency illumination in the fields of discretely tunable TEA CO_2 lasers was employed. (13 refs.)

The analytically continued *S* matrix for potentials defined as a sum of exponentials. II. The multichannel problem ....See Entry 98813

A new spectrum of the PO_2 radical ....See Entry 100410

Effects of dissociative intermediate states on the vibronic dephasing in visible/ultraviolet multiphoton transitions of gaseous molecules ....See Entry 100483

Quantum interference in the IR-multiphoton excitation of small asymmetric-top molecules: ozone ....See Entry 103543

Classical trajectory study of the effects of parent-molecule bending and overall rotation in polyatomic direct photofragmentation. Model $ICN+h\nu\rightarrow CN+I$ ....See Entry 103546

Nonequilibrated energy distribution in polyatomic molecules: the infrared MPD of cyclobutanone ....See Entry 103549

Infrared laser multiple-photon dissociation of $CDCl_3$ in a molecular beam ....See Entry 103551

Magnetic effects in glyoxal photodecomposition ....See Entry 103564

Simultaneous one- and two-photon processes in the photodissociation of NCNO using a tunable dye laser ....See Entry 103566

Spatial-anisotropy and polarized-atomic-fluorescence measurements following molecular photodissociation ....See Entry 103568

33.80K Multiphoton processes

100482 Narrowing of a two-photon resonance due to elastic collisions. V.P.Chebotayev, V.A.Ulybin (Inst. of Thermophys., Acad. of Sci., Novosibirsk, USSR).
Appl. Phys. B (Germany), vol.B31, no.4, p.249-52 (Aug. 1983).
The lineshape of two-photon absorption in a standing-wave field during elastic collisions is studied. It has been found that the transit broadening of the two-photon resonance on vibrational-rotational molecular transitions is sharply decreased because of an increase in the time of interaction of particles with the electromagnetic field due to elastic collisions. The effect considered allows one to obtain supernarrow optical resonances of two-photon absorption in a low-pressure gas with high intensity. (7 refs.)

100483 Effects of dissociative intermediate states on the vibronic dephasing in visible/ultraviolet multiphoton transitions of gaseous molecules. Y.Fujimura, T.Nakajima (Dept. of Chem., Tohoku Univ., Sendai, Japan), M.Kawasaki, H.Sato, I.Tanaka.
J. Phys. Chem. (USA), vol.87, no.13, p.2277-9 (23 June 1983).
Vibronic dephasing bringing about sequential multiphoton transition via dissociative intermediate states is studied. A linear interaction potential in the repulsive manifold makes a significant contribution to the frequency-dependent dephasing constant. This constant is calculated for the I_2 multiphoton transition via the $^1\Pi_{1u}$ state. (13 refs.)

100484 Observation of proton and electron detachment from an anthracene molecule during pronounced IR many-photon superexcitation. V.N.Bagratashvili, M.V.Kuz'min, V.S.Letokhov, A.N.Shibanov (Inst. of Spectroscopy, Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.2, p.112-16 (20 Jan. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.2, p.92-5 (20 Jan. 1983).
The detachment of a proton and an electron from a large polyatomic molecule (anthracene) has been observed (for the first time) during pronounced IR many-photon superexcitation of the molecule above the dissociation boundary in the electronic ground state. (9 refs.)

100485 Mode-selective multiphoton excitation in a model system. R.E.Wvatt (Inst. for Molecular Sci., Okazaki, Japan), G.Hose, H.S.Taylor.
Phys. Rev. A (USA), vol.28, no.2, p.815-28 (Aug. 1983).
A computational study is made of mode-selective multiphoton excitation in a model nonseparable anharmonic-oscillator system. The time evolution of quantal wave packets on the Henon-Heiles potential surface is treated via Floquet theory; periodicity of the classical laser field, $E_0\cos\omega t$, is utilized to formulate the propagator for the state amplitudes. In a previous study by Hose and Taylor (1982), a criterion was developed by which the quantum states corresponding to the classical quasiperiodic motion are identified. Two types of quasiperiodic states exist in the Henon-Heiles system: Q^I, the normal mode and Q^{II}, a local (bond) mode; highly mode-mixed states are designated as N (nonquasiperiodic). In the present study it is found that efficient multiphoton excitation into a subset of the Q^I states lying between the classical critical energy and the dissociation barrier is obtained, provided that the field strength is not too large and the frequency of the laser is tuned to the fundamental of the Q^I ladder. Implications for mode-selective excitation in real systems are discussed. (40 refs.)

100486 Resonant multiphoton interaction of noise radiation with a generalized two-level system. G.M.Krochik, N.M.Krochik (Sci.-Res. Inst. of Intermediate Organic Products & Dyes, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.9, p.715-26 (Sept. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.9, p.998-1011 (Sept. 1982).
Considers the multiphoton interaction of a light field, randomly modulated by a complex Gaussian process, with a generalized two-level system. It is shown that the shift and broadening of the transition line, caused by the quadratic Stark effect and by the presence of multiphoton resonance, saturate in a strong noise field. The resonant transition then becomes asymmetric. The authors study the multiphoton resonant ionization, find the conditions of the applicability of the averaged velocity equations, and establish the regimes which differ from the resonant multiphoton ionization in a monochromatic field. A good agreement of the calculated results with the available results of experiments on the multiphoton processes in noise fields is obtained. (15 refs.)

The evaluation of two-photon absorptivities in molecules in the adiabatic approximation by CI expansion ....See Entry 100264

Spectroscopy of two-photon transitions in C_2H_4 using the degenerate four-photon interaction method ....See Entry 100397

Vacuum-ultraviolet stimulated emission from two-photon-excited molecular hydrogen ....See Entry 100463

K_2 Rydberg state analysis by two- and three-photon ionization ....See Entry 100465

Yield of excited iodine atoms during many-photon dissociation of CF_3I and $(CF_3)_3CI$ ....See Entry 100478

Two-photon optical multistability ....See Entry 100833

Quantum interference in the IR-multiphoton excitation of small asymmetric-top molecules: ozone ....See Entry 103543

Nonequilibrated energy distribution in polyatomic molecules: the infrared MPD of cyclobutanone ....See Entry 103549

Infrared laser multiple-photon dissociation of $CDCl_3$ in a molecular beam ....See Entry 103551

Simultaneous one- and two-photon processes in the photodissociation of NCNO using a tunable dye laser ....See Entry 103566

34.00 ATOMIC AND MOLECULAR COLLISION PROCESSES AND INTERACTIONS

34.10 GENERAL THEORIES AND MODELS

(inc. statistical theories, transition state, stochastic and trajectory models, etc; see also 82.20)

100487 Modified quasiclassical description of collisions of atomic particles at medium and low energies. V.A.Sidorovich, V.S.Nikolaev.
Opt. & Spectrosc. (USA), vol.54, no.1, p.30-3 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.54-9 (Jan. 1983).
On the basis of a quantum-mechanical treatment of the scattering problem, an extrapolation of the quasiclassical method to the case of scattering of atomic particles at medium and low energies of collision is proposed. The proposed modification of the quasiclassical method refines the well-known Vainshtein-Vinogradov modification and correctly takes into account the region of possible values of transferred momentum. Comparison of the Born cross sections for the 1*s*-2*s* excitation of hydrogen atoms by electrons without consideration of exchange, obtained on the basis of two modifications of the quasiclassical method and in quantum mechanics, shows that the present modification substantially improves the Vainshtein-Vinogradov results in the region of collision energies up to the cross-section maximum and leads to cross sections identical with the quantum-mechanical ones in the entire region of collision energies starting from the reaction threshold. (17 refs.)

34.20 INTERATOMIC AND INTERMOLECULAR POTENTIALS AND FORCES

(for molecular solids, see 31.70K)

100488 Formation of weak hydrogen-bonded complexes as predicted by experimental atomic charges. M.Gussoni (Istituto di Chimica Fisica Applicata dei Materiali, CNR, Genoa, Italy), C.Castiglioni, G.Zerbi.
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.101-6 (29 July 1983).
A very simple electrostatic model for the binding energy in weak intermolecular interaction is proposed. The model requires the knowledge of atomic equilibrium charges which can be derived from molecular dipole moments and infrared intensities. The binding energy computed with this model for hydrogen-bonded complexes of known geometry agrees very well with the observed one. A further simplification of the model may indicate which of the two molecules forming the complex acts as proton donor when the geometry of the complex is not known. (37 refs.)

100489 Note on a theoretical interpretation of the isotopic ratio $\bar{\nu}_{OH}/\bar{\nu}_{OD}$ versus $\bar{\nu}_{OH}$ in isotopically diluted HDO molecules in solid hydrates. M.J.Wojcik, J.Lindgren, J.Tegenfeldt (Inst. of Chem., Univ. of Uppsala, Uppsala, Sweden).
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.112-15 (29 July 1983).
A simple intra- and inter-molecular potential for water molecules engaged in hydrogen bonding has been used in a one-dimensional approximation for a theoretical interpretation of the experimental correlation $\bar{\nu}_{OH}/\bar{\nu}_{OD}$ versus $\bar{\nu}_{OH}$ in solid hydrates. The variation in the equilibrium O-H(D) distance has also been considered. (12 refs.)

100490 Study of the additivity of internal and external potentials for simple complexes of the HDO molecule. M.J.Wojcik, J.Lindgren (Inst. of Chem., Univ. of Uppsala, Uppsala, Sweden).
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.116-19 (29 July 1983).
Additive internal and external potentials for simple complexes of the HDO molecule have been studied by polynomial fitting and solution of the variational problem. Structural and spectroscopic properties calculated allow one to evaluate the applicability of these potentials to study more complex hydrates. (30 refs.)

100491 A study of the valence interaction integrals in effective core potential applications. L.G.M.Pettersson (Inst. of Theoretical Phys., Univ. of Stockholm, Stockholm, Sweden), A.Stromberg.
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.122-8 (29 July 1983).
The valence interactions in two effective core potential (ECP) methods, the frozen orbital ECP and the method of Sakai and Huzinaga (1982), are shown to yield atomic valence orbital Coulomb and exchange interaction integrals closely approximating all-electron calculations. The ECP approximation is studied in some detail with special application in the ScO molecule. The too short bond distance in ScO when the 3s, 3p orbitals are included in the core is shown to stem from a long-range attraction of the ECP. (23 refs.)

100492 The stability of the RKR inversion procedure to errors in the spectroscopic data: origin of the inner-wall ripple. B.H.Wells, E.B.Smith (Phys. Chem. Lab., Univ. of Oxford, Oxford, England), R.N.Zare.
Chem. Phys. Lett. (Netherlands), vol.99, no.3, p.244-9 (5 Aug. 1983).
The origin of the non-physical inner-wall behaviour frequently encountered in the RKR inversion procedure is discussed. The RKR procedure is found to be

very sensitive to errors in the rotational data, but less demanding on the quality of the vibrational data. (9 refs.)

100493 Rydberg states of van der Waals molecules—a comparison with Rydberg states of atoms and chemically bonded species. P.M.Dehmer (Argonne Nat. Lab., Argonne, IL, USA).
Comments At. & Mol. Phys. (GB), vol.13, no.5, p.205-27 (1983).
The Rydberg spectra of van der Waals molecules are examined using the spectra of the homonuclear and heteronuclear rare gas dimers as examples. Owing to significant interchannel coupling, the molecular spectra often are complex and the simple analogy between atomic and molecular Rydberg structure is of limited use in analyzing the VUV spectra of these species. The more general question of the applicability of the multichannel quantum defect theory (MQDT) for the analysis of rotationally unresolved molecular spectra such as those presented is considered. It is suggested that the Rydberg spectra of certain van der Waals molecules may be midway in complexity between the spectra of simple diatomics such as He_2 or H_2 and the spectra of polyatomics. Analyses of such van der Waals Rydberg spectra using MQDT may help assess the potential and the limitations of this technique. (77 refs.)

100494 Transport properties of ground state nitrogen atoms. J.C.Rainwater (Nat. Engng. Lab., NBS, Boulder, CO, USA), L.Biolsi, K.J.Biolsi, P.M.Holland.
J. Chem. Phys. (USA), vol.79, no.3, p.1462-8 (1 Aug. 1983).
Transport properties of dilute monatomic gases depend on the two body atom-atom interaction potential. When two ground state (^4S) nitrogen atoms interact, they can follow any of four potential energy curves corresponding to the N_2 molecule; the $X^1\Sigma_g^+$, $A^3\Sigma_g^+$, $^5\Sigma_u^+$ and $^7\Sigma_u$ curves. Transport collision integrals for the $^1\Sigma_g^+$ and $^3\Sigma_u^+$ states have been calculated by representing the potentials for these states with the Hulburt-Hirschfelder potential. The $^5\Sigma_g^+$ state has a large local maximum which requires changes in the computational procedure used previously; a modified Hulburt-Hirschfelder potential has been used to represent the potential for this state. Collision integrals for the $^7\Sigma_u^+$ state have been obtained by direct use of a recent theoretical potential for this state. The collision integrals are compared with results obtained in previous studies. (51 refs.)

100495 Density functional calculations for H_2O, NH_3, and CO_2 using localized muffin-tin orbitals. J.E.Muller, R.O.Jones, J.Harris (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).
J. Chem. Phys. (USA), vol.79, no.4, p.1874-84 (15 Aug. 1983).
Density functional calculations of forces and total energies have been performed for the ground states of H_2O, NH_3, and CO_2 using the localized muffin-tin orbital (MOT) basis of Harris and Painter (1980). Exchange-correlation effects are described using the local density (LD) approximation. It is shown that: (i) the localized MOT basis yields results of useful accuracy with a small number of functions; (ii) the LD approximation gives a remarkably accurate equilibrium geometry in each case; and (iii) details of the electronic structure, such as the inversion barrier in NH_3, are reproduced with reasonable accuracy. The bonding in all three molecules is discussed in terms of the geometry dependence of the one-electron eigenvalues (Walsh diagrams). (38 refs.)

100496 Maximum-entropy inference and momentum density approach. T.Koga, M.Morita (Dept. of Appl. Chem., Muroran Inst. of Technol., Hokkaido, Japan).
J. Chem. Phys. (USA), vol.79, no.4, p.1933-8 (15 Aug. 1983).
Previously, the authors have proposed a rigorous method to obtain the total energy E of a system of interacting atoms based on the electron momentum density and its redistribution during the interaction process. In the paper, they consider an inverse problem of constructing the momentum density distribution from the knowledge of the total energy E. Using the method of the maximum-entropy inference in information theory, analytical expressions are derived for the radial momentum density as a function of E. The results are applied to the interactions in the H_2 system and the reliability of the inference is examined. In spite of its simplicity, the inferential momentum distribution is shown to be reliable semiquantitatively. (17 refs.)

100497 Intramolecular unsymmetrical OHO bonds. Thermochemistry [NMR in acetylacetones]. K.I.Lazaar, S.H.Bauer (Dept. of Chem., Cornell Univ., Ithaca, NY, USA).
J. Phys. Chem. (USA), vol.87, no.13, p.2411-16 (23 June 1983).
Most O...H-O bonds are unsymmetrical; the authors' report deals with nearly symmetric potential wells, slightly perturbed by the next to nearest neighbor environment. The ratios of residence times of the hydrogen atom in the two-well potentials in unsymmetrically substituted acetylacetones were derived from NMR chemical shifts at the carbonyl carbons (^{13}C natural abundance), recorded for dilute solutions of the enol isomers in nonpolar solvents. Cross-checks between several equilibrium constants indicate that the motion of the bridging hydrogen atom is strongly coupled to the dynamics of the molecular skeleton. (11 refs.)

100498 Determination of nonadiabatic potential curves from wavefunctions obtained by configuration interaction calculations. M.C.Bacchus-Montabonel, G.Chambaud, B.Levy (Lab. de Chimie, ENSJF, Montrouge, France).
J. Chim. Phys. & Phys.-Chim. Biol. (France), vol.80, no.5, p.425-39 (May 1983). In French.
Non-adiabatic potential-energy surfaces are evaluated from adiabatic ones. In the non-adiabatic representation, an effective hamiltonian $\underline{H}$ is defined on a small space $\bar{S}$—the reference space; the eigenfunctions of $\bar{H}$ are the projections of the open-channels obtained in the adiabatic calculations, the eigenvalues of $\bar{H}$ are the adiabatic ones. The choice of the basis describing the reference space has been investigated in the case of the $(ArH)^+$ system. The results are good for large distances (more than 4 a.u.). (14 refs.)

100499 Molecular interactions of some picolines with benzene and carbon tetrachloride. M.G.Botros, M.M.Naoum, H.G.Shinouda, H.A.Rizk (Dept. of Chem., Cairo Univ., Cairo, Egypt).
J. Chim. Phys. & Phys.-Chim. Biol. (France), vol.80, no.5, p.441-8 (May 1983).
Excess volumes, $V4^E$, of binary mixtures of α-picoline, β-picoline, and γ-picoline with benzene and carbon tetrachloride, and dipole moments, μ_2, of picolines in these mixtures have been measured as a function of a composition at 20° to 50°C. The V^E data are negative for all mixtures studied, and exhibit a minimum at a 1:1 molar ratio, suggesting that alternate molecules of the two components are probably involved in a packing pattern. The μ_2^2 data are greatest in the very dilute solutions and gradually decrease with increasing picoline concentration, indicating the applicability of Onsager's model over the entire concentration range of picolines. The results are discussed in terms of dipole association which seems to be stronger in carbon tetrachloride solutions than in benzene solutions. (34 refs.)

100500 The proton potential in short hydrogen bonds. D.Hadzi (Boris Kidric Inst. of Chem., Ljubljana, Yugoslavia).
J. Mol. Struct. (Netherlands), vol.100, p.393-402 (July 1983).
The state of knowledge of the proton potential in systems for which double minimum and symmetrical, single minimum type curves have been envisaged is critically reviewed. In particular, the proposed model potentials for carboxylic acids, for KDP type ferroelectrics and for the shortest hydrogen bonds are confronted with experimental data, particularly from vibrational spectra. The early attempts at explaining the complex features in the AH stretching region by level splitting in one-dimensional double minimum potentials have not been successful. The interest in the profile of the potential surface is shifted from this aspect to its role in anharmonic interaction based general band-shaping mechanisms. (54 refs.)

100501 A comparative study of lithium, sodium and hydrogen bonds formed by 1:1 interaction of electron donor molecules with lithium, sodium and hydrogen halides. G.V.Kulkarni, C.N.R.Rao (Solid State & Structural Chem. Unit, Indian Inst. of Sci., Bangalore, India).
J. Mol. Struct. (Netherlands), vol.100, p.531-7 (July 1983).
Dissociation energies of 1:1 complexes of hydrogen, lithium and sodium halides with water, methanol and ammonia vary in the order $LiX > NaX > HX$, the dissociation energy in the case of lithium bonds being of the order of 200 kJ mol^{-1}. The magnitude of charge transfer, Δq, between the donor and acceptor molecules is also highest in the case of lithium bonds. The dissociation energies and Δq have been related with various properties of the complexes. (7 refs.)

100502 Use of *l*-dependent pseudopotentials in the study of alkali-metal-atom-He systems. The adiabatic molecular potentials. J.Pascale (Service de Phys. des Atomes et des Surfaces, CENS, Gif-sur-Yvette, France).
Phys. Rev. A (USA), vol.28, no.2, p.632-44 (Aug. 1983).
Molecular-structure calculations have been performed to obtain the adiabatic potentials for ground state and numerous excited states of alkali-metal-He systems. They use l-dependent pseudopotentials defined from spectroscopy data or scattering data to describe the e^--M^+ and e^--He interactions (where M is any alkali-metal atom). Standard variational calculations are made, and a large basis set of Slater-type orbitals is used in order to ensure accuracy and stability of the results. The author's results are discussed along with comparisons with other theoretical and experimental data. The overall agreement which has been obtained with all available experimental data indicates that significant improvements in the calculation of the M-He adiabatic potentials have been achieved by using an l-dependent pseudopotential technique. (45 refs.)

100503 High-energy expansions for the phase shifts in screened Coulomb potentials. A.Bechler (Inst. of Theoretical Phys., Warsaw Univ., Warsaw, Poland), R.H.Pratt.
Phys. Rev. A (USA), vol.28, no.2, p.1190-2 (Aug. 1983).
A high-energy expansion is obtained for nonrelativistic phase shifts in a screened Coulomb potential, expressing their difference from the corresponding point Coulomb phase shifts as quadrature integrals over the potential. The result exhibits the role of small- and large-distance regions of the potential in determining these phase shifts. (9 refs.)

The analytically continued *S* matrix for potentials defined as a sum of exponentials. II. The multichannel problem ....See Entry 98813

On the virial coefficients of the equation of state of system of non-axial molecules ....See Entry 99067

Density functional theory of asymptotic form of electron density in heteronuclear diatomic molecules ....See Entry 100221

Molecular properties from MCSCF-SCEP wave functions. I. Accurate dipole moment functions of OH, OH^- and OH^+ ....See Entry 100240

Calculation of the ground and excited states of the Ne_2 molecule by the variational cellular method ....See Entry 100258

Intermolecular potentials for the H_2O-C_6H_6 and the C_6H_6-C_6H_6 systems calculated in an ab initio SCF CI approximation ....See Entry 100265

Substituted benzenes. V. Normal coordinate analysis of out-of-plane vibrations of mono iodonitrobenzenes ....See Entry 100340

Substituted benzenes. VI. Vibrational analysis of out-of-plane vibrations of mono bromonitrobenzenes ....See Entry 100341

Variational calculation of the rotational constants for acetylene and its isotopic derivatives ....See Entry 100343

Non-Condon scheme of radiationless transitions for the Morse oscillator model ....See Entry 100443

Collisional quenching of $A\ ^2\Sigma^+$ OH at elevated temperatures ....See Entry 100448

Line shape and moment analysis in depolarized induced light scattering ....See Entry 100458

Photofragment spectroscopy of N_2^{2+} ....See Entry 100480

Interaction potentials for Li^+-rare-gas systems ....See Entry 100505

On the Ne-Ne potential-energy curve and related properties . See Entry 100506

The quantal collision integrals and transport coefficients of dilute gaseous spin-polarized deuterium with spin-polarized hydrogen and the isotopes of helium ....See Entry 100509

Glory undulations in total integral collision cross sections. Centrifugal sudden calculations for Ar-N_2 ....See Entry 100516

Surface hopping trajectory calculations for electronic rotational and vibrational inelastic collisions for the Na-N_2 system ....See Entry 100521

Theoretical investigation of rotational rainbows in K+N_2 and K+CO collisions ....See Entry 100523

State-to-state differential and integral cross sections for vibrational-rotational excitation and elastic scattering of electrons by N_2 at 5-50 eV: calculations using extended-basis-set Hartree-Fock wave functions ....See Entry 100564

The story of the ammonia molecule: ten years of investigation of molecular inversion ....See Entry 100594

Mobilities and interaction potentials for Br^--Ar, Br^--Kr, and Br^--Xe ....See Entry 101380

The effect of molecular excitation on crystal packing. 9-cyano-and 9,10-dimethylanthracene as excited guest/host and host/guest pairs ....See Entry 101617

Lattice dynamics and interaction potentials in molecular crystals ....See Entry 101874

Theory of the long range polarization of an adatom near a solid surface ....See Entry 102163

34.40 ELASTIC SCATTERING OF ATOMS AND MOLECULES

100504 Electron scattering from a potential in a radiation field. R.Shakeshaft (Phys. Dept., Univ. of Southern California, Los Angeles, CA, USA).
Phys. Rev. A (USA), vol.28, no.2, p.667-73 (Aug. 1983).
Electron scattering from a potential in the presence of a classical, monochromatic, spatially homogeneous radiation field is considered. A coupled integral equations method is formulated to calculate the cross section for stimulated photon emission or absorption. This method is applicable for field strengths such that the difference between the instantaneous velocity and the cycle-average velocity of the electron is not too large. The method has been applied to the case of a separable potential, and some results are presented. (7 refs.)

Narrowing of a two-photon resonance due to elastic collisions ....See Entry 100482

Classical energy-sudden calculations of diffusion and viscosity cross sections for atom-diatom interactions ....See Entry 100514

34.50 INELASTIC SCATTERING OF ATOMS AND MOLECULES

100505 Interaction potentials for Li^+-rare-gas systems. L.A.Viehland (Parks Coll., Saint Louis Univ., Cahokia, IL, USA).
Chem. Phys. (Netherlands), vol.78, no.2, p.279-94 (15 July 1983).
The accuracies of proposed interaction potentials for the Li^+-rare-gas systems are tested by comparing the transport coefficients calculated from the potentials with the experimental values. The agreement is generally good for theoretical potentials that take electron correlation into account and for potentials inferred from ion-beam measurements of high accuracy, except where the transport data are primarily influenced by the long-range tail of the potential. The transport data are also used to directly determine the Li^+-rare-gas interaction potentials, with an estimated accuracy of 10% over wide ranges of ion-atom separation. (53 refs.)

100506 On the Ne-Ne potential-energy curve and related properties. R.A.Aziz, W.J.Meath, A.R.Allnatt (Univ. of Western Ontario, London, Ontario, Canada).
Chem. Phys. (Netherlands), vol.78, no.2, p.295-309 (15 July 1983).
The construction of interatomic pair potentials according to the HFD (Hartree-Fock-dispersion) and the XC (exchange-Coulomb) models is reviewed briefly. A new XC potential is constructed for Ne; as in a successful application to Ar, the adjustable parameters in the model are fixed by fitting only second virial coefficient data. The new XC potential, two slight modifications of it, and five literature potentials, are compared with respect to their ability to predict the second virial coefficients and transport properties of dilute Ne gas, the Ne-Ne differential and total scattering cross sections, and the spectroscopic constants of the dimer. A reassessment of the experimental data leads to the conclusion that a literature HFD-C potential is less reliable than previously thought. The new potentials constructed in this paper appear preferable to the other potentials considered; they reproduce essentially all the experimental data used for test purposes to within experimental error. (71 refs.)

100507 A comparison of quantal and semiclassical perturbed-rotational-state methods in H^+-CO collisions. K.Sakimoto (Inst. of Space & Astronautical Sci., Tokyo, Japan).
Chem. Phys. (Netherlands), vol.79, no.1, p.137-46 (15 Aug. 1983).
The perturbed-rotational-state (PRS) approach introduced by Takayanagi (1982) and developed by the present author is a very powerful tool for treating low-energy ion-molecule collisions. However, all previous PRS methods are based on the semiclassical impact-parameter theory. In the present work, a quantum-mechanical PRS theory is formulated, and a preliminary application to the H^+-CO collision is performed. Semiclassical impact-parameter calculations under the assumption of a straight-line trajectory are also performed, and compared with the quantum-mechanical results. The energy range studied in the calculations covers the conditions of interstellar molecular clouds. (23 refs.)

100508 Trajectory-surface-hopping study of $Na(3p^2P)+H_2 \rightarrow Na(3s^2S)+H_2(\nu',j',\theta)$. N.C.Blais (Chem. Div., Los Alamos Nat. Lab., Los Alamos, NM, USA), D.G.Truhlar.
J. Chem. Phys. (USA), vol.79, no.3, p.1334-42 (1 Aug. 1983).
Trajectory-surface-hopping calculations involving the three lowest-energy $^2A'$ potential surfaces are reported for $Na(3p^2P)$ collisions with $H_2(\nu=0$, low $j)$ at 0.9 kcal/mol relative translational energy. In addition to the total quenching cross section, the authors report distributions of final translational energy, final vibrational and rotational quantum numbers, internal energy, scattering angle, and collision time for the quenching collisions. They also report the opacity function, the correlation of scattering angle with impact parameter, and separate product translational spectra for the forward and backward scattered halves of the quenched ensemble. These results provide a detailed picture of the chemical dynamics of a typical quenching system proceeding through a quasibound intermediate configuration with large ionic character. (27 refs.)

100509 The quantal collision integrals and transport coefficients of dilute gaseous spin-polarized deuterium with spin-polarized hydrogen and the isotopes of helium. T.K.Lim (Dept. of Phys. & Atmospheric Sci., Drexel Univ., Philadelphia, PA, USA), P.A.Maurone.
J. Chem. Phys. (USA), vol.79, no.3, p.1452-4 (1 Aug. 1983).
The collision integrals and transport coefficients of spin-polarized deuterium D↑ and its admixtures with spin-polarized hydrogen H↑ and the isotopes of helium are calculated with representative Lennard-Jones interatomic potentials at temperatures below 2K. Diffractive features previously predicted to be significant in H↑ are absent in D↑ and its admixtures. (4 refs.)

100510 Symmetry selection rules in inelastic collisions of diatomic molecules in $^3\Pi$ electron states. M.H.Alexander (Dept. of Chem., Univ. of Maryland, College Park, MD, USA), B.Pouilly.
J. Chem. Phys. (USA), vol.79, no.3, p.1545-6 (1 Aug. 1983).
Recently, considerable attention has been devoted to collisions involving open-shell diatomics, where the manifold of rotational levels is split by interactions with the electronic spin or orbital angular momenta. Some experimental work has indicated that certain transitions between the various symmetry and parity doublets are more favored than others. In a series of papers (1982, 1983) authors have shown how this type of propensity rule can be derived starting from a rigorous quantum formulation of the collision dynamics. They extend this type of analysis to collisions of molecules in $^3\Pi$ electronic states, where several new selection rules can be derived, which do not apply to the systems examined previously. (14 refs.)

100511 The dispersive collision dipole in a pair of polyatomic molecules. L.Galatry (Lab. de Phys. Moleculaire, Univ. de Besancon, Besancon, France), A.Hardisson.
J. Chem. Phys. (USA), vol.79, no.4, p.1758-65 (15 Aug. 1983).
The dipole moment appearing in a pair of polyatomic molecules during a collision, originating from the dynamic correlation of the charges between the two systems, is formulated using two different methods. The first one introduces the electro-optical effect induced in one of the partners by the fluctuating field of the other and by an externally applied field. The second method takes into account the optical rectification processes of one molecule subjected to the fluctuating field of the other. These formalisms may be applied to pairs with any molecular symmetry. An application is made to molecules belonging to the T_d group, showing that in such a case the R^{-7} part of the dispersion polarization may be competitive with inductive effects. (27 refs.)

100512 Effect of the different parts of the interaction potential on the line profile in neutral atom-atom collisions. N.F.Allard, Y.G.Biraud.
J. Phys. (France), vol.44, no.8, p.935-43 (Aug. 1983).
Line profiles of Cs perturbed by Xe are calculated in the unified theory of Anderson and Talman (1956). The short range and the long range parts of the potential are represented by two square-wells. The authors compare their respective effects on the characteristics of the profile. The results improve one's understanding of the collision process. (11 refs.)

100513 Time-dependent spectra of colliding atoms in an intense radiation field. G.Nienhuis (Fysisch Lab., Rijksuniv. Utrecht, Utrecht, Netherlands).
J. Phys. B (GB), vol.16, no.15, p.2677-93 (14 Aug. 1983).
The author expresses the time-dependent physical spectrum of any signal as a twofold convolution over frequency and time of the Page-Lampard quasi-spectrum and a smoothing function that is determined by the properties of the spectrometer. This result is applied to the collisional redistribution of intense time-dependent radiation. Without resort to the adiabatic approximation the authors derive a differential equation that determines the time-dependent redistributed spectrum for any given time variation of the incident field. In the special case of adiabatic or sudden switch on the incident radiation he evaluates the approach to the steady state of the fluorescence spectrum of a two-state atom. (21 refs.)

100514 Classical energy-sudden calculations of diffusion and viscosity cross sections for atom-diatom interactions. A.S.Dickinson, D.Richards (Dept. of Atomic Phys., Univ. of Newcastle upon Tyne, Newcastle upon Tyne, England).
J. Phys. B (GB), vol.16, no.15, p.2801-15 (14 Aug. 1983).
Trajectory calculations are reported in the sudden approximation for the Maxwellian averaged diffusion and viscosity cross sections for He-N_2, Ar-N_2 and He-CO_2 collisions. Comparison is made with classical infinite-order-sudden (IOS) calculations, also known as the Mason-Monchick approximation, and with various quantal IOS calculations. For the N_2 collisions, the energy-sudden and classical IOS results agree within 1% and differ from the quantal results by less than 2%. For the He-CO_2 collisions, the classical IOS results differ by about 5% from the energy-sudden calculations. An energy-corrected sudden approximation is introduced. This correction is significant only for viscosity-type cross sections, making a 6% difference for Ar-N_2 and He-CO_2 collisions at 300K. Criteria for the validity of the classical IOS approximation are suggested. (36 refs.)

100515 Molecular study of outer K-L shell interactions: the Na-He collisional system. C.Courbin-Gaussorgues, V.Sidis, J.Vaaben (Lab. des Collisions Atomiques et Moleculaires, Univ. de Paris-Sud, Orsay, France).
J. Phys. B (GB), vol.16, no.15, p.2817-30 (14 Aug. 1983).
A Feshbach projection operator technique involving self-consistent field (SCF) calculations in orthogonal subspaces is used to obtain diabatic orbitals of the Na-He collisional system. Analysis of the molecular orbital wavefunctions and their $\partial/\partial R$ couplings show that the Barat-Lichten correlation rule for the promoted orbital is incompatible with the diabatic smoothness criterion. The previously admitted conjecture that the strong asymmetry of the system would lead to an adiabatic behaviour of the $\sigma 1s_{He}$-$\sigma 3s_{Na}$ molecular orbital (MO) crossing is not supported by the presently calculated coupling matrix elements. The molecular mechanism for Na(3s→3p) excitation appears to be induced indirectly (as for Na-Ne collisions) by two successive curve crossings via the core-core K-L shell interaction. (39 refs.)

100516 Glory undulations in total integral collision cross sections. Centrifugal sudden calculations for Ar-N_2. D.C.Clary (Dept. of Chem., Univ. of Manchester Inst. of Sci. & Technol., Manchester, England), J.N.L.Connor, H.Sun.
Mol. Phys. (GB), vol.49, no.5, p.1139-47 (10 Aug. 1983).
The first centrifugal sudden (CS) calculations of glory undulations in total integral cross sections have been carried out for Ar-N_2 in the velocity range $g=501.2$-3258.4 m s^{-1}. A model Lennard-Jones (12, 6) interaction potential with $P_2(\cos\theta)$ anisotropy has been used and N_2 is assumed to be a rigid rotor. Close coupling (CC) calculations at three velocities have also been performed. The CS and CC calculations are used to assess the reliability of the much simpler infinite order sudden (IOS) approximation. It is found that the IOS method is a reliable technique for analysing glory undulations in the total integral cross section of Ar-N_2. The calculations are relevant to recent precise experimental measurements of glory undulations for atom-molecule collision systems. (47 refs.)

100517 Zero-energy scattering and bound states in the ^{4}He trimer and tetramer. S.Nakaichi-Maeda, T.K.Lim (Dept. of Phys. & Atmospheric Sci., Drexel Univ., Philadelphia, PA, USA).
Phys. Rev. A (USA), vol.28, no.2, p.692-6 (Aug. 1983).
Using the HFDHE2 He-He potential of Aziz et al. [J. Chem. Phys. 90, 4330 (1979)] with the Faddeev-Yakubovsky theory, the authors calculated the ^{4}He atom-triatom scattering length and found it to be −116 Å. The authors reduced the s-wave two-body t matrix to a separable form through the unitary-pole approximation and did the same for the s-wave [3+1] and [2+2] subamplitudes with the energy-dependent-pole approximation in their work. Also, the binding energies of all the states in the trimer and tetramer, and the atom-diatom scattering length, already determined in the authors' previous work with other potentials, were recalculated for the new interaction. The authors found an excited trimer bound state, apparently not an Efimov state, near the atom-diatom threshold and an atom-diatom scattering length of 195 Å. A feature of the results was the absence of an excited state in the tetramer but in its place was a resonancelike state which led to the large atom-triatom scattering length. (14 refs.)

Quantum-mechanical spectral moments in collision-induced light scattering and collision-induced absorption in rare gases at low densities .....See Entry 100320

Saturation behavior of a far-wing satellite ....See Entry 100321

Collisional selection rules in the rotational spectrum for asymmetric-top molecules ....See Entry 100365

Collision induced light scattering in gaseous H_2S ....See Entry 100406

K_2 ground-state relaxation studies from transient process kinetics .... See Entry 100450

Line shape and moment analysis in depolarized induced light scattering .... See Entry 100458

Light scattering from gaseous nitrous oxide: effects of correlation between molecular and intermolecular axes upon the depolarization ratio in terms of the anisotropic potential choice .... See Entry 100462

Narrowing of a two-photon resonance due to elastic collisions .... See Entry 100482

Study of dissociation and neutralization of the H_2^+ ion passing through a molecular hydrogen target in the energy range 10-100 keV .. See Entry 103495

Why are perturbations of HCl by N_2 and CO so different? II. Matrix isolation experiments .... See Entry 103513

An experimental apparatus for chemiluminescence and its characteristics .... See Entry 103531

34.50E Rotational and vibrational energy transfer

100518 On the interpretation of vibrational relaxation times. H.Teitelbaum (Dept. of Chem., Univ. of Ottawa, Ottawa, Ontario, Canada).
Can. J. Chem. (Canada), vol.61, no.6, p.1253-66 (June 1983).
Rate laws for the evolution of vibrational energy level populations are derived when the Bethe-Teller law is obeyed. It is assumed that a Boltzmann distribution is maintained via rapid V-V processes. A variety of different rate laws result depending on the size and direction of the perturbation, the extent from equilibrium, and how classical the oscillator is at the initial and final conditions. An earlier analysis by Breshear (1973) is shown to be a special case. A prescription is given for procedures to compare relaxation times obtained from shock tube experiments and from laser-induced fluorescence experiments, when T-V energy transfer processes are rate-determining. Corrections for thermal effects are included. Shock tube, fluorescence, and chemical activation experiments are proposed which provide meaningful conditions for testing the Bethe-Teller law and for testing the existence of a Boltzmann distribution. (13 refs.)

100519 Generalized rate law for vibrational relaxation of a pure diatomic gas. H.Teitelbaum (Dept. of Chem., Univ. of Ottawa, Ottawa, Ontario, Canada).
Can. J. Chem. (Canada), vol.61, no.6, p.1267-75 (June 1983).
The master equation for the vibrational relxation of a pure gas of diatomic molecules AB is reduced to a simple analytical rate law. Anharmonicity is accounted to first order, and both T-V and near-resonant V-V energy transfer processes are included with the limitation that $\Delta v=\pm 1$. Landau-Teller type transition probabilities are used to sale the rate constants. The rate law consists of a pair of simultaneous first order nonlinear differential equations—one for the mean vibrational energy, $\bar{E}$, and one for the mean squared vibrational energy E^2; or equivalently a nonlinear second order differential equation for $\bar{E}$ with respect to time, t, plus an algebraic equation for $\bar{E}^2$. The Bethe-Teller law, $\mathrm{d}\bar{E}/\mathrm{d}t=-(E-\bar{E}^{x})/\tau$, is valid only in the limit of zero anharmonicity or slow V-V processes, or when the initial population is Boltzmann, such as in shock tube experiments. A population distribution which is initially Boltzmann will remain so; whereas a nonBoltzmann distribution rapidly becomes a Boltzmann distribution on a time scale determined by the sum of T-V and V-V rate constants. The study allows one to gauge the importance of two common assumptions: the validity of the Bethe-Teller law and the existence of a Boltzmann distribution or vibrational temperature during the relaxation. (14 refs.)

100520 Solutions of the generalized rate law for vibrational relaxation of a pure diatomic gas. H.Teitelbaum (Univ. of Ottawa, Ottawa, Ontario, Canada).
Can. J. Chem. (Canada), vol.61, no.6, p.1276-87 (June 1983).
The generalized rate law for the relaxation of the vibrational energy of a pure diatomic gas, AB, derived by the author, (ibid., vol.61, no.6, p.1266, 1983) is solved analytically for a variety of initial conditions corresponding to shock tube, laser-excited fluorescence, and chemical activation experiments The resulting expressions can be used to easily predict whether a given system will relax according to a V-V or a T-V mechanism or both. The initial conditions and the molecular anharmonicity are as important, if not more important, for this purpose than the ratio of T-V and V-V rate constants. Behind shock waves the energy relaxes exponentially with a T-V time constant. The initial distribution remains Boltzmann. A short survey of various laser and chemical excitations in the literature is presented and analyzed in terms of initial conditions. In general, the larger the degree of excitation and the higher the quantum numbers of the excited levels, the more V-V character does the energy relaxation have. The master equation for the time evolution of individual level populations is reduced to a simple form for times applicable to the early V-V redistribution of vibrational energy. This leads to a simple prescription for extrapolating measured population distributions back towards the initial distributions produced by a chemical reaction. The general features of the time-evolution profiles are found by numerical integration to show an initial broadening of the distribution simultaneous with a shift towards $v=0$. (51 refs.)

100521 Surface hopping trajectory calculations for electronic rotational and vibrational inelastic collisions for the Na-N_2 system. P.Archirel (Lab. de Chimie, ENSJF, Montrouge, France), P.Habitz.
Chem. Phys. (Netherlands), vol.78, no.2, p.213-27 (15 July 1983).
The processes $Na(^2P)+N_2[^2\Sigma(v,j)]\rightleftharpoons Na(^2S)+N_2[^2\Sigma(v',j')]$ have been investigated by classical trajectory calculations on the three lowest potential surfaces of the system Na-N_2. The transition probabilities at the real and avoided crossings were determined according to the linear model. The coupling matrix elements for rotation of the quasimolecule NaN_2 were calculated with the aid of the Hellmann-Feynman theorem and those for the relative movement of the three atoms were extracted from the splitting of the adiabatic potential surfaces according to the Landau-Zener model. The total and differential cross sections for the quenching, the excitation and the elastic processes are in good agreement with experiment. The detailed theoretical results give a better understanding of the mechanism of the processes. (30 refs.)

100522 Collisional and radiational energy transfer in the system $Na^*(3^2P)+Na_2\ (X^1\Sigma^+)\rightarrow Na(3^2S)+Na_2^*(A^1\Sigma^+)$. P.Arrowsmith, S.H.P.Bly, P.E.Charters, P.Chevrier, J.C.Polanyi, H.H.Telle (Dept. of Chem., Univ. of Toronto, Toronto, Canada).
Chem. Phys. (Netherlands), vol.79, no.1, p.31-40 (15 Aug. 1983).
An experimental study of electronic energy transfer to electronic-plus-vibrational excitation, E→E, V, has been performed in the system $Na^*(3^2P)+Na_2\ (X^1\Sigma^+)$ under low-pressure conditions. The Na* was produced in the chemical reaction $F+Na_2\rightarrow NaF+Na^*$. Emission spectra of Na_2 (A-X) showed that $Na_2(A^1\Sigma^+)$ was populated by collisional transfer, $Na^*+Na_2\rightarrow Na+Na_2^*$, as well as by absorption of sodium D-line radiation. Simulations of the experimentally observed spectra indicated that both resonant and non-resonant channels contributed to the Na^*+Na_2, E→E, V collisional energy transfer. The relative contributions of the two pathways for collisional energy transfer were found to be ≈20% resonant and 80% non-resonant. (39 refs.)

100523 Theoretical investigation of rotational rainbows in $K+N_2$ and K+CO collisions. D.Hausler, R.Schinke (Max-Planck-Inst. fur Stromungsforschung, Gottingen, Germany).
Chem. Phys. (Netherlands), vol.79, no.1, p.147-58 (15 Aug. 1983).
The appearance of rotational rainbows in $K+N_2$ and K+CO collisions is investigated using ab initio SCF potential surfaces. The scattering calculations are performed within the semiclassical coupled-states (SCCS) approximation which is a combination of the semiclassical IOS and CS approximation. The authors demonstrate that this method is ideally suited to study rotational excitation in impulsive collisions. The results are compared with the experimental data of Beck et al. (1979) and satisfactory agreement is obtained for $K+N_2$. For K+CO the authors have the interesting situation that the more inelastic rainbow is nicely reproduced while the other occurring at lower transitions is poorly described. It is shown that failures of the potential surface are responsible for this artifact. The isotope effect observed experimentally in $K+C^{16}O$ and $K+C^{18}O$ collisions is accurately reproduced and an interpretation in terms of the potential surface is given. (33 refs.)

100524 A new semiclassical approach to the molecular dynamics: label variable classical mechanics. S.Shi (Dept. of Chem., Univ. of California, Berkeley, CA, USA).
J. Chem. Phys. (USA), vol.79, no.3, p.1343-52 (1 Aug. 1983).
A new semiclassical approach to molecular collision dynamics is developed. In this approach the state of a system is described by a unit vector in Hilbert space. By choosing a reference unit vector and a continuous mapping, a correspondence between the vector in Hilbert space and the point in a label space is established, i.e. the vector in Hilbert space is parametrized or labeled by complex variables. It is shown that the label variables formally obey classical mechanics. Thus, the time evolution of the vectors in Hilbert space, i.e. the evolution of the states of the system, can be determined by calculating the evolution of the label variables classically. To illustrate this idea, the formalism for calculating the vibrational transition probability in the collinear collision A+BC is presented, and a demonstrative calculation for the collinear Secrest-Johnson model of $He+H_2$ vibrationally inelastic scattering has been carried out. The comparison with the exact quantum results shows that the agreement is encouragingly good. (12 refs.)

100525 Vibrational relaxation of NO^+ (v) ions in neutral collisions. W.Dobler, W.Federer, F.Howorka, W.Lindinger (Inst. fur Experimentalphys., Innsbruck, Austria), M.Durup-Ferguson, E.Ferguson.
J. Chem. Phys. (USA), vol.79, no.3, p.1543-4 (1 Aug. 1983).
Vibrational relaxation of neutral molecules has been an active subject for a long time and a wealth of data exists. Until recently, almost no data has been available for collisional vibrational relaxation of molecular ions. The use of selected ion flow drift tubes with monitor ion probes for vibrational state now allows such measurements from thermal to ~1 eV collision energy. Vibrational relaxation of N_2^+ ($v=1$) ions by Ne, N_2, O_2, and CO_2 and by Kr and NO have been measured previously. authors report preliminary results on vibrational quenching of $NO^+(v)$. Ions are produced by impact of ~15 eV electrons on dilute NO in H and injected into the FDT by a Venturi inlet and detected by a quadrupole mass spectrometer. The ion energy was varied from thermal to ~1 eV by an applied electric field. (12 refs.)

100526 Beam-gas collision system for excitation cross-section measurements. J.M.Madson, E.A.Theby (McDonnell Douglas Res. Labs., McDonnell Douglas Corp., St. Louis, MO, USA).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.958-66 (Aug. 1983).
A beam-gas collision experiment to measure excitation cross sections for translation-to-vibration (T-V) energy-transfer collision processes that produce short-wavelength infrared radiation (SWIR) has been assembled and used to obtain the $(0,0^\circ,0\rightarrow 0,0^\circ,1)$ excitation cross section for CO_2 by collision with Ar. A unique modulation technique used in this system involves pulse-modulating one of the reactants, injecting the pulses into a flowing plasma carrier, supersonically expanding the pulse and carrier, and extracting a beam from the expansion while preserving the modulation of the reactant. Enhanced radiation due to thermalization of excited CO_2 at sphere pressures greater than single collision conditions, has been measured and a correction factor for this effect obtained. Measurements of the argon velocity and flux in a helium beam, CO_2 number density in an integrating sphere, and infrared radiation at 4.25 μm were made to determine the excitation cross section at a collision velocity of 2.3 km s^{-1}. The average of three sets of measurements yields a value of $\sigma^*=3.7(\pm 3)\times 10^{-19}$ cm^2. (13 refs.)

The analytically continued *S* matrix for potentials defined as a sum of exponentials. II. The multichannel problem .... See Entry 98813

Intramolecular energy redistribution in polyatomic ions .... See Entry 100292

Rotational and vibrational distributions of $N_2(C^3\Pi_u)$ excited by state-selected $AR(^3P_2)$ and $Ar(^3P_0)$ metastable atoms .... See Entry 100339

Raman spectroscopic studies on the dynamics of a molecular 'probe' (methyl iodide) in hydrocarbon solvents .... See Entry 100403

Viscosity dependence of internal conversion rates of polyatomic molecules .... See Entry 100444

Coriolis effects on intramolecular vibrational relaxation: rotational contour dependence of pyrimidine fluorescence .... See Entry 100449

Electron transfer in alkali atom CH_3NO_2 collisions .... See Entry 100546

Rotational excitation of molecules by slow neutrons. II .... See Entry 100583

Determination of the rate constants used in design calculations relating to low-temperature CO_2-D_2 gasdynamic lasers .... See Entry 100731

Vibrational relaxation and laser extraction in rare gas halide excimers .... See Entry 100740

A molecular dynamics simulation of rotational and vibrational relaxation in liquid HCl .... See Entry 101523

State-selected molecular-beam reaction dynamics of K with HF ($v=1$, $j=5$, 6 and 7) .... See Entry 103500

Nonequilibrated energy distribution in polyatomic molecules: the infrared MPD of cyclobutanone .... See Entry 103549

Light-induced dynamics of chlorophyll systems studied by neutron spectroscopy .... See Entry 103791

34.50H Electronic excitation and ionization (inc. beam-foil excitation and ionization)

100527 Intershell transition of atomic electrons during inner-shell ionization by heavy-ion impact. T.Mukoyama (Inst. for Chem. Res., Kyoto Univ., Kyoto, Japan).
Bull. Inst. Chem. Res. Kyoto Univ. (Japan), vol.61, no.1, p.30-5 (March 1983).
Expressions for probabilities of electron transition between *K* and *L* shells during ion-atom collisions have been derived using the semiclassical approximation. The *K*-shell ionization cross sections by heavy-ion impact have been modified by taking into account the intershell transition probabilities of *K*- and *L*-shell electrons. The results indicate that the effect of the intershell transition on the *K*-shell ionization cross sections is small. (13 refs.)

100528 Beam foil spectra, radiative lifetimes and transition probabilities of carbon. Liu Jiarui, Yu Guiju, Liu Wanyin (Inst. of Phys., Acad. Sinica, Peking, China), Wang Duanwei, Liu Hanpeng, Sun Yinguan, Shang Shixuan.
Nucl. Tech. (China), no.2, p.22-4 (April 1983). In Chinese.
When a monoenergetic (175 keV, 1 μA) beam of $^{12}C^+$ ions passed through a $5\sim10$ $\mu g/cm^2$ carbon foil, a beam-foil spectroscopic source of atomic and ionic carbon was produced in various stages of ionization and electronic excitation. Spectra, radiative lifetimes and transition probabilities had been obtained by the beam-foil method for many excited terms in C II and C III. (7 refs.)

100529 Hermitean DIM model for potential energy surfaces relevant to chemiionization processes. J.Vojtik, I.Paidarova (J. Heyrovsky Inst. of Phys. Chem. & Electrochem., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.93-7 (29 July 1983).
A new version of the diatomics-in-molecules (DIM) approach to the calculation of basic characteristics of chemiionization processes is presented. In this scheme the description of a resonant state (including the prediction of its width) is based on the diagonalization of only one hermitean matrix. A sample calculation on the $He(2^3S)$-H_2 system is reported. (14 refs.)

100530 Description of a measurement program for determining excitation cross section values of exhaust species. M.G.Dunn, J.A.Lordi (Aerodynamic Res. Dept., Calspan Advanced Technol. Center, Buffalo, NY, USA), S.Zakanycz.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.366, p.50-8 (1983). (Modern Utilization of Infrared Technology VIII, San Diego, CA, USA, 26-27 Aug. 1982).
A measurement program currently underway at Calspan to determine the excitation cross section (σ^*) for the interaction of CO_2 and H_2O molecules with atomic oxygen is described. A shock-tube technique is used to drive a monoenergetic stream of atomic oxygen, in a helium plus argon diluent, into a jet of target gas injected normal to the incident beam. Subsequent radiation resulting from the collisional interaction of the highly expanded beams is observed immediately downstream using a filtered indium antimonide detector. With this experimental technique, measurements have been obtained for interaction velocities in the range of 4.5 to 7 km/sec. (3 refs.)

100531 Optimum argon-hydrocarbon Penning mixture ionization formula. A.E.D.Heylen (Dept. of Electrical & Electronic Engng., Univ. of Leeds, Leeds, England).
Int. J. Electron. (GB), vol.55, no.2, p.259-64 (Aug. 1983).
A general formula is presented which allows the Penning ionization in an argon-acetylene gas mixture to be directly obtained for any value of reduced electric field at any given gas added fraction. Agreement between this formula and experimental data is excellent. (7 refs.)

100532 Flowing afterglow studies of organic positive ions generated by Penning ionization using metastable argon atoms. D.R.Anderson, V.M.Bierbaum, C.H.Depuy, J.J.Grabowski (Dept. of Chem., Univ. of Colorado, Boulder, CO, USA).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.1, p.65-94 (1 Aug. 1983).
Penning ionization of organic molecules has been used as a convenient, clean ion source for flowing afterglow studies of organic positive ion/molecule reactions. Ionization reactions of 36 compounds were investigated, including alkanes, alkenes, ketones, ethers, chlorides and silanes. In many cases the parent ion is produced solely, but a few compounds fragment to give a daughter ion as the only ion. Some of these ions were then studied in reactions with their parent neutral molecules and in hetero-ion/molecule reactions. The combination of mild ionization and rapid thermalization in helium buffer gas circumvents complications from excited reactants. The reactions between ethylene radical ion and ethylene were examined in detail and the results are compared with both low-and high-pressure results in the literature. Rate constants and branching ratios were measured and mechanistic implications are discussed. It was determined that the loss of metastable argon by diffusion and destruction at the walls is considerably slower than the comparable loss of ions and this must be taken into account in kinetic measurements. Other reactions, including proton transfer equilibria, were also studied briefly. (40 refs.)

100533 Study of $O_2(^1\Delta)$ production in a glow discharge at large molar flow rates. L.Torchin, R.Jegou, H.Brunet (Labs. de Marcoussis, Centre de Recherches de la Campagnie Generale d'Electricite, Marcoussis, France).
J. Chem. Phys. (USA), vol.79, no.4, p.2100-2 (15 Aug. 1983).
Derwent and Thrush (Faraday Discuss. Chem. Soc., vol.53, p.162, 1972) suggested that the nearly resonant energy transfer $O_2(^1\Delta)+I(^2P_{3/2})\rightleftarrows O_2(^3\Sigma)+I(^2P_{1/2})$ could be used to produce laser action in atomic iodine. Considerable efforts have been devoted to singlet oxygen production. As an iodine laser would require molar flow rates and pressure around 5-10 m mol./s and 10 Torr, the authors have studied $O_2(^1\Delta)$ production in an electric discharge under such conditions. Atomic oxygen, a rather efficient deactivator of singlet oxygen, has also been measured. (9 refs.)

100534 Ionisation of atomic hydrogen by 4.8 MeV C^{6+} ions. M.B.Shah, H.B.Gilbody (Dept. of Pure & Appl. Phys., Queen's Univ. of Belfast, Belfast, N Ireland).
J. Phys. B (GB), vol.16, no.15, p.L449-52 (14 Aug. 1983).
A crossed-beam coincidence counting technique incorporating time-of-flight spectroscopy, previously developed in the authors' laboratory, has been used to determine the cross section for ionisation of H(1s) atoms by C^{6+} ions at 400 keV amu^{-1}. The result is compared with previous measurements for bare nuclei projectiles and with recent theoretical predictions. (15 refs.)

100535 Inverted cusps in electron spectra near zero velocity in an attractive Coulomb field. J.Burgdorfer (Univ. of Tennessee, Knoxville, TN, USA).
Phys. Rev. Lett. (USA), vol.51, no.5, p.374-7 (1 Aug. 1983).
An inverted cusp in the near-zero-velocity electron-loss spectrum for a $2p$ ($m=0$) initial state is predicted for an attractive final-state Coulomb interaction. The dip occurs in the singly differential cross section $d\sigma/d\nu_e$, calculated in Born approximation, at $\nu_e=\nu_P$, where the electron velocity ν_e matches the projectile velocity ν_P and where the familiar cusp normally appears. The dip becomes more pronounced with increasing projectile velocities $\nu_P\rightarrow\infty$. Its existence is traced to the odd Π_z parity of the initial state. (13 refs.)

100536 Projectile ionization in fast heavy-ion-atom collisions. D.Schneider (Phys. Div., Argonne Nat. Lab., Argonne, IL, USA), M.Prost, N.Stolterfoht, G.Nolte, R.Du Bois.
Phys. Rev. A (USA), vol.28, no.2, p.649-55 (Aug. 1983).
Electron emission following the ionization of projectile ions has been investigated systematically in collisions with Ne^{q+} and Ar^{q+} ions at several hundred MeV incident on different target gases. The projectile electrons are concentrated within one maximum, the electron-loss peak (ELP). The variation of the shape and intensity of the ELP with the projectile energy, its charge state, the observation angle, and the target gas has been measured. Theoretical predictions which are based on the binary-encounter approximation show, in general, good agreement with the experimental data. The contributions of the different subshells to the ELP are deduced. It is shown that electronic screening of the target nucleus plays an important role in the ionization process of the projectile ions. (18 refs.)

100537 Experimental evidence of beam-foil convoy electrons being produced by an electron transfer to the continuum mechanism. P.Focke, W.Meckbach, C.R.Garibotti, I.B.Nemirovsky (Centro Atomico Bariloche, Comision Nacional de Energia Atomica, Bariloche, Argentina).
Phys. Rev. A (USA), vol.28, no.2, p.706-12 (Aug. 1983).
The origin of beam-foil convoy electrons has been a subject of many controversial interpretations and discussions. In this work, velocity distributions of electrons ejected into the forward direction from a carbon-foil target have been measured with incident proton beams of energies between 60 and 300 keV, and under the same experimental conditions as equivalent measurements recently performed in this laboratory with a He-gas target. Cusp widths are discussed as a function of projectile velocity and instrumental angular acceptance by taking fractional peak heights from the base line as well as by previously subtracting a background obtained by joining peak tails. It is concluded that neither of these procedures is valid. On the other hand, measured electron spectra can be well fitted in terms of a general parametric expression of the scattering amplitude for an electron transfer to the continuum process The absence of a strong negative cusp skewness, as was observed with the gas target, hints in the direction of an electron loss rather than an electron capture to the continuum process. A significant background contribution that is absent for a single-collision electron transfer to the continuum process is interpreted as due to the emission of secondary electrons that are not correlated to the emerging projectiles. (23 refs.)

100538 Electric field ionization of foil-excited Rydberg states of fast heavy ions. E.P.Kanter, D.Schneider, Z.Vager (Phys. Div., Argonne Nat. Lab., Argonne, IL, USA).
Phys. Rev. A (USA), vol.28, no.2, p.1193-4 (Aug. 1983).
The absolute yield of beam-foil-excited Rydberg states is measured, with the use of field-ionization techniques, for 125-MeV sulfur ions. The result, which agrees with a simple estimate, is compared with yields inferred from recent measurements of delayed *K* X-rays. (10 refs.)

Collisional quenching of $A\ ^2\Sigma^+$ OH at elevated temperatures .... See Entry 100448

Surface hopping trajectory calculations for electronic rotational and vibrational inelastic collisions for the Na-N_2 system .... See Entry 100521

Collisional and radiational energy transfer in the system Na^* (3^2P)+Na_2 ($X^1\Sigma^+$)$\rightarrow$Na(3^2S)+Na_2^*($A^1\Sigma^+$) .... See Entry 100522

Atomic charge exchanges in close collisions between N^{+q} ions and gas targets in the MeV energy range .... See Entry 100549

Determination of the absolute rate constant for associative ionization in crossed-beam collisions between $Na3^2P_{3/2}$ atoms .... See Entry 103517

34.50L Chemical reactions, energy disposal, and angular distribution, as studied by atomic and molecular beams

(see also 31.70F and 82.20K Potential-energy surfaces, 82.40D Beam reactions)

100539 The production of charged fragments of energetic hydrogen cluster ions by interaction with an H_2O gas target. P.R.W.Henkes (Inst. fur Kernverfahrenstech., Kernforschungszentrum Karlsruhe, Karlsruhe, Germany), U.Pfeiffer.
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.1, p.43-57 (1 Aug. 1983).
Hydrogen cluster ions of 800 keV were passed through an H_2O gas target. The production and destruction of charged fragments was followed as a function of the target thickness. The comparison of the experimental results with those of a model calculation shows that the dominant process for fragment production is most probably the evaporation of H_2 molecules. Indications of the luminescence of clusters after electron impact are found from a background signal. (16 refs.)

Cluster spectroscopy .... See Entry 100472

Determination of the absolute rate constant for associative ionization in crossed-beam collisions between $Na3^2P_{3/2}$ atoms .... See Entry 103517

34.70 CHARGE TRANSFER

(see also 82.30 Charge transfer reactions)

100540 Electron capture process in proton-alkali atom collisions. K.B.Choudhury, D.P.Sural (Dept. of Phys., Jadavpur Univ., Calcutta, India).
Indian J. Phys. Part B, vol.57B, no.1, p.20-6 (Feb. 1983).
The electron capture process in proton-alkali atom collisions is studied using the wave formulation of the impulse approximation. Differential and integral cross sections for electron capture from sodium into the ground state of hydrogen are calculated for incident energy varying from 50 to 500 keV. The results are compared with those from other available works. (6 refs.)

100541 Multiple scattering of neon ions in helium in the presence of magnetic focusing. S.Kundu, T.Chakraborty, S.B.Karmohapatro (Saha Inst. of Nuclear Phys., Calcutta, India).
Indian J. Phys. Part B, vol.57B, no.1, p.51-6 (Feb. 1983).
Reports the indirect evaluation of lateral multiple scattering distributions from the peak current density of 1.5-10 keV Ne^+ ion in helium target of reduced thickness $2.25\times10^{-3}<\tau<1\times10^{-2}$ in a 210° two direction focusing mass spectrometer and compare the results with the multiple scattering theory, modified to accommodate the magnetic focusing effect. The value of

the scattering parameter and the deviations of the experimental data from the scaling properties inherent in the theory due to the low range of τ is independent of magnetic focusing. The total collision cross section of neon ions in helium is also evaluated in the same apparatus by beam attenuation technique showing the predominance of multiple scattering over charge transfer and oscillations in the cross section curve might be due to variations in multiple scattering on electrons of the target. (11 refs.)

100542 A theoretical study of coherence effects in charge transfer collisions: application to Na-Li$^+$. A.E.Orel, K.C.Kulander (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
J. Chem. Phys. (USA), vol.79, no.3, p.1326-33 (1 Aug. 1983).
The authors have carried out a theoretical study of charged exchange in the Na-Li$^+$ system and have examined the effects of coherent laser preparation of excited target states. Accurate potential energy curves and nonadiabatic coupling matrix elements were obtained from ab initio, all-electron configuration-interaction calculations. These were used in determining the cross sections over a range of collision energies. Significant differences between coherent and incoherent target preparation were observed in both total and partial cross sections. (22 refs.)

100543 Measurements of cross sections for inelastic collisions between $^4He^+$ ions. B.Peart, K.Rinn, K.Dolder (Dept. of Atomic Phys., Univ. of Newcastle upon Tyne, Newcastle upon Tyne, England).
J. Phys. B (GB), vol.16, no.15, p.2831-5 (14 Aug. 1983).
Cross sections for He^{2+} production and charge transfer have been measured for collisions between two unexcited He^+ ions at centre-of-mass energies between 14 and 58 keV. In this range the cross section for He^{2+} production rose with increasing energy from 5.3×10^{-18} cm^2 to 24×10^{-18} cm^2, whilst the cross section for charge transfer increased from 5.2×10^{-18} cm^2 to about 19×10^{-18} cm^2. The measurements of charge transfer were compared with theoretical and experimental results for $He(1s^2)+He^{2+}\rightarrow He^+(1s)+He^+(1s)$. Excellent agreement was found which implies that, for interactions between $^4He^+$ ions at these energies, charge transfer proceeds almost exclusively into the ground state. (6 refs.)

100544 $He^{2+}+He$ collisions in time-dependent Hartree-Fock theory. K.R.S.Devi, J.D.Garcia (Dept. of Phys., Univ. of Arizona, Tucson, AZ, USA).
J. Phys. B (GB), vol.16, no.15, p.2837-47 (14 Aug. 1983).
Reports the results of the first calculations of single- and double-electron transfer cross sections in $He^{2+}+He(1s^2)$ collisions within the time-dependent Hartree-Fock approximation. The energy range studied is 30 to 150 keV. The total cross sections are calculated in the rotating-frame approximation; the final amplitudes are determined by projection of the time-evolved two-electron wavefunction onto atomic states with appropriate translation factors. The authors compare their results with other theoretical calculations and with experiment. (17 refs.)

100545 Charge exchange in the O^{8+}-He collision at keV amu^{-1} energies. S.Bliman, D.Hitz, B.Jacquot (CENG, Grenoble, France), C.Harel, A.Salin.
J. Phys. B (GB), vol.16, no.15, p.2849-60 (14 Aug. 1983).
Charge exchange between O^{8+} and $He(1s^2)$ is studied both theoretically and experimentally. In the energy range where capture cross sections have been measured good agreement is obtained between theory and experiments. Calculations predict that in single-electron capture the electron is transferred dominantly into O^{7+} ($n=4$), which is supported by earlier experimental work. (14 refs.)

100546 Electron transfer in alkali atom CH_3NO_2 collisions. M.A.D.Fluendy, S.Lunt (Dept. of Chem., Univ. of Edinburgh, Edinburgh, Scotland).
Mol. Phys. (GB), vol.49, no.5, p.1007-16 (10 Aug. 1983).
Vibrational and electronic excitations in alkali metal atom-nitromethane collisions at relative energies of 40-160 eV have been observed. The inelastic processes observed are similar to those seen in the analagous alkyl halide systems and are interpreted via a similar sequential electron capture and recapture mechanism. The dynamics are determined by the molecular orbital into which capture occurs with the excited state corresponding to capture into the σ^* orbital rather than the lowest unoccupied orbital (π^*) dominating the dynamics. (19 refs.)

100547 Electron capture in collisions between highly charged ions and atoms. E.Salzborn (Justus-Liebig Univ., Giessen, Germany).
Phys. Bl. (Germany), vol.39, no.7, p.200-6 (July 1983). In German.
The transfer of electrons from neutral atoms with which ions collide is a three-body problem, even in the simples case of the collision of naked nuclei with hydrogen atoms. No analytical solution of this problem is possible. Perturbation theory gives approximate solutions for the capture cross-section if the impact velocity of an ion (v) is very large compared to the orbital velocity (v_0) of the target electron. $v_0=2.19\times10^8$ cm/s for the hydrogen atom. The collision cross-section increases considerably with increasing charge of the ion and decreases steeply with increasing collision energy. Perturbation theory cannot be applied for $v\leq v_0$. The suggestion has been made to consider an adiabatically formed and decaying quasimolecule on the strength of the Coulomb forces. In multielectron systems there are numerous paths for attaining electron capture. There are further complications if several electrons are captured in one collision and if transfer ionisation by the capture of so-called 'passive' electrons takes place. At low collision energies of the order of 1keV, additional target electrons are not liberated by Coulomb ionisation, but by the release of potential energy in the capture process. This potential energy is the difference between the energies of recombination and ionisation. (15 refs.)

100548 Charge-transfer cross sections by high-velocity, completely stripped boron and carbon ions from atomic hydrogen. C.R.Mandal, S.Datta, S.C.Mukherjee (Dept. of Theoretical Phys., Indian Assoc. for the Cultivation of Sci., Jadavpur, Calcutta, India).
Phys. Rev. A (USA), vol.28, no.2, p.1144-6 (Aug. 1983).
Charge-transfer cross sections in collisions of completely stripped ions of boron and carbon with the ground state of atomic hydrogen have been calculated in the framework of the continuum-distorted-wave approximation. The total charge-transfer cross sections have also been evaluated by applying n^{-3} law from n=6 levels. The present calculated results for total cross sections are found to be in better agreement with the experimental results as compared to the existing theoretical results over the entire energy region considered. (7 refs.)

100549 Atomic charge exchanges in close collisions between N^{+q} ions and gas targets in the MeV energy range. B.Rosner, D.W.Mingay, E.Barnard (Nucl. Dev. Corp. of South Africa (Pty), Pretoria.Ltd.,S Africa).
S. Afr. J. Phys. (S. Africa), vol.6, no.1, p.1-6 (1983).
Charge state distributions of nitrogen ions after small impact-parameter collisions with nitrogen, neon, argon, krypton and xenon gases were studied. The projectiles with kinetic energies between 1.5 and 3.0 MeV and incident charge states between 1^+ and 5^+ were detected after scattering under single-collision conditions to angles between 0.2° and 4.0°. Details of the experimental set-up established in a 1.1-m diameter off-set scattering chamber are described. The results indicate that after a single close collision, the outgoing charge distributions are rather insensitive to the value of the incoming charge, the scattering angle and the target gas. Comparison with the prediction of the statistical 'compound atom' model indicates that the good agreement for the observed shapes of the outgoing charge state distributions and their average values for lower energies worsens for higher energies and heavier targets. This can be qualitatively accounted for by the possibility that under the latter conditions the randomization assumed by the model was not achieved. (13 refs.)

Connection between the bremsstrahlung tip and direct radiative recombination: angular distributions and polarization correlations ....See Entry 98788

Precision determination of the nuclear *g* factor of $^{39}K^+$ ion and diamagnetic shielding constant difference between a ^{39}K atom and a $^{39}K^+$ ion ....See Entry 100282

Photoinduced electron transfer between aromatic hydrocarbons and arene diazonium salts in micellar solutions ....See Entry 100442

A comparative study of lithium, sodium and hydrogen bonds formed by 1:1 interaction of electron donor molecules with lithium, sodium and hydrogen halides ....See Entry 100501

Experimental evidence of beam-foil convoy electrons being produced by an electron transfer to the continuum mechanism ....See Entry 100537

Elastic and rearrangement processes in positron-hydrogen collisions ....See Entry 100553

Study of dissociation and neutralization of the H_2 ion passing through a molecular hydrogen target in the energy range 10-100 keV ..See Entry 103495

Spin non-conservation in low-energy molecular charge-transfer reactions ....See Entry 103496

34.80 ELECTRON SCATTERING

100550 Electron scattering from supersonic jet-cooled molecules. J.P.Doering (Dept. of Chem., Johns Hopkins Univ., Baltimore, MD, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.2083-4 (15 Aug. 1983).
Reports the first results from an experiment designed to measure the electron energy loss spectrum of rotationally and vibrationally cooled free molecules. As examples of the technique, data are presented for rotational cooling of an EUV transition in N_2 as well as cooling of a number of transitions in a typical diene: 2,3-dimethyl-1,3-butadiene (DMB). (12 refs.)

100551 Stopping power of M-shell electrons for heavy charged particles. H.Bichsel.
Phys. Rev. A (USA), vol.28, no.2, p.1147-50 (Aug. 1983).
The stopping-power data given by Khandelwal and Merzbacher (1966) have been reevaluated because, according to Choi (1973) their expressions for the M-shell form factors were in error. Present results are (20-45)% smaller. In addition, the coefficients for the asymptotic expression were calculated. (13 refs.)

100552 Electron energy degradation in neon. R.P.Singhal, D.E.Rio, P.F.Schippnick, A.E.S.Green (Dept. of Phys., Univ. of Florida, Gainesville, FL, USA).
Radiat. Res. (USA), vol.95, no.1, p.32-44 (July 1983).
Spatial (radial and longitudinal) yield spectra for electron energy degradation in neon gas for 20 eV to 1 keV incident electrons are generated using a Monte Carlo technique. The differential elastic and inelastic scattering cross sections needed for these calculations are obtained from atomic independent particle models augmented by semiempirical modifications. Numerical four-dimensional yield spectra are represented analytically within the framework of a microplume model. Some special features of two-dimensional and four-dimensional yield spectra for a gas with a high threshold energy such as neon are discussed. Finally, yields of some prominent emission lines in neon are calculated and their spatial characteristics are represented by contour diagrams. (35 refs.)

Projectile ionization in fast heavy-ion-atom collisions ....See Entry 100536

34.80B Elastic scattering of electrons by atoms and molecules

100553 Elastic and rearrangement processes in positron-hydrogen collisions. A.Mukherjee, D.P.Sural (Dept. of Phys., Jadavpur Univ., Calcutta, India).
Indian J. Phys. Part B, vol.57B, no.1, p.13-19 (Feb. 1983).
The elastic and rearrangement processes in positron-hydrogen atom collisions are studied in an integral equation approach to the second order potential method. The principal value parts of the kernels are taken into account. The integral and differential cross sections for positronium formation are calculated for incident energies between 13.6 eV and 54.4 eV, and are compared with the available results. (16 refs.)

100554 Elastic and inelastic scattering of electrons by lithium atoms. H.S.Desai, N.S.Rao (Dept. of Phys., MS Univ. of Baroda, Baroda, India).
Indian J. Phys. Part B, vol.57B, no.1, p.37-9 (Feb. 1983).
An analytical expression for the differential scattering cross section (DCS) is obtained through order (K_i^{-2}), for the elastic and inelastic scattering of electrons by lithium atoms. Yates high energy higher order Born (HHOB) and Glauber eikonal series (GES) approximations are used for these derivations. The exchange scattering amplitudes for these processes are obtained by using Lewis integral technique. The present scattering amplitudes are compared with the recent scattering amplitudes of Rao and Desai (1983). (11 refs.)

100555 A classical model for the low-energy $e^{\pm}$-H(1s) elastic scattering. P.Grujic (Inst. of Phys., Belgrade, Yugoslavia), A.Tomic, S.Vucic.
J. Chem. Phys. (USA), vol.79, no.4, p.1776-82 (15 Aug. 1983).
A new one-electron atom classical semistochastic model has been proposed and used for calculations of an electron (positron)-ground state hydrogen elastic scattering in the low-energy region. Differential cross sections are evaluated numerically for $E=6.7$ eV, within the classical trajectory, extended Monte Carlo method. The results for the electron impact appear reasonably good for $\theta>90°$, but suffer from the forward scattering divergence. Except for the backward scattering, positron results turned out to be consistently higher than for the electron impacts. A thorough discussion of the classical approach and its perspectives in $e^{\pm}$-H scattering is given and further possible elaborations are proposed. (35 refs.)

100556 The angular variation of the asymmetry in scattering of spin-polarised electrons by hydrogen. P.W.Edmunds, M.R.C.McDowell (Dept. of Math., Royal Holloway Coll., Univ. of London, Egham, England), J.van de Ree.
J. Phys. B (GB), vol.16, no.15, p.L453-8 (14 Aug. 1983).
The angular distribution of the asymmetry in scattering of spin-polarised electrons by spin-polarised hydrogen atoms has been calculated for the first

time, for the 1s-1s and 1s-2s transitions, at impact energies of 35 and 54.4 eV. A full six-state calculation was done at 54.4 eV and ten-state localised exchange calculations at both energies. The predicted behaviour of $A_{1s,1s}(\theta)$ is smooth with a maximum of about −0.25 near 20° (54.4 eV). However, $A_{1s,2s}(\theta)$ is always positive and shows a strong narrow 'resonance' near 40°. (10 refs.)

100557 Potentials obtained by inversion of e-He atomic scattering data. H.Burger, L.J.Allen, H.Fiedeldey, S.A.Sofianos (Dept. of Phys., Univ. of South Africa, Pretoria, S Africa), R.Lipperheide.
Phys. Lett. A (Netherlands), vol.97A, no.1-2, p.39-41 (8 Aug. 1983).
Local potentials for e-He atomic scattering have been obtained from phase shifts fitted to the experimental data at 2 and 19 eV by means of quantum mechanical and semi-classical WKB inversion methods. (6 refs.)

Scattering electrons in Budapest (and elsewhere) .... See Entry 98714

Structural determination of recalcitrant molecule (S_2F_4) .... See Entry 100249

Valence-shell photoabsorption by CO_2 and its connections with electron-CO_2 scattering .... See Entry 100362

State-to-state differential and integral cross sections for vibrational-rotational excitation and elastic scattering of electrons by N_2 at 5-50 eV: calculations using extended-basis-set Hartree-Fock wave functions .... See Entry 100564

Inner-shell resonance in differential elastic scattering of electrons from N_2 .... See Entry 100573

Calculation of the polarization potential for e-N_2 collisions ... See Entry 100576

Elastic and rotational excitation of the oxygen molecule by intermediate-energy electrons .... See Entry 100579

34.80D Atomic excitation and ionization by electron impact

100558 Angular distribution of electrons scattered inelastically by hydrogen atoms. H.S.Desai, N.S.Rao (Dept. of Phys., Univ. of Baroda, Baroda, India).
Curr. Sci. (India), vol.52, no.10, p.480-1 (20 May 1983).
The Yates approximation (1979) is a small angle and high energy approximation. The main advantage of this approximation is that it is computationally simple and higher order Born terms can be obtained in the closed form. There is no problem of divergent integrals. This approximation is further simplified and has been applied to various atoms for the elastic processes. In all these problems, first two Born terms were derived according to Yates and the third Born term was approximated by the third Glauber eikonal series (GES) term of Yates. An attempt is made to calculate differential cross-section (DCS) for H(1S-2S) inelastic scattering. (8 refs.)

100559 Electron-impact ionization cross sections for Li and Na. V.Strzondala (Vysoka Skola Banska, Ostrava, Czechoslovakia).
Cesk. Cas. Fyz. Sekce A (Czechoslovakia), vol.33, no.3, p.251-8 (1983). In Czech.
Electron-impact ionization cross sections for Li and Na have been computed using some theoretical, semiempirical and empirical methods. The results of the calculations are plotted in diagrams and tables which, for comparison, also present the experimental results previously reported in the literature. (22 refs.)

100560 Determination of atomic cross-sections for electron impact excitation using effective Feynman diagrams and Einstein coefficients. S.Eliezer, D.Salzmann (Soreq Nuclear Res. Center, Yavne, Israel).
Laser & Part. Beams (GB), vol.1, pt.1, p.97-101 (Feb. 1983).
An 'effective Feynman diagram' technique is introduced to obtain relations between the cross-sections of various atomic processes. The technique is used to obtain a simple relation between the cross-sections of electron impact excitation and resonant photon absorption. The method is important because calculations of complicated atomic wavefunctions are eliminated. (15 refs.)

100561 Electron impact excitation of helium-like ions in Coulomb Glauber approximation. II. M.Kumar, S.N.Singh, A.N.Tripathi, M.K.Srivastava (Dept. of Phys., Univ. of Roorkee, Roorkee, India).
Indian J. Phys. Part B, vol.57B, no.1, p.1-5 (Feb. 1983).
For pt.I see Paramana (India), vol.16, no.6, p.457-65 (1981). Electron impact excitation integrated cross sections for $2^3s \rightarrow 2^3p$, $2^3s \rightarrow 3^3p$ and $2^3p \rightarrow 3s$ transitions in C^{4+}, N^{5+}, O^{6+} and Ne^{8+} are evaluated using Coulomb-Glauber approximations. The results are presented in terms of scaled integrated cross section $Z^4\sigma$ against scaled energy E/Z^2. (8 refs.)

100562 A higher order model for inelastic electron-atom scattering. D.P.Dewangan (Phys. Res. Lab., Ahmedabad, India).
Indian J. Phys. Part B, vol.57B, no.1, p.57-62 (Feb. 1983).
A new theoretical model, which fully incorporates the second Born amplitude under a closure approximation and which, in the limit of asymptotically high energy, reduces to the unrestricted Glauber approximation, is developed. A preliminary application of the model to the e-H(2*s*) excitation at 54.4 eV gives encouraging agreement with the differential cross sections measured by Williams (1981). (21 refs.)

100563 K-shell doubly differential cross sections for ionization of atoms. J.N.Das, S.Chakraborty (Dept. of Appl. Maths., Univ. Coll. of Sci., Calcutta, India).
Indian J. Phys. Part B, vol.57B, no.1, p.63-6 (Feb. 1983).
Doubly differential cross sections for the *K*-shell ionization have been calculated using a new model of the potential for the atomic scattering electron, proposed by the authors. A way of choosing the parameter in the potential is also suggested. Certain amendment to the earlier calculation has been made in order to remove some unsatisfactory aspects of the previous calculation of the authors. The results are presented in tabular form and agree better with the experimental results in general. (5 refs.)

100564 State-to-state differential and integral cross sections for vibrational-rotational excitation and elastic scattering of electrons by N_2 at 5-50 eV: calculations using extended-basis-set Hartree-Fock wave functions. J.R.Rumble,Jr. (NBS, Washington, DC, USA), D.G.Truhlar, M.A.Morrison.
J. Chem. Phys. (USA), vol.79, no.4, p.1846-58 (15 Aug. 1983).
The authors have calculated differential, integral, and momentum-transfer cross sections for vibrational-rotational excitation as well as for pure rotational excitation, pure vibrational excitation, and elastic scattering for electron collisions with N_2 at 5-50 eV impact energy. Scattering calculations were carried out in the fixed-nuclei approximation and excitation cross sections obtained using the sudden approximation. The interaction potential used in these calculations consists of three terms: static and local-exchange potentials, calculated from extended-basis-set Hartree-Fock wave functions as functions of internuclear distance, and a semiempirical polarization potential. Two different local exchange potentials were employed. The results are compared to each other, to previous calculations, and to experiment. (71 refs.)

100565 Treatment of resonances with the dilated electron propagator: the ^2P shape resonance in *e*-Mg scattering. M.Mishra, H.A.Kurtz, O.Goscinski, Y.Ohrn (Dept. of Quantum Chem., Uppsala Univ., Uppsala, Sweden).
J. Chem. Phys. (USA), vol.79, no.4, p.1896-902 (15 Aug. 1983).
The dilated electron propagator technique based on an underlying bivariational SCF and a second order self-energy is applied to study the ^2P shape resonance in *e*-Mg scattering. Basis set effects are studied and comparisons with the results from an alternative construction of the second order dilated electron propagator are made. (27 refs.)

100566 *R*-matrix calculation for the excitation of the lowest-lying autoionising level in lighter alkali metal atoms. S.N.Tiwary (Dept. of Appl. Math. & Theoretical Phys., Queen's Univ. of Belfast, Belfast, N Ireland).
J. Phys. B (GB), vol.16, no.15, p.L459-63 (14 Aug. 1983).
Low-energy electron impact total excitation cross sections of the lowest-lying autoionising level generated due to the inner-shell electron excitation $1s^22s^22p^63s^2S^e \rightarrow 1s^22s^22p^53s^{22}P^0$ and $1s^22s^22p^63s^23p^64s^2S^e \rightarrow 1s^22s^22p^63s^23p^54s^{22}P^0$ complex transitions in lighter alkali metal atoms i.e. sodium (Na) and potassium (K) atomic systems respectively have been calculated using single configuration Hartree-Fock (HF) wavefunctions for both initial and final states within the *R*-matrix method in the low bombarding energy region. The present calculated theoretical results differ significantly in nature from all earlier predictions and also disagree with the estimated values of the contribution of the lowest-lying autionising level to direct ionisation on the basis of the classical scaling law reported by McDowell (1969). (19 refs.)

100567 Electron-collision excitation cross section of the silver atom. A.Yu.Krasavin, A.N.Kuchenev, Yu.M.Smirnov.
Opt. & Spectrosc. (USA), vol.54, no.1, p.11-13 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.20-4 (Jan. 1983).
The cross sections for direct excitation by electron collision were measured for fifteen transitions of the silver atom. For thirteen of these transitions the optical excitation functions were recorded, varying the energy of the exciting electrons from the threshold energy to 250 eV. The operating region of the spectrum was 2000-5500 Å. The excitation cross sections of the two principal lines exceeded the excitation cross sections of all the remaining lines by more than an order of magnitude. Reabsorption of the resonance lines was detected from the change in the ratio of intensities of the lines at 3280.68 and 3382.89 Å, and so their intensity has been corrected relative to the intensities of the nonreabsorbed lines. All radiative transitions, with the exception of resonance transitions, participate in cascade population of the lowest resonance levels, making it possible to determine the resulting direct excitation cross sections of the $5p^2P_{1/2}$ and $5p^2P_{3/2}$ levels from the ground state of the silver atom. The part played by cascade population of the resonance levels is not large and is <8% for the $5p^2P_{3/2}$ level, and 10% for the $5p^2P_{1/2}$ level, of the excitation cross sections of the corresponding resonance transitions. (5 refs.)

100568 Eikonal exchange amplitude for the excitation of hydrogen-like ions by electron impact. H.Kotegawa (Dept. of Phys., Hiroshima Univ., Hiroshima, Japan), W.-J.Chen, H.Narumi.
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1369-76 (May 1983).
Validity of the Coulomb-eikonal approximation is examined in an excitation process of hydrogen-like ions. In particular, the Coulomb-eikonal exchange amplitude if formulated with a general expression which is reduced to a two-dimensional integral. The exchange amplitude evaluated for every excitation process from an arbitrary state (n,l,m) to any other state (n',l',m'). It is noted that the cross section calculated by this approximation with exchange never depends on any indefinite constant phase. (10 refs.)

100569 Angular and energy distributions of secondary electrons from helium. Slow electrons ejected by electron impact. Yong-Ki Kim (Argonne Nat. Lab., Argonne, IL, USA).
Phys. Rev. A (USA), vol.28, no.2, p.656-66 (Aug. 1983).
Recommended angular and energy distributions of slow secondary electrons produced from helium by electron impact are presented in a compact table. The table lists coefficients for the Legendre polynomials from which all angular and energy distributions can be generated for scattering angles between 0° and 180°, secondary-electron energies between 0 and 40 eV, and incident-electron energies between 100 2000 eV. The distributions represent double-differential cross sections that are consistent with expected asymptotic behavior, angular symmetry, and integrated cross sections. These cross sections should be sufficiently reliable to serve as normalization standards for experiments on secondary-electron distribution. (32 refs.)

100570 Application of the asymptotic Green's-function approximation to e^--H scattering. S.N.Tiwary (Dept. of Appl. Math. & Theoretical Phys., Queen's Univ. of Belfast, Belfast, N Ireland).
Phys. Rev. A (USA), vol.28, no.2, p.751-5 (Aug. 1983).
The author performed calculations for the excitation of the $2p_m$ states of the hydrogen atom by electron impact for λ, χ, and $d\sigma/d\Omega$ within the recently proposed asymptotic Green's function approximation, and the results are compared with the experimental observations and other theoretical predictions. Agreement between the author's calculated results and experimental data is reasonably good. (20 refs.)

Modified quasiclassical description of collisions of atomic particles at medium and low energies .... See Entry 100487

Elastic and rearrangement processes in positron-hydrogen collisions .... See Entry 100553

Elastic and inelastic scattering of electrons by lithium atoms .... See Entry 100554

The angular variation of the asymmetry in scattering of spin-polarised electrons by hydrogen .... See Entry 100556

Local model exchange potentials .... See Entry 100574

On the mass spectrometric determination of ionisation cross sections .... See Entry 100589

Positronium formation cross sections in the inert gases .... See Entry 100603

34.80G Molecular excitation, ionization, and dissociation by electron impact

100571 Metastable decomposition of $Ar_3{}^+$ cluster ions into $Ar_2{}^+$ and Ar^+. K.Stephan, T.D.Mark (Inst. fur Experimentalphys., Leopold Franzens Univ., Innsbruck, Austria), E.Mark, A.Stamatovic, N.Djuric, A.W.Castleman,Jr..
Beitr. Plasma Phys. (Germany), vol.23, no.4, p.369-72 (1983).
The authors present the first account of a study of metastable (unimolecular decay) and collision-induced dissociation of $Ar_3{}^+$ cluster ions using an experimental setup consisting of a molecular beam-electron impact ion source and a double focusing (reversed Nier Johnson geometry) mass spectrometer. The existence of the following metastable decay processes (accessible by the

authors sampling time window) could be demonstrated: $Ar_3^{+*} \rightarrow Ar_2^+$ and $Ar_3^{+*} \rightarrow Ar^+$. The processes were studied as a function of electron impact energy. The present results are of importance in order to provide some guidance for the development of appropriate theoretical models for the dissociation of cluster ions. (21 refs.)

100572 Molecular and fragment ion structure for ortho- and meta-xylene isomers. F.H.Abd El-Kader, A.A.Shokhba (Phys. Dept., Cairo Univ., Cairo, Egypt).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.1, p.59-63 (1 Aug. 1983).
Metastable peak characteristics have been applied to study the fragmentation behaviour of the molecular ions and the high intensity fragment ions of the ortho- and meta-xylene isomers after electron impact. Metastable peaks for the fragmentation of ions generated by field ionization have also been studied. The kinetic energy released (T) is calculated for the decomposition of molecular and fragment ions of the two isomers in the first and second field-free regions. It is also found that the T-values are lifetime independent. (15 refs.)

100573 Inner-shell resonance in differential elastic scattering of electrons from N_2. F.A.Rajgara, A.Roy, D.Mathur (Tata Inst. of Fundamental Res., Bombay, India).
Indian J. Phys. Part B, vol.57B, no.1, p.32-6 (Feb. 1983).
A new channel for detection of resonances associated with electron-impact excitation of inner-shell electrons is reported. A shape resonance in N_2 is located in the differential elastic cross section function at an electron energy of 401.9 eV. (6 refs.)

100574 Local model exchange potentials. S.Sur, A.S.Ghosh (Dept. of Theoretical Phys., Indian Assoc. for the Cultivation of Sci., Calcutta, India).
Indian J. Phys. Part B, vol.57B, no.1, p.767-70 (Feb. 1983).
A new variant of model exchange potential based on free electron gas approximation has been proposed. Model calculations have been performed for e-He and e-H_2 scattering. Predicted values are found to be superior to all other existing values. (8 refs.)

100575 Vibrational excitation of CH_4 by electron impact: 3-20 eV. H.Tanaka, M.Kubo, N.Onodera, A.Suzuki (Dept. of General Sci., Sophia Univ., Tokyo, Japan).
J. Phys. B (GB), vol.16, no.15, p.2861-9 (14 Aug. 1983).
Differential cross sections (DCS) for the vibrational excitations ($\nu_{2,4}$, 170 meV; $\nu_{1,3}$, 360 meV) of CH_4 by electron impact have been investigated for incident energies of 3 to 20 eV in the range of 30 to 140° using a crossed-beam apparatus. Integral and momentum transfer cross sections are calculated from the DCS. At about 7.5 eV, the angular distribution shows d-wave behaviour, and the integral cross sections are enhanced to about 10^{-16} cm^2. The parameters of angular correlation theory with the irreducible tensor method for the T_2 molecular symmetry of CH_4 were obtained by fitting. It was found that the d wave alone suffices to explain the angular distributions due to the presence of a broad resonant excitation process in the $\nu_{2,4}$ and $\nu_{1,3}$ channels. At incident energies of 10 to 20 eV, the angular distributions are isotropic within the experimental error. At lower energies of 3 to 5 eV, the distributions are practically constant within the angular range of 40 to 140°, but the cross sections continuously increase towards smaller angles. (13 refs.)

100576 Calculation of the polarization potential for e-N_2 collisions. K.Onda, A.Temkin (Lab. for Astron. & Solar Phys., NASA/Goddard Space Flight Center, Greenbelt, MD, USA).
Phys. Rev. A (USA), vol.28, no.2, p.621-31 (Aug. 1983).
A polarization potential (V_{pol}) for e-N_2 collisions is calculated by the generalization of the static part of the method of polarized orbitals to molecular targets. Partial differential equations (PDE) are derived for polarized orbitals, which are functions of the distance (r) from the molecular center and angle (θ) from the molecular axis. The equations are solved with the use of the noniterative PDE technique. From the polarized orbitals a polarization potential can be constructed whose r and θ dependence is found to be significantly different from the well-known phenomenological one. The two potentials are further compared by carrying out limited hybrid-theory scattering calculations. Only those scattering results based on the calculated V_{pol} are in satisfactory accord with experiment. (28 refs.)

100577 Dissociative recombination in low-energy e-H_2^+ collisions. A.Giusti-Suzor (Lab. de Photophys. Moleculaire, Univ. de Paris-Sud, Orsay, France), J.N.Bardsley, C.Derkits.
Phys. Rev. A (USA), vol.28, no.2, p.682-91 (Aug. 1983).
The theory of configuration interaction in molecules is extended to permit the simultaneous treatment of doubly excited electronic states and vibrationally excited Rydberg states which can decay by autoionization and predissociation. The method is applied to dissociative recombination and compared with the corresponding multichannel quantum-defect theory. Calculations using both techniques are reported for collisions of electrons of energy below 0.5 eV with H_2^+ ions in the lowest three vibrational states. The Rydberg states lead to narrow structures in the cross sections, mostly in the form of dips. The cross section and recombination rate for ground-state ions are anomalously low, being smaller than those for $v=1$ and 2 by a factor of ~ 6. (33 refs.)

100578 Cross sections for electron-impact excitation of the electronic states of N_2. Lee Mu-Tao, V.McKoy (Arthur Amos Noyes Lab. of Chem. Phys., California Inst. of Technol., Pasadena, CA, USA).
Phys. Rev. A (USA), vol.28, no.2, p.697-705 (Aug. 1983).
Distorted-wave cross sections are presented for the excitations of the $w^1\Delta_u$, $W^3\Delta_u$, $A^3\Sigma_u^+$, $b'^1\Sigma_u^+$, and $c'^1\Sigma_u^+$ states of N_2 by low-energy electron impact. The distorted waves are obtained in the static-exchange field of the ground electronic state. Differential and integral cross sections are presented from near threshold up to 60-eV impact. Comparison is made with available experimental data and with other calculations. (30 refs.)

100579 Elastic and rotational excitation of the oxygen molecule by intermediate-energy electrons. P.K.Bhattacharyya (Dept. of Phys., Calcutta Univ., Calcutta, India), K.K.Goswami.
Phys. Rev. A (USA), vol.28, no.2, p.713-21 (Aug. 1983).
The Glauber-type eikonal amplitude for a fixed molecular orientation is used in the framework of adiabatic approximation to compute pure elastic excitation ($J=1 \rightarrow J'=1$), rotational excitation ($J=1 \rightarrow J'=3$), and orientationally averaged elastic cross sections of the oxygen molecule in its ground electronic and vibrational states with the use of electrons as incident particles. Both differential and integral cross sections are reported at electron energies 20-200 eV. The effect of target polarization is included in the effective electron-molecule potential used, but that of electron exchange is neglected. The results are compared with the available experimental data and theoretical calculations of other workers. A comparative study of the molecules H_2, N_2, and O_2 as targets is made. (56 refs.)

100580 Energy lost in formation of fluorine atoms in the course of electron-beam dissociation of fluorine and fluoride molecules. A.S.Bashkin, A.N.Oraevskii, V.N.Tomashov, N.N.Yuryshev (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.242-3 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.428-9 (Feb. 1983).
It was found that the comparison of a mixture used in a chemical HF laser influenced the energy of formation ϵ_F of a fluorine atom when fluorine and fluoride molecules were associated by an electron beam. The relative uses of ϵ_F were determined for SF_6, C_5F_{12}, and CF_4. (6 refs.)

Emission spectra of supersonically cooled methyldiacetylene cations .... See Entry 100375

Emission spectra of supersonically cooled dimethyldiacetylene cations .... See Entry 100376

Studies of the photoionization cross section of the 2π level of nitric oxide .... See Entry 100466

Estimation of equilibrium structure and anharmonicity by use of changes in the r_z structure by isotopic substitution and vibrational excitation. I. General formulation and application to OCl_2 .... See Entry 100593

34.90 OTHER TOPICS IN ATOMIC AND MOLECULAR COLLISION PROCESSES AND INTERACTIONS

100581 Hydrogen and deuterium atoms, stabilized by condensation of an atomic beam in superfluid helium. E.B.Gordon, A.A.Pel'menev, O.F.Pugachev, V.V.Khmelenko (Inst. of Chem. Phys., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.5, p.282-5 (5 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.5, p.237-9 (5 March 1983).
Concentrations of H and D atoms, stabilized in a molecular matrix, up to 1×10^{20} cm^{-3} are achieved by condensation of an atomic beam of superfluid helium. Transformation D atoms into H atoms is observed, indicating the occurrence of tunneling chemical exchange reactions between atomic and molecular hydrogen isotopes. (7 refs.)

100582 Effect of extrinsic electric fields upon dielectronic recombination: Mg^{1+}. K.LaGattuta, Y.Hahn (Dept. of Phys., Univ. of Connecticut, Storrs, CT, USA).
Phys. Rev. Lett. (USA), vol.51, no.7, p.558-61 (15 Aug. 1983).
Recently, large discrepancies have appeared between theoretical predictions and experimental measurements of dielectronic recombination cross sections (σ^{DR}) for Mg^{1+} targets. This disagreement has provoked new work aimed at understanding, more fully, the effect of applied fields upon the process. This Letter reports calculations of σ^{DR} for Mg^{1+} in a small applied electric field. The field effect is large enough to bring the experimental σ^{DR} into much closer agreement with the theory. (11 refs.)

100583 Rotational excitation of molecules by slow neutrons. II. B.Ritchie (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Phys. Rev. A (USA), vol.28, no.2, p.645-8 (Aug. 1983).
The contribution of the spin-orbit interaction to the rotationally inelastic scattering of neutrons from a closed-shell diatomic molecule is studied. For small momentum transfer and $\Delta J=\pm1$ rotational transitions, the first Born-approximation amplitude depends approximately on the factor $\Delta\omega D q^{-1}$ (in atomic units), where $\Delta\omega$ is the energy transferred, D is the permanent dipole moment of the target, and q is the momentum transferred. The dependence on $\Delta\omega D$ is the same as that of the coefficient of absorption of long-wavelength radiation, and the dependence on q^{-1} is characteristic of particle scattering in a dipole potential. Essentially $\Delta J=\pm1$ cross sections are enhanced because rotational energy transfer can occur over appreciable target-neutron distances. Thus the tiny rotational transition strength $\triangle\omega D$ is weighted by the large factor q^{-1}. This means that a classical average of the cross section over molecular orientations cannot describe the physical process. The importance of this result to the theory of neutron-optical activity is discussed. (11 refs.)

100584 Use of universal Gaspar potential for evaluating the degree of ionization of atoms in an electric field. P.P.Vaitekunas, J.J.Glembockis, A.J.Savukynas (Inst. of Phys., Acad. of Sci., Lithuanian SSR).
Sov. Phys.-Collect. (USA), vol.22, no.2, p.23-6 (1982). Translation of: *Litov. Fiz. Sb. (USSR)*, vol.22, no.2, p.30-4 (1982).
A theoretical estimate is obtained for the degree of multiple-electron atoms in a strong electric field by using the universal Gaspar potential. It is shown that the resultant degree of ionization differs little from the results provided in the Thomas-Fermi approximation, if the matching parameter for the Gaspar and Coulomb potentials is determined from the hydrogen-like approximation in the case of a strong field. (8 refs.)

K_2 Rydberg state analysis by two- and three-photon ionization .... See Entry 100465

Electric field ionization of foil-excited Rydberg states of fast heavy ions .... See Entry 100538

35.00 PROPERTIES OF ATOMS AND MOLECULES; INSTRUMENTS AND TECHNIQUES

35.10 ATOMS

35.10B Atomic masses, mass spectra, abundances, and isotopes

(inc. isotope separation; for mass spectrometry, see also 07.75; for radioisotope separation see 28.42H or 82.55)

100585 Resonance neutron radiography using a pulsed neutron source and a 2-dimensional scintillation detector. M.G.Strauss, G.H.Lander, R.Brenner, C.T.Roche (Argonne Nat. Lab., Argonne, IL, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.519-30
Resonance neutron radiography is an imaging technique whereby a single exposure to neutrons produces several radiographs each of which shows a

distribution of a different isotope in the object. An accelerator-based pulsed spallation source has recently been completed at Argonne National Laboratory (ANL). A 2-dimensional neutron-position scintillation detector was also recently developed. It consists of a thin (1-2 mm) ^{6}Li glass scintillator coupled to an array of photomultipliers. The neutron source and detector were used in a resonance radiography experiment in which a foil sample consisting of indium and gold were radiographed. Two images were obtained; one due to resonance absorption of 1.46 eV neutrons in ^{115}In showing the extent of indium in the sample, and the other due to absorption of 4.91 eV neutrons in ^{197}Au showing the extent of gold. A radiography experiment on nuclear fuel pellets showed resonances of the uranium and plutonium isotopes in the range of 0.3-10 eV. The area of potential applications of resonance radiography below 20 eV includes isotopes ($Z > \sim 40$) of fission products, rare earths, heavy metals, and actinides. (8 refs.)

Neutron resonance transmission analysis of reactor spent fuel assemblies ....See Entry 99651

Large scintillation cells for high sensitivity radon concentration measurements ....See Entry 100189

Separation of deuterium by IR multiphoton decomposition of chlorodifluoromethane. IR multiphoton absorption by and decomposition of CF_2DCl/CF_2HCl mixture ....See Entry 100470

Multiple scattering of neon ions in helium in the presence of magnetic focusing ....See Entry 100541

Auger electron and characteristic energy loss spectra for electro-deposited americium-241 ....See Entry 103014

Resonance neutron radiography ....See Entry 103484

Tritium separation by laser multiple-photon dissociation of $CDTCl_2/CD_2Cl_2$ mixture ....See Entry 103545

Infrared laser multiple-photon dissociation of $CDCl_3$ in a molecular beam ....See Entry 103551

35.10D Electric and magnetic moments, polarizability

100586 **Isoelectronic wavelength predictions for magnetic-dipole, electric-quadrupole, and intercombination transitions in the Mg sequence.** J.L.Curtis, P.S.Ramanujam (Dept. of Phys. & Astron., Univ. of Toledo, Toledo, OH, USA).
J. Opt. Soc. Am. (USA), vol.73, no.8, p.979-84 (Aug. 1983).
Precise wavelength predictions are presented for the $3s3p\ ^3P_1$-$3s3p\ ^3P_2$ magnetic-dipole transitions, the $3s3p\ ^3P_0$-$3s3p\ ^3P_2$ electric-quadrupole transitions and the $3s^2\ ^1S_0$-$3s3p\ ^3P_1$, intercombination lines for all members of the Mg isoelectronic sequence with $Z \leq 45$. Magnetic-dipole and intercombination transitions of this type have recently been observed in Tokamak spectra and have applications for localized diagnostics in high-temperature plasmas. The predictions are based on interpolations and extrapolations of empirical regularities, which also provide insights into the dynamics of these atomic systems. (37 refs.)

100587 **Determination of the high-frequency dynamic polarizability of atoms by analogy with the two-center problem.** P.P.Vaitekunas, A.Yu.Savukinas.
Opt. & Spectrosc. (USA), vol.54, no.1, p.17-19 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.31-5 (Jan. 1983).
It is shown that analogy with the two-center problem can be used to examine the polarizability of atoms in a nonresonant high-frequency electromagnetic field. The principal terms in the high-frequency dipole dynamic polarizability of H, He, and Be^{2+}, obtained from energy calculations of H_2^+, H_2, and He_2^{2+} molecules at small internuclear distances, are presented. (15 refs.)

Semiclassical parametrization of the 6snh-6sni-6snk intervals in BaI ....See Entry 100257

Precision determination of the nuclear *g* factor of $^{39}K^+$ ion and diamagnetic shielding constant difference between a ^{39}K atom and a $^{39}K^+$ ion ....See Entry 100282

Vacuum polarization corrections and spin-orbit splitting in antiprotonic atoms ....See Entry 100283

Polarization of an atomic sodium beam by laser optical pumping ....See Entry 100329

Analysis of $Ar3p^6$ and $Kr4p^6$ photoionization from photoelectron-spin-polarization data ....See Entry 100334

Calculation of the probability of ionization of a hydrogen atom by a linearly polarized wave by the method of complex coordinates .... See Entry 101383

Theory of the long range polarization of an adatom near a solid surface ....See Entry 102163

Static dipole moment of an atom or a centrosymmetric molecule near a perfect metallic surface ....See Entry 102168

Surface plasmon contribution to the static dipole moment of an atom near a surface ....See Entry 102276

35.10F Relativistic corrections, fine- and hyperfine-structure constants

100588 **Precise determination of the $^{171}Yb^+$ ground state hyperfine separation.** R.Blatt, H.Schnatz, G.Werth (Inst. fur Phys., Univ. Mainz, Mainz, Germany).
Z. Phys. A (Germany), vol.312, no.3, p.143-7 (1983).
The authors performed a microwave-optical double resonance experiment on the ground state of $^{171}Yb^+$ ions. About 10^5 particles were confined in a r.f. quadrupole trap for periods of several hours in the presence of He buffer gas. Hyperfine pumping by a pulsed dye laser was followed by microwave transitions, which were observed via changes in the ionic fluorescence intensity. The ground state hyperfine splitting has been determined to $\Delta W = 12642812124.2 \pm 1.4$ Hz. The ultimate line width obtained in this experiment was 33 mHz, corresponding to a line Q of 3.8×10^{11}. The final error of ΔW is mainly determined by the accuracy of the available frequency reference. (14 refs.)

Semiclassical parametrization of the 6snh-6sni-6snk intervals in BaI ....See Entry 100257

The 2^3S-2^3P_J, $J=0$, 1, 2 intervals in neutral helium ....See Entry 100281

Vacuum polarization corrections and spin-orbit splitting in antiprotonic atoms ....See Entry 100283

Nuclear moments and isotope shifts of europium isotopes by hyperfine structure investigations with collinear laser-ion beam spectroscopy ....See Entry 100285

Multichannel quantum-defect analysis of the bound even-parity spectrum of neutral barium ....See Entry 100291

1.14-μm thulium line unbroadened by collisions .... See Entry 100311

Collision effects in velocity-selective optical pumping of sodium ....See Entry 100326

35.10H Ionization potentials, electron affinities

100589 **On the mass spectrometric determination of ionisation cross sections.** U.T.Raheja, C.Badrinathan, D.Mathur (Tata Inst. of Fundamental Res., Bombay, India).
Indian J. Phys. Part B, vol.57B, no.1, p.27-31 (Feb. 1983).
Details are presented of a recently developed experimental facility which enables accurate and reliable cross sections for electron-induced production of multiply-charged ions. (6 refs.)

An ab initio study of core-valence correlation ....See Entry 100270

35.10W Weak Interactions

100590 **Parity violation in atomic cesium and alternatives to the standard model of electroweak interactions.** C.Bouchiat, C.A.Piketty (Lab. de Phys. Theorique, Ecole Normale Superieure, Paris, France).
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.73-8 (18 Aug. 1983).
The authors study the implications of the recent observation of a parity violation in atomic cesium. After a discussion of the uncertainties associated with the atomic physics calculations they derive conservative bounds for the weak charge Q_W. These bounds are used to put constraints on alternatives to the standard electroweak model, involving an 'extra U(1)' gauge group. They analyze the possibility that the extra boson might be very light and give, as a by-product, the typical range of momentum transfer explored in atomic parity violation experiments. (20 refs.)

35.20 MOLECULES

(see also 61.55, 61.60, and 61.65 Specific structures of metals and alloys, of other inorganic materials, and of organic materials, respectively)

100591 **Computer representation of molecular surfaces.** N.L.Max (Computer Grpahics Group, Lawrence Livermore Nat. Lab., Livermore, CA, USA).
Proceedings of the Fifteenth Hawaii International Conference on System Sciences 1982, Honolulu, HI, USA, 6-8 Jan. 1982 (HI, USA: Hawaii Int. Conference Syst. Sci. 1982), p.59-66 vol.2
This review article surveys recent work on computer representation of molecular surfaces. Several different algorithms are discussed for producing vector or raster drawings of space-filling models formed as the union of spheres. Other smoother surfaces are also considered. (20 refs.)

35.20B General molecular conformation and symmetry; stereochemistry

100592 **The structure of dimethylamine.** D.C.McKean (Dept. of Chem., Univ. of Aberdeen, Aberdeen, Scotland).
J. Chem. Phys. (USA), vol.79, no.4, p.2095-6 (15 Aug. 1983).
The molecule of dimethylamine has the special interest that in each methyl group there are three bonds of differing strength, the weakest by far being that trans (antiperiplanar) to the lone pair, the strongest, that trans to the other methyl group. A least squares refinement of the geometry to fit the observed inertial constants was carried out, as in the r_0 or the preferable r_z structure, with isotopic changes to bond lengths, etc., included, these being either refined to, where the data permit, or constrained to well-established empirical values, or determined from good models. (17 refs.)

100593 **Estimation of equilibrium structure and anharmonicity by use of changes in the r_z structure by isotopic substitution and vibrational excitation. I. General formulation and application to OCl_2.** M.Nkata, S.Yamamoto, T.Fukuyama, K.Kuchitsu (Dept. of Chem., Faculty of Sci., Univ. of Tokyo, Tokyo, Japan).
J. Mol. Struct. (Netherlands), vol.100, p.143-59 (July 1983).
A general formulation is presented on the differences in the average (r_z) structure caused by isotopic substitution and vibrational excitation; the differences in the average structure for both bonded and nonbonded atomic pairs are represented as linear combinations of quadratic average values of the Cartesian displacement coordinates. This method is applicable to a joint analysis of spectroscopic and electron diffraction data so that the equilibrium geometrical parameters and effective anharmonic constants for polyatomic molecules can be estimated even when only a limited number of rotational constants for isotopic species and vibrationally excited states are available. Its application to OCl_2 molecule as an example is discussed. (28 refs.)

Scattering electrons in Budapest (and elsewhere) ....See Entry 98714

Formulation of the total molecular energy in semi-empirical SCF-MO method with overlap: application to the determination of the approximate equilibrium geometry .... See Entry 100229

Conformations of simple disulfides and L-cystine .... See Entry 100231

The vinyloxonium cation ($CH_2CHOH_2^+$) ....See Entry 100232

Ab initio SCF study of hyperfine couplings, geometries, and inversion barriers in the isoelectronic radicals NF_3^+, CF_3, and BF_3^- ....See Entry 100237

Molecular and electronic structure of phosphonium cyclopropylide ($H_3P=C(CH_2)_2$): a theoretical study ....See Entry 100238

The ab initio gradient revolution in structural chemistry: the importance of local molecular geometries and the efficacy of joint quantum mechanical and experimental procedures .... See Entry 100247

Symmetry of Kekule structures ....See Entry 100248

Structural determination of recalcitrant molecule (S_2F_4) ....See Entry 100249

A suggested revised conformation of methylthionitrite as seen by its spectra and preliminary ab initio calculations ....See Entry 100250

Structure of the nitrite ion ....See Entry 100256

Ab initio calculation of equilibrium geometry and hyperfine coupling constants of the cyclopentane cation ....See Entry 100260

Electronic structure and orbital interactions in linear PtCO . See Entry 100266

Density functional calculations for low-lying states of CO_2 ...See Entry 100295

Molecular structure of N_2O_5 in the gas phase. Large amplitude motion in a system of coupled rotors ......See Entry 100342

Why are formaldehyde and (possibly) propynal nonplanar in their $S_1(\pi^*,n)$ electronic states? ......See Entry 100348

Conformational and vibrational analysis with the aid of normal coordinate calculations ......See Entry 100355

Vibrational spectra and chemical structure of hetero-metal complexes and clusters with thiometalate ligands ......See Entry 100356

Microwave structures of cyanocyclopropane and cyclopropylacetylene. Effects of cyclopropyl π conjugation on structure ......See Entry 100367

Microwave substitution structure of the amine group in meta-chloroaniline $C_6H_4ClNH_2$ ......See Entry 100369

Microwave spectrum and structure of difluoro(trifluorosilyl)borane, SiF_3BF_2 ......See Entry 100372

The use of ^{18}O substitution in the characterization of $MReO_4$ molecules. The IR spectrum of matrix-isolated $CsReO_4$ ......See Entry 100374

Matrix-isolation infrared and ultraviolet spectroscopic studies of less stable conformers of 1,3,5-hexatriene ......See Entry 100393

The conformation and vibrational spectra of isocyanato and isothiocyanatocyclohexane ......See Entry 100395

Empirical force field calculations. XXII. Preferred conformations and barriers, to rotation in (2,2-dimethylpropyl)benzene and (1-tert-butyl-2,2-dimenthylpropyl)benzene ......See Entry 100416

EPR evidence on molecular and electronic structure of nitrogen trifluoride radical cation ......See Entry 100418

Carbon-13 magnetic resonance of hydroaromatics. II. Conformation of tetralin and tetrahydroanthracene and their methyl derivatives ......See Entry 100420

Multiple conformational states of a Pro-Pro peptide. Solid-state and solution conformations of Boc-Aib-Pro-Pro-NHMe ......See Entry 100421

The determination of absolute configuration using nuclear magnetic resonance techniques ......See Entry 100425

Study of the structure of branched oligoesters by NMR spectroscopy method ......See Entry 100426

Circular dichroism studies on azole nucleosides. The solution conformation of 5-amino-1-β-D-ribofuranosylimidazole-4-carboxamide, bredinin, pyrazofurin, ribavirin, and related nucleosides ......See Entry 100435

Study of the additivity of internal and external potentials for simple complexes of the HDO molecule ......See Entry 100490

Density functional calculations for H_2O, NH_3, and CO_2 using localized muffin-tin orbitals ......See Entry 100495

Molecular and fragment ion structure for ortho- and meta-xylene isomers ......See Entry 100572

Molecular properties of pentyl-cyano mesogens having different core structures ......See Entry 100597

Crystal and molecular structure of biacetyl (2,3-butanedione), $(H_3CCO)_2$, at -12 and -100°C ......See Entry 101680

Crystal and molecular structure of 1,6,9,12,17,20-hexaoxacyclodocosane-2,5,13,16-tetra-one ......See Entry 101685

Crystal and molecular structure of dioximeacetone thiosemicarbazone ......See Entry 101686

Hydrogen bonding and conformational effects on ^{13}C NMR chemical shifts of hydroxybenzaldehydes in the solid state ......See Entry 102767

Structure determination of carbonates and diglycol carbonates by gas chromatography-mass spectrometry ......See Entry 103609

35.20D Interatomic distances and angles

Structure of the nitrite ion ......See Entry 100256

An ab initio study of core-valence correlation ......See Entry 100270

Relativistic effects in Cu_2 bonding ......See Entry 100280

Microwave spectrum and structure of difluoro(trifluorosilyl)borane, SiF_3BF_2 ......See Entry 100372

Molybdenum K-edge extended X-ray absorption fine structure (EXAFS) studies of synthetic Mo-Fe-S clusters containing the MoS_4 unit: development of a fine adjustment technique based on models ......See Entry 100413

Density functional calculations for H_2O, NH_3, and CO_2 using localized muffin-tin orbitals ......See Entry 100495

The structure of dimethylamine ......See Entry 100592

35.20G Bond strengths, dissociation energies, hydrogen bonding, etc

Structural determination of recalcitrant molecule (S_2F_4) ......See Entry 100249

Resonance of an unshared electron pair between two atoms connected by a single bond ......See Entry 100252

An ab initio study of core-valence correlation ......See Entry 100270

A brief survey of the basic theoretical arguments on molecular structures and chemical bondings ......See Entry 100276

A quantitative analysis of the ν_s (IR) bands of H-bonds. I. Theory ......See Entry 100377

Molecular complexes of the hydrogen halides studied by matrix isolation infrared spectroscopy ......See Entry 100390

FTIR spectra of base-hydrogen fluoride hydrogen-bonded complexes in solid argon ......See Entry 100391

Infrared spectroscopic studies of hydrogen bonding in triethylammonium salts. II. Association of triethylammonium salts with bases ......See Entry 100398

Vibrational study of strong C-H...X hydrogen bonds in solid complexes of boron decachlorocarboranes ......See Entry 100405

Formation of weak hydrogen-bonded complexes as predicted by experimental atomic charges ......See Entry 100488

Note on a theoretical interpretation of the isotopic ratio $\bar{\nu}_{OH}/\bar{\nu}_{OD}$ versus $\bar{\nu}_{OH}$ in isotopically diluted HDO molecules in solid hydrates ......See Entry 100489

The proton potential in short hydrogen bonds ......See Entry 100500

A comparative study of lithium, sodium and hydrogen bonds formed by 1:1 interaction of electron donor molecules with lithium, sodium and hydrogen halides ......See Entry 100501

Measurements of depolarization ratios of gaseous linear chain molecules: a test of the principle of the additivity of bond polarizabilities ......See Entry 100595

Ab initio orbital calculations on clusters of methyl fluoride ......See Entry 100624

Hydrogen bonding and conformational effects on ^{13}C NMR chemical shifts of hydroxybenzaldehydes in the solid state ......See Entry 102767

Why are perturbations of HCl by N_2 and CO so different? II. Matrix isolation experiments ......See Entry 103513

35.20J Barrier heights (internal rotation, inversion); rotational isomerism, conformational dynamics

100594 The story of the ammonia molecule: ten years of investigation of molecular inversion. D.Papousek (J. Heyrovsky Inst. of Phys. Chem. & Electrochem., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
J. Mol. Struct. (Netherlands), vol.100, p.179-98 (July 1983).
The application of the Hougen-Bunker-Johns (HBJ) Hamiltonian to quasi-planar molecules is discussed with special emphasis on ammonia. The double-minimum potential functions of ammonia obtained in the approximation of the rigid invertor, 'harmonic' nonrigid invertor, and 'anharmonic' non-rigid invertor are compared from the point of view of their isotopic invariancy. The HBJ Hamiltonian can also be applied with advantage to the quantitative analysis of the transition frequencies obtained by high and very high resolution spectroscopy, as well as to the interpretation of the anomalous inversional dependence of the dipole moment function, quadrupole couping or of the g-tensor function. The newly determined 'true' barrier height for ammonia inversion by fitting the experimental data on vibration-inversion-rotation transitions is 1834 cm^{-1}. (48 refs.)

Molecular and electronic structure of phosphonium cyclopropylide $(H_3P{=}C(CH_2)_2)$: a theoretical study ......See Entry 100238

A suggested revised conformation of methylthionitrite as seen by its spectra and preliminary ab initio calculations ......See Entry 100250

Ethene thiol: a vibrational analysis ......See Entry 100354

Conformational and vibrational analysis with the aid of normal coordinate calculations ......See Entry 100355

Microwave spectrum and selenol internal rotation of 2-propaneselenol ......See Entry 100370

Microwave spectrum and structure of difluoro(trifluorosilyl)borane, SiF_3BF_2 ......See Entry 100372

Matrix-isolation infrared and ultraviolet spectroscopic studies of less stable conformers of 1,3,5-hexatriene ......See Entry 100393

On the second rotational isomeric form of butadiene-1,3 ......See Entry 100404

Empirical force field calculations. XXII. Preferred conformations and barriers, to rotation in (2,2-dimethylpropyl)benzene and (1-tert-butyl-2,2-dimenthylpropyl)benzene ......See Entry 100416

Circular dichroism studies on azole nucleosides. The solution conformation of 5-amino-1-β-D-ribofuranosylimidazole-4-carboxamide, bredinin, pyrazofurin, ribavirin, and related nucleosides ......See Entry 100435

Molecular and fragment ion structure for ortho- and meta-xylene isomers ......See Entry 100572

Ab initio energy calculations for the intramolecular rotational potential of polyacetylene ......See Entry 100609

Rotational isomerism and ultrasonic relaxation in 1,2-dibromoethane ......See Entry 101864

35.20M Electric and magnetic moments (and derivatives), polarizability, and magnetic susceptibility

100595 Measurements of depolarization ratios of gaseous linear chain molecules: a test of the principle of the additivity of bond polarizabilities. J.E.M.Haverkort, F.Baas, J.J.M.Beenakker (Huygens Lab., Rijksuniv., Leyden, Netherlands).
Chem. Phys. (Netherlands), vol.79, no.1, p.105-9 (15 Aug. 1983).
The depolarization ratio for a number of *n*-alkanes and n-perfluoro-alkanes are reported, and a discrepancy for C_2H_6 with earlier results is explained. A simple model based upon the principle of the additivity of bond polarizabilities is shown to be in disagreement with the authors' results. A model based on the classification of chemical bonds into types and subtypes, according to the chemical environment of these bonds is shown to be in considerably better agreement with their data, although the agreement is not completely adequate. (19 refs.)

100596 Polarizabilities of interacting polar molecules. A.D.Buckingham, P.A.Galwas, Liu Fan-Chen (Chem. Lab., Univ. of Cambridge, Cambridge, England).
J. Mol. Struct. (Netherlands), vol.100, p.3-12 (July 1983).
Collision-induced polarizability in the electro-optical Kerr effect is shown to be the dominant contributor to the second Kerr virial coefficient B_K of dipolar gases. It gives a positive B_K and may be orders of magnitude larger than the contribution due to the intrinsic anisotropy in the polarizability of the free molecules, thus resolving a long-standing discrepancy between experiment and theory. The collision-induced contribution provides a reasonable fit to the observed B_K for the fluoromethanes if a simple Stockmayer-type potential is used. (27 refs.)

100597 Molecular properties of pentyl-cyano mesogens having different core structures. D.A.Dunmur, A.E.Tomes (Dept. of Chem., Univ. of Sheffield, Sheffield, England).
Mol. Cryst. & Liq. Cryst. (GB), vol.97, no.1-4, p.241-53 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
The molecular properties of polarizability, polarizability anisotropy and dipole moment have been measured for a series of mesogenic molecules having a terminal cyano group and a terminal n-pentyl chain. Molecules investigated were of the form n-pentyl-X-cyano, where X was biphenyl, cyclohexyl-phenyl, phenyl-cyclohexyl, bicyclohexyl and bicyclo-octyl-phenyl. Measured polarizabilities were compared with bond additivity calculations for the molecules having different alkyl chain conformations. The relative nematic stabilities of the mesogens and their physical properties are discussed in terms of their measured molecular properties. (35 refs.)

Molecular properties from MCSCF-SCEP wave functions. I. Accurate dipole moment functions of OH, OH^- and OH^+ ......See Entry 100240

An ab initio SCF calculation of the polarizability tensor of sulphur dioxide ......See Entry 100242

Electronic transition dipole moment functions and difference potentials for transitions among low-lying states of Li_2 and Na_2 .... See Entry 100245

Complete development of dipole moment of tetrahedral molecules. Application to triply degenerate band and to the ν_2 and ν_4 dyade .... See Entry 100338

Adequate representation of the dipole moment function for diatomic molecules and the matrices of vibration-rotation transition moments .... See Entry 100349

Vibration-rotational and rotational intensities for CO isotopes .... See Entry 100351

Laser Stark spectroscopy of silyl fluoride in the 10-μm region: analysis of the ν_2 and ν_5 bands .... See Entry 100385

Molecular solutes in nematic liquid crystals: orientational order and electric field gradients .... See Entry 100415

Line shape and moment analysis in depolarized induced light scattering .... See Entry 100458

Coherence in the quasi-continuum model .... See Entry 100461

Formation of weak hydrogen-bonded complexes as predicted by experimental atomic charges .... See Entry 100488

The dispersive collision dipole in a pair of polyatomic molecules .... See Entry 100511

Calculation of the polarization potential for e-N_2 collisions .... See Entry 100576

The story of the ammonia molecule: ten years of investigation of molecular inversion .... See Entry 100594

Static dipole moment of an atom or a centrosymmetric molecule near a perfect metallic surface .... See Entry 102168

Magnetic order and magnetogyration in π(2p) electron systems .... See Entry 102604

35.20P Rotation, vibration, and vibration-rotation constants

Reduced partition function ratios of titanium, zirconium, and hafnium compounds .... See Entry 100230

The first valence states of the SO^+. Ion rotational analysis of the $A^2\Pi_i$-$X^2\Pi_r$ and $b^4\Sigma^-$-$a^4\Pi_i$ transitions. Comparison of experimental and ab initio calculated molecular parameters .... See Entry 100246

Substituted benzenes. V. Normal coordinate analysis of out-of-plane vibrations of mono iodonitrobenzenes .... See Entry 100340

Substituted benzenes. VI. Vibrational analysis of out-of-plane vibrations of mono bromonitrobenzenes .... See Entry 100341

Variational calculation of the rotational constants for acetylene and its isotopic derivatives .... See Entry 100343

On the use of 'effective normal coordinates' in computing the vibration-rotation energy levels of the CO_2 molecule .... See Entry 100345

Why are formaldehyde and (possibly) propynal nonplanar in their $S_1(\pi^*,n)$ electronic states? .... See Entry 100348

Adequate representation of the dipole moment function for diatomic molecules and the matrices of vibration-rotation transition moments .... See Entry 100349

The application of the nonrigid bender Hamiltonian to a quasilinear molecule .... See Entry 100350

Conformational and vibrational analysis with the aid of normal coordinate calculations .... See Entry 100355

On vibrational energy localization at high levels of excitation. Vibrational excitons .... See Entry 100360

The vibrational numbering of bands in the spectra of polyatomic molecules .... See Entry 100363

Microwave spectra of ortho-cloroaniline .... See Entry 100366

Microwave spectrum and selenol internal rotation of 2-propaneselenol .... See Entry 100370

The millimeter wave spectrum of silyl fluoride .... See Entry 100371

A quantitative analysis of the ν_s (IR) bands of H-bonds. I. Theory .... See Entry 100377

Absolute frequency measurements of the 2-0 band of CO at 2.3 μm; calibration standard frequencies from high resolution color center laser spectroscopy .... See Entry 100384

Laser Stark spectroscopy of silyl fluoride in the 10-μm region: analysis of the ν_2 and ν_5 bands .... See Entry 100385

Diode laser spectra of cis-HONO near 850 cm^{-1} and trans-HONO near 1700 cm^{-1} .... See Entry 100388

Infrared and Raman spectra and normal coordinate calculations for methylisothiocyanate .... See Entry 100389

Molecular complexes of the hydrogen halides studied by matrix isolation infrared spectroscopy .... See Entry 100390

Matrix isolation infrared spectra of the complexes between methylacetate and water or hydrochloric acid .... See Entry 100392

Detection of the hydronium ion (H_3O^+) by high-resolution infrared spectroscopy .... See Entry 100402

Laser spectroscopy and microwave-optical double resonance ICL $A^3\Pi(1)$ $\nu=19$ of a supersonic expansion .... See Entry 100432

Estimation of equilibrium structure and anharmonicity by use of changes in the r_z structure by isotopic substitution and vibrational excitation. I. General formulation and application to OCl_2 .... See Entry 100593

The story of the ammonia molecule: ten years of investigation of molecular inversion .... See Entry 100594

Effect of molecular rotation upon charge transport between disordered carbazole units .... See Entry 102379

Classical trajectory study of the effects of parent-molecule bending and overall rotation in polyatomic direct photofragmentation. Model $ICN+h\nu \rightarrow CN+I$ .... See Entry 103546

35.20S Hyperfine and fine-structure constants

Ab initio SCF study of hyperfine couplings, geometries, and inversion barriers in the isoelectronic radicals NF_3^+, CF_3, and BF_3^- .... See Entry 100237

Ab initio calculation of equilibrium geometry and hyperfine coupling constants of the cyclopentane cation .... See Entry 100260

EPR evidence on molecular and electronic structure of nitrogen trifluoride radical cation .... See Entry 100418

A comparison of the carbon-13 hyperfine constants of carboxylated cyclohexadienyl and hydroxycyclohexadienyl radicals .... See Entry 103554

35.20V Ionization potentials, electron affinities, molecular core binding energy

100598 EOM/propagator ionization potentials: extension of the excitation operator manifold. J.Baker (Dept. of Quantum Chem., Uppsala Univ., Uppsala, Sweden).
Chem. Phys. (Netherlands), vol.79, no.1, p.117-28 (15 Aug. 1983).
The excitation operator manifold required for the calculation of vertical IPs in the EOM/propagator formalism is extended to include products of five spin orbital field operators (referred to as the $\mathbf{h}_5$ basis). Spin symmetry adaptation is used for all the operators of this manifold. Using a direct diagonalization technique introduced previously the effect of inclusion of the $\mathbf{h}_5$ basis on calculated IPs is illustrated for various levels of approximation to the electron density by numerical applications to ethylene and water. The fourth-order terms thus introduced are shown to have greater magnitude than previously included third-order terms, in agreement with earlier work. (30 refs.)

100599 Calculation of the vertical ionization potentials of XBO and XBS molecules (X=H, F and Cl) by perturbation corrections to Koopmans' theorem. D.C.Frost, C.Kirby, W.M.Lau, C.A.McDowell, N.P.C.Westwood (Dept. of Chem., Univ. of British Columbia, Vancouver, British Columbia, Canada).
J. Mol. Struct. (Netherlands), vol.100, p.87-94 (July 1983).
Vertical ionization potentials of the linear triatomic molecules, HBO, FBO, ClBO, HBS, FBS, and ClBS are computed by applying Rayleigh-Schrodinger perturbation corrections to Koopmans' theorem. Comparison with the experimental data for the XBS molecules gives the authors confidence that their theoretical values for the ionization potentials will greatly assist in the identification of the, as yet, unobserved photoelectron spectra of the XBO species. (41 refs.)

100600 A study of the first ionization potential of the $CrO(X^5\Pi)$ molecule with high-temperature photoelectron spectroscopy. J.M.Dyke, B.W.J.Gravenor, R.A.Lewis, A.Morris (Dept. of Chem., Univ. of Southampton, Southampton, England).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.7, p.1083-8 (July 1983).
The first band in the He I photoelectron spectrum of the $CrO(X^5\Pi)$ molecule, obtained via the gas-phase reaction $Cr+O_3$, has been recorded. The adiabatic and vertical ionization potentials of the observed band were measured as 7.85 ± 0.02 and 8.16 ± 0.01 eV, respectively. Analysis of the observed vibrational structure yielded $\tilde{w}_e=640\pm30$ cm^{-1} and Franck-Condon analysis of the vibrational envelope gave $r_e=1.79\pm0.01$ Å for the ground electronic state of the ion, which is predicted on the basis of ab initio configuration-interaction calculations to be a $^4\Sigma^-$ state. (29 refs.)

Formulation of the total molecular energy in semi-empirical SCF-MO method with overlap: application to the determination of the approximate equilibrium geometry .... See Entry 100229

Complete valence-shell ionization spectra of N_2 and CO: application of the extended two-particle-hole Tamm-Dancoff approximation (2ph-TDA) .... See Entry 100234

Proton affinities of GeH_4 and SiH_4. II. Calculations of the proton affinity of GeH_4 in terms of extended basis sets .... See Entry 100261

Electron affinities of the alkali dimers: Na_2, K_2, and Rb_2 .... See Entry 100269

An ab initio study of core-valence correlation .... See Entry 100270

The binding energy of the ground state of Be_2 .... See Entry 100271

Matrix isolation infrared spectra of the complexes between methylacetate and water or hydrochloric acid .... See Entry 100392

Laser spectroscopy and microwave-optical double resonance ICL $A^3\Pi(1)$ $\nu=19$ of a supersonic expansion .... See Entry 100432

K_2 Rydberg state analysis by two- and three-photon ionization .... See Entry 100465

Formation of weak hydrogen-bonded complexes as predicted by experimental atomic charges .... See Entry 100488

Zero-energy scattering and bound states in the ^4He trimer and tetramer .... See Entry 100517

Photoionization measurements on isolated iron-atom clusters .... See Entry 100622

35.20X Mass spectra

Spectrophotometric investigation of fluorinated neodymium β-diketonates .... See Entry 100399

Metastable decomposition of Ar_3^+ cluster ions into Ar_2^+ and Ar^+ .... See Entry 100571

35.80 ATOMIC AND MOLECULAR MEASUREMENTS AND TECHNIQUES

100601 Stabilization of a microwave oscillator using a resonance Raman transition in a sodium beam. R.P.Hemmer, S.Ezekiel (Res. Lab. of Electronics, MIT, Cambridge, MA, USA), C.C.Leiby,Jr..
Opt. Lett. (USA), vol.8, no.8, p.440-2 (Aug. 1983).
Preliminary results on the stabilization of a 1772-MHz oscillator to a resonance Raman transition in an atomic beam of sodium are presented. Short-term stability of 5.6×10^{-11} ($\tau=100$ sec) for a 15-cm Ramsey interaction-region separation has been achieved. Sources of frequency drift are briefly discussed. (13 refs.)

Diffraction of an atomic beam by standing-wave radiation .... See Entry 100322

Cluster spectroscopy .... See Entry 100472

Beam-gas collision system for excitation cross-section measurements .... See Entry 100526

Description of a measurement program for determining excitation cross section values of exhaust species .... See Entry 100530

Ionisation of atomic hydrogen by 4.8 MeV C^{6+} ions .... See Entry 100534

Photoionization measurements on isolated iron-atom clusters ....See Entry 100622

Measurement of metastable atom microconcentrations in a molecular beam by resonant laser fluorescence ....See Entry 103623

36.00 STUDIES OF SPECIAL ATOMS AND MOLECULES

36.10 EXOTIC ATOMS AND MOLECULES (CONTAINING MESONS, MUONS, AND OTHER ABNORMAL PARTICLES)

100602 μ-atom energy levels-revisited. S.Bhattacharyya (Gokhale Coll., Calcutta, India), L.Chatterjee, T.Roy.
Indian J. Phys. Part B, vol.57B, no.1, p.80-4 (Feb. 1983).
Muonic atoms have been studied in the framework of a cut-off type potential $V(r)$ such that $V(r)=-ze^2 2/r$ outside the nuclear radius, and $V(r)=(kr^2+\text{constant})$ within the nuclear boundary. The energy values agree well with those obtained by other authors. (4 refs.)

100603 Positronium formation cross sections in the inert gases. M.Charlton, G.Clark, T.C.Griffith, G.R.Heyland (Dept. of Phys. & Astron., Univ. Coll. London, London, England).
J. Phys. B (GB), vol.16, no.15, p.L465-70 (14 Aug. 1983).
New measurements of positronium formation cross sections are reported for the inert gases at energies up to 150 eV. These data show pronounced structure in the cross sections of all gases in the form of secondary peaks and plateaus above the ionisation potentials. (15 refs.)

100604 Kaonic hydrogen atom X-rays. P.M.Bird, A.S.Clough, K.R.Parker (Dept. of Phys., Univ. of Surrey, Guildford, England), G.J.Pyle, G.T.A.Squier, S.Baird, C.J.Batty, A.I.Kilvington, F.M.Russell, P.Sharman.
Nucl. Phys. A (Netherlands), vol.A404, no.3, p.482-94 (15 Aug. 1983).
The X-ray spectrum obtained with kaons stopping in liquid hydrogen has been measured. Possible candidates for X-ray lines from kaonic hydrogen atoms have been indentified and the results compared with previous experiments and with theoretical predictions. X-ray lines from Σ^-p atoms may also have been observed. (9 refs.)

100605 An optical model for kaonic atoms. C.J.Batty (Rutherford Appleton Lab., Didcot, England).
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.162-4 (28 July 1983).
It is shown that a laplacian form for the optical model potential gives a significantly improved fit to the strong interaction data for kaonic atoms. (5 refs.)

100606 Rate for positronium decay to five photons. G.S.Adkins, F.R.Brown (Joseph Henry Labs., Princeton Univ., Princeton, NJ, USA).
Phys. Rev. A (USA), vol.28, no.2, p.1164-5 (Aug. 1983).
In this report the authors calculate Γ_5, the rate for orthopositronium to decay to five photons. They find that $\Gamma_5=[0.0189(11)]\alpha^2\Gamma_{LO}$, where Γ_{LO} is the lowest-order orthopositronium decay rate. The relevance of the result to the experimental situation is discussed. (8 refs.)

100607 Hyperfine structure of muonium: an analytic solution by perturbation calculations. C.J.Wotzasek, M.A.Gregorio, S.Reinecke (Inst. de Fisica, Univ. Federal do Rio de Janeiro, Rio de Janeiro, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.3, p.517-39 (Sept. 1982). In Portuguese.
The authors compute the purely coulomb contributions to the terms of order $E_F(\alpha^2 m_e/m_\mu)\ln\alpha^{-1}$ of the hyperfine splitting of muonium. Results agree with those of other authors. The goal of the work was twofold: first, to confirm that contribution; second, and perhaps more important, to check the analytic solution of the relativistic coulomb problem of the Bethe-Salpeter equation with instantaneous kernel. (3 refs.)

Anomalous Coulomb correction to the scattering length in connection with the shift of the ground level to the K^-p atom ....See Entry 99469

Galileo-invariant theory of low energy pion-nucleus scattering. III. The π^--^{4}He reaction and light π-mesoatoms ....See Entry 99600

Vacuum polarization corrections and spin-orbit splitting in antiprotonic atoms ....See Entry 100283

Elastic and rearrangement processes in positron-hydrogen collisions ....See Entry 100553

36.20 MACROMOLECULES AND POLYMER MOLECULES

(for biological macromolecules, see also 87.15; for polymer reactions and polymerization, see 82.35)

100608 Response function theory and its application to polymer dynamics. M.S.Jhon (Dept. of Chem. Engng., Carnegie-Mellon Univ., Pittsburgh, PA, USA), J.S.Dahler.
J. Chem. Phys. (USA), vol.79, no.2, p.1013-16 (15 July 1983).
A response theory is constructed for systems with deterministic, nonrandom dynamics which are not governed by Hamiltonian mechanics. This theory is used to compute the response of a polymeric solution (modelled as elastic dumbbells suspended in a Newtonian solvent) to a flow field. This externally imposed flow displaces the system from its initial state of equilibrium and causes each function of state to respond in a characteristic way. The response function of greatest interest is the fluid stress tensor. The authors present a correlation function expression for this tensor and derive Kubo-like formulas for a number of material functions, namely, the shear and extensional viscosities and the primary and secondary normal stress coefficients associated with laminar flows. Finally, an expression is obtained for the extra stress due to turbulent flow. (7 refs.)

100609 Ab initio energy calculations for the intramolecular rotational potential of polyacetylene. B.K.Rao, J.A.Darsey, N.R.Kestner (Chem. Dept., Louisiana State Univ., Baton Rouge, LA, USA).
J. Chem. Phys. (USA), vol.79, no.3, p.1377-80 (1 Aug. 1983).
Using ab initio methods, calculations have been performed on the rotational states of polyacetylene. Using a 4-31G basis set a gauche state is found involving a 40° rotation from the cis state. It is 0.6 kcal/mol lower in energy than the cis state. The trans state is the lowest energy state with an energy 2.60 kcal/mol lower than the gauche. Trans-cisoid to trans isomerization is proposed to occur by a rotation about the single C-C bonds in the backbone with a rotational barrier of 2.61 kcal/mol. The lack of sensitivity which arises when using a STO-3G poor basis set is also demonstrated. (20 refs.)

100610 Monte Carlo study of dynamics of the multichain polymer system on the tetrahedral lattice. A.Kolinski, P.Romiszowski (Dept. of Chem., Univ. of Warsaw, Warsaw, Poland).
J. Chem. Phys. (USA), vol.79, no.3, p.1523-6 (1 Aug. 1983).
Diffusion of the chain molecules in the concentrated solutions was studied by means of the computer simulation method. The computations were made for various chain lengths and polymer concentrations. It was observed that the rate of diffusion of the polymer chains strongly depends on the chain length according to the relation $D\propto n^{-b}$. It was found that the value of exponent b increases with the polymer concentration. (16 refs.)

100611 CO binding to heme proteins: a model for barrier height distributions and slow conformational changes. N.Agmon, J.J.Hopfield (Div. of Chem., California Inst. of Technol., Pasadena, CA, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.2042-53 (15 Aug. 1983).
A model for the dependence of the potential energy barrier on a 'protein coordinate' is constructed. It is based on a two dimensional potential energy surface having as variables the CO-iron distance and a conceptual protein coordinate. The distribution of barrier heights observed in kinetics follows from an initial Boltzmann distribution for the protein coordinate. The experimental nonexponential rebinding kinetics at low temperatures or large viscosities (when the protein coordinates can be assumed 'frozen') can be fit with a simply parameterized energy surface. Using the same energy surfaces and the theory of bounded diffusion perpendicular to the reaction coordinate, the authors generate (in qualitative agreement with experiment) the survival probability curves for larger diffusivity, when the constraint on the protein coordinate is relaxed. On the basis of the authors' results, the outcomes of new experiments which examine the concepts underlying the theory can be predicted. (18 refs.)

100612 Statistics of the entanglement of polymers: unentangled loops and primitive paths. E.Helfand, D.S.Pearson (Bell Labs., Murray Hill, NJ, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.2054-9 (15 Aug. 1983).
Attempts to apply the reptation and tube model to describe polymer disentanglement and associated relaxations have had wide success. However, questions have arisen in various applications as to the statistics of entanglement of a random walk with an obstacle net. Calculations are presented of a number of probabilities which characterize the degree to which a polymer, represented by a lattice walk, entangles with an array of obstacles. In particular, the authors have calculated the number of ways that such a walk can form unentangled closed loops of various types. If one reels in a general random walk from its ends, pulling out unentangled loops, one is left with the so-called primitive path, which is taken to represent the path of the tube. The probability that an N step random walk has a K step primitive path has been determined. Asymptotic formulas for this probability are presented. (17 refs.)

100613 The one-dimensional n→0 vector model and the helix-coil transition. G.T.Brinke, F.E.Karasz (Dept. of Polymer Sci. & Engng., Univ. of Massachusetts, Amherst, MA, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.2065-71 (15 Aug. 1983).
The one-dimensional n→0 vector model is shown to be closely related to a model describing helix-coil transitions in polypeptides. This makes available a vast amount of theory developed in this area and allows a simple derivation of the self-avoiding walk length distribution corresponding to the one-dimensional n→0 vector model. The effect of the peculiar feature of this model, the extra factor 1/2 for single site walks, is shown to be minor. The interpretation of the one-dimensional n→0 vector model as a model for helix-coil transitions commits little error and the corresponding 'helix sequence' length distribution is in a first approximation identical to the helix sequence length distribution of existing models for the helix-coil transition. The equivalence between the n→0 vector model and an equilibrium polymerization model found by Wheeler et al. (1981) implies a close connection between the self-avoiding walk length distribution and the molecular weight distribution. The results confirm the mean-field predictions that the molecular weights of the polymer species are distributed exponentially. The solution of the one-dimensional n→0 vector model shows a phase transition in the limit of zero magnetic field. (28 refs.)

100614 Position-space renormalisation group for directed branched polymers. H.J.Herrmann (Service de Physique Theorique, CENS, Gif-sur-Yvette, France), F.Family, H.E.Stanley.
J. Phys. A (GB), vol.16, no.11, p.L375-9 (1 Aug. 1983).
All previous attempts to obtain accurate quantitative estimates of critical properties for directed percolation or directed animals with the position-space renormalisation group (PSRG) have failed. The authors analyse the problems that appear in the renormalisation of directed models, and then present a PSRG that avoids these problems and gives reliable predictions. (16 refs.)

100615 On the probability distribution of the end-to-end vector of a polymer chain. M.K.Kosmas (Chem. Dept., Univ. of Ioannina, Ioannina, Greece).
J. Phys. A (GB), vol.16, no.11, p.L381-4 (1 Aug. 1983).
The author calculates the fourth and sixth moments of the probability distribution of the end-to-end vector of a polymer chain, close to the critical dimensionality 4. The results support that the excluded volume interactions do not change the Gaussian structure of the probability for large distances. Depending on the value of the excluded volume parameter u', an expansion or a shrinkage to this probability occurs even for the dimensionality 4. (7 refs.)

100616 Molecular dimensions by neutron scattering. R.Ullman (Ford Motor Co., Dearborn, MI, USA).
J. Polym. Sci. Polym. Lett. Ed. (USA), vol.21, no.7, p.521-6 (July 1983).
The scattering from an assembly of randomly arranged polymer molecules varies with wave vector according to $I(q)=AMcS(q)\approx AMc(1-q^2R_g{}^2/3)+$terms of order q^4 where q, the magnitude of the wave vector, is equal to $(4\pi/\lambda)\sin(\theta/2)$; λ is the wavelength; and θ is the scattering angle. The polymer molecular weight is M, c is concentration, and A is a lumped constant containing a contrast factor, detector efficiency, and a variety of other parameters. R_g is the radius of gyration, obtained from the slope-to-intercept ratio of the $[I(q)]^{-1}$vs. q^2 plot. Unfortunately, in many neutron scattering experiments, measurements are not carried out at sufficiently low values of qR_g, and therefore both experimental slopes and experimental intercepts can be in error. To estimate these errors and to provide possible correction factors, the author has carried out calculations for three model systems: Gaussian coils, rods, and spheres. (4 refs.)

100617 Polyimides. II. Effect of structure on properties of polyimides. I.K.Varma, B.S.Rao (Indian Inst. of Technol., New Delhi, India).
J. Polym. Sci. Polym. Lett. Ed. (USA), vol.21, no.7, p.545-50 (July 1983).
Condensation polyimides based on 3,3′,4,4′-benzophenone tetracarboxylic acid dianhydride (BTDA) and several diamines have been investigated extensively as adhesives. The effect of molecular weight on the thermal stability of polyi-

mides derived from BTDA and 4,4′-diaminodiphenylether has been described in the literature. St. Clair, St. Clair, and Smith (1977) have reported the solubility studies of homopolymers of BTDA with 4,4′-diaminodiphenylether and m- or p-phenylene diamine. The purpose of the the authors' investigations was to evaluate the effect of isomeric changes in the molecular structure of these polyimides on thermal behaviour and adhesive properties. The systems selected to study the effect of positional isomerism on properties of condensation polyimides were based on BTDA and m-phenylene diamine (M), p-phenylene diamine (P), and 4,4′-diaminodiphenylether (E). Six copolyimides were prepared by taking 1:2, 1:1, and 2:1 molar ratios of E/M and P/M. (11 refs.)

100618 Small-angle X-ray scattering techniques—investigation of macromolecular structures. N.C.Sahu, S.C.Das (Dept. of Phys., Regional Engng. Coll., Rourkela, India).
J. Opt. (India), vol.12, no.1, p.12-18 (Jan.-March 1983).
Small angle X-ray scattering (SAXRS) techniques are employed to investigate structure of macromolecules. The theory is simple involving an inverse relationship between the particle dimensions and the scattering angle. The instrument however is sophisticated yielding high resolution. A Kratky Camera of the latest design was used. The authors use Kratky and Porod to investigate the pore structure of giant molecules of cellulose in Jute, and Babinet's reciprocal relationship is considered. Instrumental techniques are also discussed. (18 refs.)

100619 Effects of protonation on the conformational characteristics and geometry of the rod-like benzobisoxazole polymers. W.J.Welsh (Dept. of Chem., Coll. of Mount St. Joseph, Mount St. Joseph, OH, USA), J.E.Mark.
Polym. Eng. & Sci. (USA), vol.23, no.3, p.140-3 (Feb. 1983). [received: July 1983]
Recent experiments on model compounds suggest that rodlike polybenzobisoxazole (PBO) and polybenzobisthiazole (PBT) chains are protonated when dissolved in highly acidic solvents. The PBO model compound can exist as a $2H^+$ ion, with one proton on each nitrogen atom, or (depending on the acidity of the medium) as a $4H^+$ ion, with two additional protons on the oxygen atoms. The PBT model compounds generally form $2H^+$ ions, owing to the lower basicity of sulfur atoms relative to oxygen atoms. In the present study, geometry-optimized CNDO/2 calculations have been carried out in an attempt to predict the effect of protonation on the conformational characteristics and geometry of PBO model compounds. Values of the conformational energy vs. rotation of the endphenylenes about the heterocyclic group are calculated for cis-PBO model compounds in the unprotonated form and as $2H^+$ and $4H^+$ ions. All three species prefer the coplanar conformation with maximum barriers, occurring at the perpendicular conformation, of approximately 8.4, 33.6, and 84.0 kJ mol^{-1} for the unprotonated form, the $2H^+$ ion, and the $4H^+$ ion, respectively. (23 refs.)

100620 Study of conformational elasticity of polymer chains by Monte Carlo method. P.G.Khalatur, B.N.Klyushnik, P.M.Pakhomov.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.7, p.1510-16 (July 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The process of stretching of PE chains with the number of units N=30-97 has been simulated using a computer. The elastic force f acting on the macromolecule end fixed on the r distance is calculated. For short unperturbed chains the various analytical approximations described the dependence of f on r are analysed. The best results are attained using expressions including $\langle r_0^s \rangle$ moments. For moderately stretched non-self-intersecting chains the f value is proportional to $(r/N)^{3/2}$. The average number of interunit contacts per unit is practically constant for small r and is decreased $\sim(1-r/N)$ for strongly stretched chains. (13 refs.)

100621 Study of conformational structure of macromolecules under stretching. Results of computer simulation and IR-spectroscopy. P.G.Khalatur, P.M.Pakhomov, B.N.Klyushnik.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.7, p.1517-24 (July 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The process of stretching of PE chains has been studied by Monte Carlo methods and IR spectroscopy. In simulation the chemical structure of the chain, retardation and paired mutual dependence of internal rotations, volume interactions are taken into account. The change of conformational composition and orientation of chain elements towards the stretching axis is studied. The comparison of calculated and experimental data shows the satisfactory correlation in the change of content of various conformers and their orientation for not very high degrees of stretching ($\lambda \leq 3$-4). The reasons of discrepancies at large λ values are discussed. (13 refs.)

Investigation of the interaction of diglycidol ether of methylphosphonic acid with gelatin .... See Entry 99216

Field desorption of hydrocarbon polymers .... See Entry 99227

Polymer physics: organization of macromolecules in the solid state .... See Entry 101592

An application of Monte Carlo method to simulate disorders in polymer crystals .... See Entry 101593

A ^{13}C-NMR study of the microstructure of polyphenylacetylenes prepared with $MoCl_5$ and WCl_6 .... See Entry 102761

Kinetic Ising model for polymer dynamics: applications to dielectric relaxation and dynamic depolarized light scattering .... See Entry 102812

Vibrational spectra and structure of stereoregular poly(methyl methacrylates) and of the stereocomplex .... See Entry 102885

End group determination in hydroxyl-telechelic polyisobutylenes by infrared spectroscopy .... See Entry 103624

Intermolecular interactions in collagen self-assembly as revealed by Fourier transform infrared spectroscopy .... See Entry 103781

Splice junctions: association with variation in protein structure .... See Entry 103784

Photoabsorption and photoelectron-yield spectra of polypeptides in the vacuum-UV region .... See Entry 103792

36.40 ATOMIC AND MOLECULAR CLUSTERS

100622 Photoionization measurements on isolated iron-atom clusters. E.A.Rohlfing, D.M.Cox, A.Kaldor (Corporate Res. Sci. Lab., Exxon Res. & Engng. Co., Linden, NJ, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.161-6 (29 July 1983).
Laser vaporization of a metal substrate within a pulsed supersonic nozzle is used to generate beams of iron-atom clusters, Fe_x, x=2-25, which are detected by laser photoionization and time-of-flight mass spectrometry. By examining the dependence of the Fe_x^+ signal on ionizing laser intensity and frequency, the authors have been able to roughly determine the ionization potentials (IPs) of the isolated iron clusters. Oscillations in the curve of IP versus cluster size are observed. (17 refs.)

100623 Quasiresonant excitation transfer in molecular aggregates. R.P.Parson, R.Kopelman (Dept. of Chem., Univ. of Michigan, Ann Arbor, MI, USA).
J. Chem. Phys. (USA), vol.79, no.3, p.1444-51 (1 Aug. 1983).
Excitation transfer in finite molecular aggregates is analyzed in the context of the Haken-Strobl model (1973). Explicit solutions are presented for a trimer and a rectangular tetramer. Special emphasis is placed upon population transfer among subunits (monomers, dimers) and its relationship to energy transfer, and upon the problems associated with coherence of this transfer process. These aggregates serve as models for the problem of excitation transfer in disordered media, where partial coherence resulting from short-range interactions has been largely ignored. The authors' most intriguing result is the greatly diminished effectiveness of the longer-ranged transfer in the presence of short-range clusters. Under some conditions the ensuing energetic mismatches may well dominate the overall energy transport and render invalid the usual description in terms of hopping among individual sites. An application to triplet energy transport in isotopic mixed naphthalene crystals is given; it is seen that the reduced efficiency of non-nearest-neighbor transfer processes reinforces the two-dimensional characteristics of the energy transport. (14 refs.)

100624 Ab initio orbital calculations on clusters of methyl fluoride. T.Oi, E.Sekreta, T.Ishida (Dept. of Chem., State Univ. of New York, Stony Brook, NY, USA).
J. Phys. Chem. (USA), vol.87, no.13, p.2323-9 (23 June 1983).
Various two-, and three-, and four-membered clusters of methyl fluoride have been studied by means of the Gaussian-70 program using the minimal STO-3G and the 4-31G basis sets. Results obtained by using the STO-3G set are more consistent with experimental results than those obtained by using the 4-31G set. The optimum C-F...H-C configuration in all clusters investigated is as follows: R_{HF}=2.1 Å, FHC angle=180°C, CFH angle=120-125°. The optimum STO-3G stabilization energies obtained for the three cluster sizes correspond to the following: −0.78, −0.82, and −0.83, in kcal/mol of F...H-C interaction, for the two-, three-, and four-membered clusters, respectively; and −0.39, −0.82, and −0.83, in kcal/mol of monomer, for the two-, three-, and four-membered systems, respectively. (19 refs.)

Vibrational spectra and chemical structure of hetero-metal complexes and clusters with thiometalate ligands .... See Entry 100356

Cluster spectroscopy .... See Entry 100472

Dissociation dynamics of vibrationally excited van der Waals clusters: $I_2XY \to I_2X+Y$ (X, Y=He, Ne) .... See Entry 100476

Magnetic properties of metallic clusters .... See Entry 102333

40.00 CLASSICAL AREAS OF PHENOMENOLOGY

(inc. applications)

41.00 ELECTRICITY AND MAGNETISM; FIELDS AND CHARGED PARTICLES

(see also 03.50 Maxwell theory: general mathematical aspects)

41.10 CLASSICAL ELECTROMAGNETISM

41.10D Electrostatics, magnetostatics

100625 The cylindrical Poisson-Boltzmann equation. I. Transformations and general solutions. C.J.Benham (Dept. of Math., Univ. of Kentucky, Lexington, KY, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.1969-73 (15 Aug. 1983).
In the paper the cylindrical Poisson-Boltzmann equation in reduced coordinates is transformed into an algebraically nonlinear second order ordinary differential equation, which is a particular case of Painleve's third equation. The only singularities of solutions to this equation are movable poles of second order. Series expansions are developed which express the general solution locally about points of analyticity and about a pole. Back transformation yields local solutions to the cylindrical Poisson-Boltzmann equation. The solutions throughout an interval generally require analytic continuation of these local expressions. In addition to developing exact solutions, asymptotic properties are anlayzed for the case of an isolated cylindrical polyelectrolyte. Further, an alternative technique of solution is sketched in which the cylindrical Poisson-Boltzmann equation is transformed into the sine-Gordon equation, which may then be solved by standard methods to give a one parameter family of solutions. A bibliography of references to the third Painleve equation is presented. The application of these results to the analysis of the theoretical behavior of cylindrical polyelectrolytes in ionic solutions will be presented in a subsequent contribution. (29 refs.)

100626 An analytic solution for the potential due to a circular parallel plate capacitor. W.J.Atkinson (Dept. of Radiation Oncology, Univ. of Alabama, Birmingham, AL, USA), J.H.Young, I.A.Brezovich.
J. Phys. A (GB), vol.16, no.12, p.2837-41 (21 Aug. 1983).
An analytic solution is given for the potential due to a capacitor consiting of two coaxial circular discs with equal radii and of infinitesimal thickness. The potential is expressed as a rapidly converging infinite series which can be readily evaluated. The utility of the expression is illustrated by two examples in which the potential has been computed. (11 refs.)

Some converse theorems in Newtonian field theory and their applications .... See Entry 98787

General method of calculating the electric field pattern of latent charge images .... See Entry 99218

41.10F Steady-state electromagnetic fields; electromagnetic induction

100627 Attenuation of low frequency fields by conducting ellipsoidal shells. F.L.Curzon, D.A.Parfeniuk (Phys. Dept., Univ. of British Columbia, Vancouver, BC, Canada).
Can. J. Phys. (Canada), vol.61, no.8, p.1260-9 (Aug. 1983).
The diffusion rate (λ, s^{-1}) of a spatially uniform, switched-on, field through a prolate spheroidal shell, has been related to the geometry of the shell, and orientation of the field with respect to it. The shell is assumed to be an isotropic ohmic conductor; the fields are described by Poisson's equation. For a spatially uniform alternating field (frequency ω), the attenuated field inside the shell is shown to be a function of λ/ω; the smaller this ratio, the lower the attenuation. The computed results have been verified experimentally and by checking them against exact solutions which are available for limiting cases of the general problem. The results are relevant to the properties of an electric field meter whose sensor is a gas-filled glass bulb. The breakdown frequency of the gas depends on the field within it. (6 refs.)

100628 The nonlinear generation of a steady magnetic field in a conducting sphere placed in an oscillatory magnetic field. W.N.Hugrass (School of Phys. Sci., Flinders Univ. of South Australia, Bedford Park, Australia).
J. Appl. Phys. (USA), vol.54, no.8, p.4280-4 (Aug. 1983).
It is shown that the nonlinear 'Hall' force generated in a conducting sphere placed in an oscillatory (AC) magnetic field has a nonzero curl. It therefore drives a poloidal current which has a steady (DC) component and a second harmonic component. A general analytic expression for the DC toroidal magnetic field generated by the Hall current is obtained for the weakly nonlinear case: $\omega_{ce}/\nu \ll 1$, where $\omega_{ce}=eB/m$ is the electron cyclotron frequency in the AC magnetic field and ν is the effective collision frequency. The DC magnetic field is evaluated numerically (using the general analytic formulae) for the special case where the applied AC magnetic field is uniform. (10 refs.)

100629 Compact uniform field electrode profiles [laser system applications]. G.J.Ernst (Dept. of Appl. Phys., Twente Univ. of Technol., Enschede, Netherlands).
Opt. Commun. (Netherlands), vol.47, no.1, p.47-51 (1 Aug. 1983).
By modification of the conformal transformation used by Chang in determining uniform field electrode profiles, a large improvement can be achieved in the uniformity of the electric field strength distribution over the surface of the electrodes. When such electrodes are used in a TEA laser system smaller electrodes can be used for the same gas discharge width. (3 refs.)

Studies on certain modified Luneberg lenses ....See Entry 100870

41.10H Electromagnetic waves: theory

100630 Mie scattering subroutines (DBMIE and MIEV0): a comparison of computational times. J.D.Felske, Z.Z.Chu, J.C.Ku (Dept. of Mech. & Aerospace Engng., State Univ. of New York, Amherst, NY, USA).
Appl. Opt. (USA), vol.22, no.15, p.2240-1 (1 Aug. 1983).
Although the theoretical description of the scattering of a planar electromagnetic wave by a homogeneous spherical particle has been known for some time, the ability to accurately compute the scattered field for particles of arbitrary size and refractive index is relatively recent. This is a result not only of the need for a digital computer but also of the fact that a simple straightforward programming of the theoretical result can lead to serious computational errors. Dave's (1968) DBMIE subroutine established a reliable numerical algorithm for performing such calculations. Most codes in use today possess Dave's algorithmic structure. Recently, Wiscombe (1979) developed a new set of Mie scattering codes (MIEV0 and MIEV1), which incorporate several advances in computational technique as well as some more efficient ways to organize the computation. The authors assess the effectiveness of these techniques by making a direct comparison of computational times of the DBMIE and the unvectorized MIEV0 subroutines using the same computing machine—a CDC Cyber 170/173 (single precision=14 decimal digits). (3 refs.)

100631 n-Fold polarization measures and associated thermodynamic entropy of N partially coherent pencils of radiation. R.Barakat (Div. of Appl. Sci., Harvard Univ., Cambridge, MA, USA).
Opt. Acta (GB), vol.30, no.8, p.1171-82 (Aug. 1983).
An n-fold ($n=2, \ldots, N$) measure of the degree of polarization associated with an $N \times N$ coherency matrix characterizing N pencils of radiation is discussed. The measure is cast in terms of the N possible scalar invariants of the coherency matrix and automatically takes into account possible rank deficiency. When $N=2$, the single polarization measure reduces to the usual expression for polarization as the fraction of the intensity contained in the polarized component. The $N=3$ case is discussed as an illustrative example, with special reference to the rank deficiency of a plane wave arbitrarily oriented with respect to the given coordinate system. Finally, these results are used to redevelop von Laue's theory of the thermodynamic entropy of partially coherent pencils of radiation. (17 refs.)

100632 Propagation of electromagnetic wave packets in nondispersive dielectric media. S.Bosanac (R. Boskovic Inst., Zagreb, Yugoslavia).
Phys. Rev. A (USA), vol.28, no.2, p.577-91 (Aug. 1983).
The speed of tunneling of the electromagnetic wave packets propagating in nondispersive dielectric media is analyzed on the basis of Maxwell's equations. It is shown that under certain conditions this speed can exceed the speed of light in vacuum. (15 refs.)

100633 Diffraction of plane electromagnetic wave by anisotropic spheroid. S.S.Oganesyan (Erevan Inst. of Nat. Economy, Erevan, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.9, p.693-7 (Sept. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.9, p.971-6 (Sept. 1982).
Considers the scattering of a plane electromagnetic wave by an anisotropic oblong spheroid. The problem is solved by the method of vector harmonics. The cross section for scattering is calculated as a function of the anisotropy factor. (12 refs.)

100634 Three-dimensional problem of inverse scattering in stratified randomly inhomogeneous media. B.M.Shevtsov (Pacific Ocean Oceanological Inst., Acad. of Sci., USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.9, p.742-9 (Sept. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.9, p.1032-40 (Sept. 1982).
Inverse scattering upon the incidence of a wave packet on a half-space of a stratified randomly inhomogeneous medium is discussed on the basis of a nonlinear equation for the reflection coefficient. Expressions are obtained in general form for the average intensity of the backscattered field, which are compared by the example of an incident Gaussian wave packet with the results of radiative transfer theory, as well as with different forms of perturbation theory. The behavior of the higher moments of the intensity of the backscattered field is investigated. (8 refs.)

100635 Approximate solution of the problem of the coefficient of reflection from a layer of a one-dimensional randomly inhomogeneous medium. V.L.Brekhovskikh (Inst. of Atmospheric Phys., Acad. of Sci., USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.9, p.749-53 (Sept. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.9, p.1041-5 (Sept. 1982).
The problem of the reflection of a plane wave from an absorbing one-dimensional stochastic medium, the fluctuations of whose dielectric constant are represented in the form of a telegraphic random process, is considered. A simple formula is proposed for the probability distribution density of the reflection coefficient as a function of the layer thickness which is valid over a wide range of values of the parameters. (8 refs.)

100636 Excitation of an infinite periodic structure by a local harmonic source with an imprecisely known frequency. A.A.Bykov (Moscow State Univ., Moscow, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.9, p.753-8 (Sept. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.9, p.1046-52 (Sept. 1982).
The excitation of an infinite periodic structure by a harmonic source is investigated. The distribution function of the modulus of the directivity function of the scattered field at a large distance from the source is plotted on the assumption that the frequency of the excitation field is a random variable with a specified distribution function. It is shown that if the distance from the source to the periodic structure is large in comparison with the period, the directivity distribution function is preferable to the directivity pattern for describing the scattered field, because the number of lobes of the latter grows without bound as the source is moved to infinity. (9 refs.)

100637 Electromagnetic field transformation upon change in properties of the medium with time within a limited region. V.V.Borisov (Leningrad State Univ., Leningrad, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.9, p.759-64 (Sept. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.9, p.1053-9 (Sept. 1982).
A solution containing the transient process is constructed for differing time dependence of the initial field (unit Heaviside function, inclusion of harmonic oscillations). It is shown that the solution reduces to Lommel functions of two variables. It is found that with special choice of the initial field, a harmonic regime is established instantaneously in the wave exiting from a region with changing properties. (7 refs.)

100638 A study of statistical moments of shortwave fields, propagating in a medium with strong, Gaussian random inhomogeneities. The system of moment equations. N.A.Armand, V.N.Sekistov.
Radio Eng. & Electron. Phys. (USA), vol.27, no.10, p.1-6 (Oct. 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.10, p.1857-63 (Oct. 1982).
A new asymptotic method is developed which allows one to compute the statistical moments of the field of SHF waves, propagating in a medium with strong, Gaussian random inhomogeneities. (12 refs.)

100639 Fundamental electrodynamic relationships for nonperiodic processes in a linear nonstationary medium without dispersion. E.I.Krupitskiy.
Radio Eng. & Electron. Phys. (USA), vol.27, no.10, p.21-6 (Oct. 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.10, p.1881-7 (Oct. 1982).
The auxiliary quadratic relationships, the Umov-Poynting theory, the reciprocity relationship and the integral representations of vectors of nonperiodic fields are extended to the case of a linear, anisotropic and nonstationary medium without dispersion. (5 refs.)

100640 The shaping properties of zoned Fresnel lenses at millimeter wavelengths. G.A.Andreyev, O.V.Bazarskiy, A.I.Kolesnikov, Ya.L.Khlyavich.
Radio Eng. & Electron. Phys. (USA), vol.27, no.10, p.151-3 (Oct. 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.10, p.2027-30 (Oct. 1982).
These lenses decrease significantly the weight and the thermal losses below those encountered in ordinary dielectric lenses. At the same time the invariance of the product $\sqrt{\lambda} f$ of the ZFL (λ is the wavelength and f is the focal length), which causes the radiation from various Fresnel zones to be in phase when λ is varied, provides a constant impulse response and a constant spatial spectrum over a wide range of frequencies. The authors investigate the shaping properties of the ZFL at millimeter wavelengths for the paraxial and the nonparaxial cases. The radio images were formed by using a Fresnel lens with ten zones, constructed from organic glass. The lens has an apertures $D=400$ mm and a focal length $f=500$ mm at the frequency of 75 GHz. The SHF radiation in the frequency range from 40 to 80 GHz was provided by the generator G4-104. (5 refs.)

100641 On the scattering of an *E* polarized planar wave by a finite number of tapes located in one plane. N.V.Kvach, V.G.Sologub.
Radio Eng. & Electron. Phys. (USA), vol.27, no.10, p.154-6 (Oct. 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.10, p.2031-7 (Oct. 1982).
In this communication a method is extended to the case of the *E* polarization. Just as in the case of *H* polarization, the solution of the problem is determined by a function which (except for a constant multiplier) is the Fourier transform of the surface current density in the plane containing the metallic tape screens, which now satisfies a system of pairs or integral equations. (3 refs.)

100642 On the Abel transformation in the problem of diffraction by a thin strip. S.S.Vinogradov, Yu.A.Tuchkin, V.P.Shestopalov (Inst. of Radiophys. & Electronics, Acad. of Sci., Kharkov, Ukrainian SSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.916-18 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.330-4 (Nov. 1982).
A method has previously been developed by Vinogradov (1978, 1980) for solving dual series equations which makes essential use of integral transformations with a kernel of Abel type. It is of interest to generalize this approach to the case of dual integral equations. The authors make such a generalization to the case of the dual integral equations arising in the classical problem of diffraction by a thin strip. The connection of the present method with other approaches is also discussed. (9 refs.)

100643 Eigenwaves in an inhomogeneous azimuthally bigyrotropic medium. V.A.Mescheryakov, A.E.Mudrov, G.A.Red'kin (V.D. Kuznetsov Physicotech. Inst., Tomsk State Univ., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.11, p.1015-18 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.46-9 (Nov. 1982).
The problem of natural electromagnetic waves in an azimuthally magnetized bigyrotropic medium which is inhomogeneous in the radial direction is solved analytically. A system of generalized wave equations is obtained in the longitudinal components of the electrical and magnetic fields. Particular solutions

of the system are represented in the form of generalized power series. The series exponents are determined and recursion formulas are built up for calculating their coefficients. The passage to particular cases of a homogeneous gyrotropic and inhomogeneous isotropic medium is realized, and the results are compared with known data from the literature. (6 refs.)

100644 A characterization of the range of the divergent beam X-ray transform. D.V.Finch, D.C.Solmon (Dept. of Math., Oregon State Univ., Corvallis, OR, USA).
SIAM J. Math. Anal. (USA), vol.14, no.4, p.767-71 (July 1983).
The authors give a characterization of the range of the divergent beam X-ray transform when the source set is a sphere. The result is analogous to the theorem of Helgason (1965) and Ludwig (1966) on the range of the Radon transform. (11 refs.)

Characteristics of the formation of an electromagnetic wave field with an instantaneous change in the states of charges ....See Entry 100646

Scattering from sinusoidal gratings: an evaluation of the Kirchhoff approximation ....See Entry 100656

Comparison of the extended boundary condition method and perturbation method for scattering from a sinusoidal sea surface ....See Entry 104500

41.70 PARTICLES IN ELECTROMAGNETIC FIELDS: CLASSICAL ASPECTS

(inc. synchrotron radiation)

100645 Adiabatic invariant and evolution equations for the motion of a particle in a strongly inhomogeneous magnetic field. K.Sh.Khodzhaev, A.G.Chirkov, S.D.Shatalov (Leningrad Polytech. Inst., Leningrad, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.9, p.703-10 (Sept. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.9, p.983-91 (Sept. 1982).
Considers a new example of motions of a charged particle in electric and magnetic fields which can be studied by an asymptotic method (the electric field is not assumed to be weak and the magnetic field is assumed to be weakly inhomogeneous). In the present case the authors find the adiabatic invariant which depends on all values of the magnetic field intensity along the trajectory loop. In the first approximation they obtain the Hamiltonian structure of the evolution equations. The motion is analyzed by using the obtained evolution equations and adiabatic invariant. (9 refs.)

100646 Characteristics of the formation of an electromagnetic wave field with an instantaneous change in the states of charges. V.L.Kon'kov, G.P.Novikova (Gorki Res. Inst. of Phys. & Technol., N.I. Lobachevskii State Univ., Gorki, USSR).
Sov. Phys. J. (USA), vol.25, no.11, p.1057-9 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.93-5 (Nov. 1982).
It is shown that in the process of annihilation and neutralization of two moving charges of opposite sign, energy is not radiated at the instant of the disappearance of the charges, but is formed later from the energy of the magnetic fields of the disappearing charges, i.e. a reaction effect occurs. An analogous effect will also occur in other radiation processes such as the instantaneous starting and stopping of charges, their instantaneous creation and the electrification of bodies, etc. The existence of the reaction effect in the radiation of electromagnetic energy by charges seems to be an essential defect in macroscopic electrodynamics. (10 refs.)

Particle production by accelerated charges moving in condensed matter ....See Entry 99283

Weakly bound states of an electron in an external electromagnetic field ....See Entry 99402

Studies of the chromatic properties and dynamic aperture of the BNL colliding beam accelerators ....See Entry 99854

A high-current racetrack induction accelerator ....See Entry 99890

Effect of synchrotron radiation in the proposed 4-GeV Argonne microtron ....See Entry 99891

MARYLIE: the Maryland Lie algebraic transport and tracking code ....See Entry 99949

The lattice design and tolerance analysis of the CBA transport line ....See Entry 99952

Free electron laser for a mildly relativistic electron beam .....See Entry 100075

On the formation of vortices in an electron stream, moving in an inhomogeneous static electromagnetic field ....See Entry 100649

Demonstration of a two-stage backward-wave-oscillator free-electron laser ....See Entry 100717

Wiggler-free free electron waveguide laser in a uniform axial magnetic field: single particle treatment ....See Entry 100785

Stimulated emission from a relativistic electron beam in a variable-parameter longitudinal magnetic wiggler ....See Entry 100786

41.80 PARTICLE BEAMS AND PARTICLE OPTICS

(see also 07.80 Electron and ion microscopy, 07.77 Beam handling equipment)

100647 Zone plate encoded neutron holography. T.D.Beynon (Univ. of Birmingham, Birmingham, England), V.S.Crocker, H.U.Mast.
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.945-51
Recent progress in the understanding of the neutron holographic process is summarized, together with some new experimental results. System limitations are identified and the results of a Monte Carlo simulation of the technique are presented. (5 refs.)

MARYLIE: the Maryland Lie algebraic transport and tracking code ....See Entry 99949

Evaluation and minimization of aberrations for a solenoid lens ....See Entry 100042

The design of periodic beam transport systems ....See Entry 100046

Design of the NSCL coupling line ....See Entry 100047

An RF separator for cloud muons at TRIUMF ....See Entry 100051

Symmetrical systems in charged-particle beam transport ....See Entry 100168

Beam transport systems consisting of two quadrupole triplets ....See Entry 100169

A quadrupole system for independent horizontal and vertical beam control ....See Entry 100170

41.80D Electron beams and electron optics

100648 Diocotron instability of magnetized tubular electron beams. V.E.Nechaev (Inst. of Appl. Phys., Acad. of Sci., USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.9, p.769-75 (Sept. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.9, p.1067-74 (Sept. 1982).
Diocotron oscillations in ring and tubular electron beams are considered theoretically. The dependence of the frequency and oscillation increment on the parameters is investigated. The fundamental features of static spatial oscillations in relativistic beams are obtained, and an estimate is made of the length in which an instability develops. (10 refs.)

100649 On the formation of vortices in an electron stream, moving in an inhomogeneous static electromagnetic field. I.G.Kozlov.
Radio Eng. & Electron. Phys. (USA), vol.27, no.10, p.120-5 (Oct. 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.10, p.1994-2000 (Oct. 1982).
An experimental setup is described for studying the motion of nonrelativistic electrons in inhomogeneous axially symmetrical static electromagnetic fields. Electron vortices are observed in a highly inhomogeneous field, and their theoretical basis is given. (8 refs.)

100650 Calculation of anode-plasma electron-optical systems in the presence of gas ionization in the accelerating space. K.N.Ul'yanov, A.B.Tskhay, L.P.Shanturin.
Radio Eng. & Electron. Phys. (USA), vol.27, no.10, p.133-9 (Oct. 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.10, p.2008-15 (Oct. 1982).
The solution of the internal and external problems is examined for a planar and axisymmetrical gas-filled anode-plasma diode, taking into account the gas ionization at high accelerating voltages. The external problem for an axisymmetric flow is solved in the paraxial approximation. (7 refs.)

The use of mini-lenses in the transmission electron microscope ....See Entry 99235

185-MeV injector design for the ANL 4-GeV microtron project ....See Entry 99744

An adiabatic matching device for the Orsay linear positron accelerator ....See Entry 99768

Transverse beam containment in the ANL 4-GeV microtron ....See Entry 99892

Conceptual design for a CW 1-GeV double-sided microtron ....See Entry 99893

Analytical study of the generation and control of orbit errors in the ANL 4-GeV CW electron microtron design ....See Entry 99894

Beam-beam synchrobetatron resonances ....See Entry 99951

Is magnetic flux quantized in a toroidal ferromagnet? ....See Entry 100652

A classical electron-cyclotron maser with axial electron beam injection ....See Entry 100716

Coherent radiation of electron bunches in free-electron lasers ....See Entry 100787

Two-dimensional model of the interaction of a relativistic electron beam with the fields excited in a plasma ....See Entry 101438

41.80G Ion beams and ion optics

100651 Use of axially symmetric electrostatic fields for ion beam focusing. E.Colton (Phys. Div., Argonne Nat. Lab., Argonne, IL, USA), J.C.Kelly.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.1, p.2734-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The 1/r electric field obtained between charged coaxial cylindrical electrodes is useful for focusing hollow ion beams in ion microprobe and ion implantation applications. The focusing strengths are mass independent at nonrelativistic energies. Focused particle densities can be enhanced by using a diverging-converging pair to flatten the dependence of focal length on incoming beam radius. Transport of 425 keV and 1 MeV protons has been simulated and results are presented. (4 refs.)

A transverse-field-focusing (TFF) accelerator for intense ribbon beams ....See Entry 99778

On improving the chromatic effects of storage rings with antisymmetric insertions ....See Entry 99851

Studies of the chromatic properties and dynamic aperture of the BNL colliding beam accelerators ....See Entry 99854

Investigation of stochastic beam growth with a nonlinear lens ....See Entry 99950

Beam-beam synchrobetatron resonances ....See Entry 99951

The lattice design and tolerance analysis of the CBA transport line ....See Entry 99952

Developments of the CRYEBIS generation at Orsay ....See Entry 100030

Optically pumped polarized ion source with 16.5-GHz ECR low source ....See Entry 100031

A brighter H$^-$ source for the intense pulsed neutron source accelerator system ....See Entry 100032

A nonlinear lens system to smooth the intensity distribution of a Guassian beam ....See Entry 100053

SRA: a new ion accelerator scheme ....See Entry 100079

Studies of the helix controlled beam front accelerator concept ....See Entry 100080

Collective acceleration of laser produced ions ....See Entry 100081

The IFA-2 collective ion accelerator system ....See Entry 100082

41.90 OTHER TOPICS IN ELECTRICITY AND MAGNETISM

100652 Is magnetic flux quantized in a toroidal ferromagnet?. A.Tonomura, H.Umezaki, T.Matsuda, N.Osakabe, J.Endo, Y.Sugita (Central Res. Lab., Hitachi Ltd., Tokyo, Japan).
Phys. Rev. Lett. (USA), vol.51, no.5, p.331-4 (1 Aug. 1983).
Total magnetic flux trapped in a tiny toroidal magnet is measured by an electron holography technique to test predicted flux quantization. The experimental results show that the magnetic flux is quantized neither by h/e units nor by $h/2e$ units. This fact provides further evidence for the existence of the Aharonov-Bohm effect. (10 refs.)

42.00 OPTICS

(for properties of gases and of liquids and solids, see 51.70 and 78. respectively; for atmospheric optics, see 92.65; for physiology of the eye, see 87.32)

100653 New aspects of Huygens principle. J.Tabin (Inst. of Phys., Tech. Univ., Gliwice, Poland).
Appl. Phys. B (Germany), vol.B31, no.4, p.225-8 (Aug. 1983).
In the case of two-dimensional problems the vector field determined by Huygens' integral and its derivatives of the first and second order are continuous in the space including the surface of integration except edges and corners. In many applications, however, the determined potential, its normal derivative and those presumed by Helmholtz's formulation differ essentially. A procedure partially analytical and partially numerical is described yielding a field more exactly satisfying the presumptions. (6 refs.)

42.10 PROPAGATION AND TRANSMISSION IN HOMOGENEOUS MEDIA

100654 Scattering from a V-shaped groove in the resonance domain. G.S.White, J.F.Marchiando (US NBS, Washington, DC, USA).
Appl. Opt. (USA), vol.22, no.15, p.2308-12 (1 Aug. 1983).
Radiation scattered from a *V*-shaped groove in the resonance domain was measured and compared to predictions from a rigorous theory. The calculated scattering accurately predicted the number of peaks and general shape of the observed scattering. Small variations in groove shape were found to alter peak heights noticeably and peak positions slightly. Finite beam size caused unavoidable discrepancies between calculated and measured scattering. (3 refs.)

100655 Selective reflection of light by helical piles of birefringent plates. G.Joly, N.Isaert (Lab. de Dynamique des Cristaux Moleculaires, CNRS, Villeneuve-d'Ascq, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.15, p.1135-8 (25 April 1983). In French.
Helical piles of transparent plates with rectilinear birefringence, lightened in the direction of the screw axis, show two series of selective reflection domains. The piles studied experimentally reflect totally right handed circular vibrations for one series and left handed circular vibrations for the other. (11 refs.)

100656 Scattering from sinusoidal gratings: an evaluation of the Kirchhoff approximation. A.Wirgin (Lab. de Mecanique Theorique, Univ. de Paris VI, Paris, France).
J. Opt. Soc. Am. (USA), vol.73, no.8, p.1028-41 (Aug. 1983).
The Brekhovskikh variant of the Kirchhoff approximation (KA), as it applies to the description of the scattered field at large distances from a perfectly conducting sinusoidal grating (of amplitude h and period d) exposed to a plane wave of wavelength λ and incidence angle θ_i, is evaluated by means of energy-balance error calculations and comparisons with quasi-rigorous reference results obtained from the extensive form of the Rayleigh theory (RT). The RT is theoretically exact for all d/λ provided that $h/d \lesssim 0.072$ and can be made to yield accurate numerical solutions at all θ_i and for all polarizations roughly for $h/d < 0.39\text{-}0.0177\ (d/\lambda)$ when $d/\lambda \leq 15$. The KA is found to yield sufficiently accurate solutions at normal incidence not only for roughly $h/d < 0.011\ (d/\lambda)$. Furthermore, the quality of the KA diminishes rapidly with increasing angle of incidence, as is shown by the fact that unacceptable errors occur for $h/d \gtrsim 0.1$ above $\theta_i \simeq 6°$, for $h/d \gtrsim 0.05$ above $\theta_i \simeq 37°$, and for $h/d \gtrsim 0.016$ above $\theta_i \simeq 63°$ at the period/wavelength ratio of 10. At higher frequencies ($d/\lambda \simeq 36$) there is some improvement in that, for example, the error becomes excessive for $h/d \gtrsim 0.1$ only above $\theta_i \simeq 25.5°$. The KA proves to be unsafe at any frequency and incident angle as soon as h/d exceeds 0.13. This threshold is shown to be related to the onset of multiple scattering in the sense of geometrical optics. (62 refs.)

100657 Analysis of diffraction of an ellipsoidal wavefront. P.Rajagopala Rao (Electrical Engng. Dept., Baghdad Univ. of Technol., Baghdad, Iraq), M.M.Mahmoud, G.V.P.Rao.
J. Opt. (India), vol.12, no.1, p.8-11 (Jan.-March 1983).
Derives an expression from first principles for diffraction at an ellipsoidal wavefront. The diffraction of spherical and planar wavefronts are shown as specific cases from the same. The areas of Fresnel half period zones from the ellipsoidal wavefront are shown to be dependent on the ellipticity of the wavefront. (3 refs.)

100658 A note on wedge functions and echelette gratings. R.C.McPhedran (Dept. of Theoretical Phys., Univ. of Sydney, Sydney, Australia).
Opt. Acta (GB), vol.30, no.8, p.1029-34 (Aug. 1983).
The diffraction formalism of Jovicevic and Sesnic (see J. Opt. Soc. Am., vol.62, p.865, 1972) for echelette gratings has been the subject of much controversy. The authors outline how the formalism may be altered to make it rigorous. The cases of symmetric and asymmetric groove profiles are considered separately. In the latter situation, two separate modal expansions must be used in the groove region. (12 refs.)

100659 Comments on 'Determination of the absorption coefficient of thin absorbing films from measurements on the change of phase in transmission'. J.Casset (Dept. de Phys. du Solide, Univ. de Provence, Marseille, France).
Opt. Acta (GB), vol.30, no.8, p.1039-40 (Aug. 1983).
Comments on the paper by N. Barakat (see ibid., vol.29, p.1309, 1982) giving examples of similar methods used for particular cases. (6 refs.)

100660 Number of degrees of freedom in inverse diffraction. M.Bertero (Istituto Matematico l'Univ. di Genoa, Genoa, Italy), C.De Mol, F.Gori, L.Ronchi.
Opt. Acta (GB), vol.30, no.8, p.1051-65 (Aug. 1983).
The problem of inverse diffraction from plane to plane is considered in the case where a finite aperture exists in the boundary plane. Singular values and singular functions for the problem are introduced, and the number of degrees of freedom is defined in terms of the distribution of the singular values. Numerical computations are presented for the one-dimensional problem and it is shown that the effect of evanescent waves disappears at a distance of approximately one wavelength from the boundary plane, even when the dimension of the slit is comparable with the wavelength of the diffracted field. (16 refs.)

100661 The spatial coherence properties of Gaussian Schell-model beams. A.T.Friberg, R.J.Sudol (Dept. of Phys. & Astron., Univ. of Rochester, Rochester, NY, USA).
Opt. Acta (GB), vol.30, no.8, p.1075-97 (Aug. 1983).
The transverse and longitudinal spatial coherence properties of the light beams generated by planar Gaussian Schell-model sources are discussed. It is found that for all Gaussian Schell-model beams the ratio of the transverse coherence length to the beam width remains invariant upon propagation. An examination of the longitudinal coherence for both on-axis and off-axis pairs of points indicates that the longitudinal coherence will not, in general, die out as the separation between the points is increased. Rather, the degree of longitudinal coherence will approach a finite (non-zero) value as long as the source contains a finite coherence area, regardless of how small this area may be. Gaussian quasi-homogeneous beams are studied as a limiting case. The relation of the present work to the analysis of speckle size is briefly discussed. (33 refs.)

100662 Semiapertures quadrature. A.Magiera, L.Magiera (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.13, no.1, p.91-100 (1983).
Contains the results obtained from the application of Hilbert transforms to present the diffraction patterns of the real semiapertures in analytical form with a quadrature component of the aperture function. The results have been compared with those obtained for amplitude-apodized optical systems. (4 refs.)

100663 A simple graphical method to determine the action of a system of retarders. S.Y.Keshavan (Dept. of Mech. Engng., Univ. of the West Indies, St. Augustine, Trinidad).
Strain (GB), vol.19, no.3, p.115-25 (Aug. 1983).
Graphical methods for the study of the transformation of polarised light are essentially pictorial representations of the changes in the polarisation of light as it passes through a system of polarisers and retarders. The analysis is common in both photoelasticity and crystallography. In the proposed method, knowing the characteristic parameters along a particular light path, a simple graphical method for determining the linear retarders which cause the variation of polarisation of light along the light path is illustrated. In a general loaded three dimensional photoelastic model, the characteristic parameters can be found at intervals along the light path. This graphical method makes use of the characteristic parameters and splits the light path into individual retarders which cause the combined effect for the light path. (6 refs.)

100664 On the structure of the diffraction field in the Fraunhofer zone. V.A.Zverev, T.P.Kosoburd, N.S.Stepanov (N.I. Lobachevski State Univ., Gorki, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.950-1 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.604-6 (Nov. 1982).
Fraunhofer diffraction for planar objects is one of the classical divisions of wave optics. A rectangular structure, even if it is contained in the transparency, is not preserved in the diffraction pattern. With increasing angle of inclination there is a tendency for the appearance of axial symmetry (with the symmetry axis y_1 corresponding to the line of intersection of the plane of incidence and the transparency itself). (4 refs.)

100665 Calculation of the parameters of a laser beam transmitted by a focusing rod. A.A.Kuznetsov, A.B.Tsibulya (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.243-5 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.430-2 (Feb. 1983).
Expressions are derived for relating the parameters of a laser beam at the entry and exit of a focusing rod with a parabolic refractive index profile. The derivation is made by using the framework of paraxial geometric optics and by modeling a laser beam by a ray packet equivalent in result to the Kogelnik model. (4 refs.)

Simple and direct determination of complex refractive index and thickness of unsupported or embedded thin films by combined reflection and transmission ellipsometry at 45° angle of incidence .... See Entry 99157

New graphical method for the determination of the optical constants of thin films .... See Entry 99161

Selective counting path to Young's fringes in speckle photography for eliminating diffraction halo effects .... See Entry 99162

Experimental determination of variations in optical-waveguide film thickness by the interference of scattering fields of modes with different polarization .... See Entry 99170

Technique for measuring the amount of pressure-induced polarization scrambling by optical windows in high pressure light scattering cells .... See Entry 99193

Effect of spatial incoherence of the laser in photon-correlation spectroscopy .... See Entry 99196

Focus-error operator and related special functions .... See Entry 100670

Grating coding for image subtraction with uneven bar widths .... See Entry 100674

Apodization by a set of slits in one- and two-dimensional optical systems .... See Entry 100677

Diffraction efficiency of blazed holographic gratings .... See Entry 100700

Digital and optical moire detection of flaws applied to holographic nondestructive testing .... See Entry 100705

Estimate of the influence of secondary scattering on the diffraction efficiency of volume holograms of diffuse objects .... See Entry 100707

Photon interference and correlation effects produced by independent quantum sources .... See Entry 100712

Influence of self-sustained pulsation in semiconductor lasers on optical transmission system .... See Entry 100816

Temporal and interference fringe analysis of TEM$_{01}$* laser modes .... See Entry 100819

An estimate of the effect of interference on the reflection of the radiated power of a laser beam from a stratified receiver ....See Entry 100823

Parametric interaction of oppositely propagating light waves of identical frequency ....See Entry 100840

Design of ripple-free multilayer optical filters. A practical illustration ....See Entry 100879

Characteristic curve of meteoric spectrograms obtained by an optical diffraction transmission grating ....See Entry 100881

Calculation of electro-optical diffraction deflector with edge effects taken into account ....See Entry 100883

Graphical representation of prism coupling into thin films ....See Entry 100884

Optical soliton-like surface phenomena ....See Entry 100891

Image transmission characteristics of dielectric slab with gradient index ....See Entry 100894

Launching light from semiconductor lasers into plane-ended multimode optical fibers ....See Entry 100896

Launching light from semiconductor lasers into multimode optical fibers having hemispherical ends and taper-with-hemisphere ends ....See Entry 100897

Dispersionless single-mode fibers with trapezoidal-index profiles in the wavelength region near 1.5 μm ....See Entry 100900

Polarization-maintaining optical fibers with low dispersion over a wide spectral range ....See Entry 100901

Thermal properties of highly birefringent optical fibers and preforms ....See Entry 100902

Effects of loss on equivalent-step-index fibre determination ...See Entry 100907

Beat length determination of birefringent fibers by measuring delay of transmitted light pulse ....See Entry 100918

Investigation of the birefringence of natural alkali-halide crystals with the help of interference of polarized rays ....See Entry 102846

42.20 PROPAGATION AND TRANSMISSION IN INHOMOGENEOUS MEDIA

100666 Theoretical and experimental investigations of light scattered from a rotating ground glass. V.Harwalkar, H.Bohidar, S.Chopra (Phys. Dept., Indian Inst. of Technol., New Delhi, India).
Appl. Phys. B (Germany), vol.B31, no.4, p.215-20 (Aug. 1983).
The authors report on a theoretical analysis and experimental observations on the statistical properties of light scattered from a rotating ground glass using a multichannel analyser based photon correlator system. Analysis of data indicates that the linewidth of scattered radiation depends on the scattering angle, which contradicts evidence presented earlier by Estes et al. (1971) and others. (4 refs.)

100667 Photon correlation spectroscopy of polydisperse samples. I. Histogram method with exponential sampling. G.C.Fletcher, D.J.Ramsay (School of Math. & Phys., Macquarie Univ., North Ryde, Sydney, New South Wales, Australia).
Opt. Acta (GB), vol.30, no.8, p.1183-96 (Aug. 1983).
The method of cumulants for analysing data from polydisperse solutions of scatterers works well for fairly narrow distributions of particle radii. With broader distributions cumulants analysis is less successful, largely because of truncation errors in the series expansions. The authors have represented continuous broad distributions of decay rates by exponentially spaced δ functions and histogram steps in order to compare these two approaches and to determine an optimal practical procedure. Different histograms, obtained by varying slightly the step positions, are 'overlaid' to obtain more detail in the recovered distribution function. Results of this procedure for analysing light-scattering data are presented for both synthetic data of known distribution function and also for real data from a polydisperse suspension of fat particles in milk. For the synthetic data the mean decay rate (and hence the mean particle size), polydispersity and skew of the distribution are recovered more effectively by the histogram method than by cumulant analysis. The distribution functions of decay rate are also converted to distribution functions of particle radius. (12 refs.)

Particle size distributions from forward scattered light using the Chahine inversion scheme ....See Entry 99076

Simultaneous determination of refractive index and size of spherical dielectric particles from light scattering data ....See Entry 99077

Particle size distributions from Fraunhofer diffraction. I. An analytic eigenfunction approach ....See Entry 99078

Low amplitude measurement by direct lock-in ESPI, a proposal ....See Entry 99079

Selective counting path to Young's fringes in speckle photography for eliminating diffraction halo effects ....See Entry 99162

Analysis of Young's fringes in speckle photography: generalised square imaging aperture ....See Entry 99164

Speckle and its application to strain sensing ....See Entry 99166

Automated data reduction for speckle metrology ....See Entry 99167

White light optical processing of speckle interferograms ....See Entry 99168

Speckle-shear interferometry with double Dove prisms ....See Entry 99169

The spatial coherence properties of Gaussian Schell-model beams ....See Entry 100661

Possibilities of holographic separation of the useful signal ....See Entry 100698

Statistical properties of modal noise in fibre-laser systems ...See Entry 100914

Transient decay following pulse excitation of diffuse scattering samples ....See Entry 103622

42.30 OPTICAL INFORMATION, IMAGE FORMATION AND ANALYSIS

100668 Introduction to two-dimensional Fourier analysis. M.S.Rzeszotarski (Case Western Reserve Univ., Cleveland, OH, USA), F.L.Royer, G.C.Gilmore.
Behav. Res. Methods & Instrum. (USA), vol.15, no.2, p.308-18 (April 1983). (12th National Conference on the Use of On-Line Computers in Psychology, Minneapolis, MN, USA, 1982).
An introduction is given to some of the methods used in two-dimensional Fourier analysis and to two-dimensional image processing in general. (9 refs.)

100669 Pattern recognition. E.S.Gelsema.
Informatie (Netherlands), vol.25, no.6, p.58-64 (June 1983). In Dutch.
Pattern recognition by computer is concerned with the classification of perceived objects either from the nature and sequence of constituent elements syntactic pattern recognition or based on an analysis of statistical features (dimensions, surface structure, light reflection etc.). In everyday language the term 'picture processing' is used. The author presents a survey of the methodological background to 'picture processing' is used. The author presents a survey of the methodological background to 'picture processing' and statistical-analytical pattern recognition. (4 refs.) *R.S.*

100670 Focus-error operator and related special functions. J.Ojeda-Castaneda (Phys. Inst., Univ. Erlangen, Erlangen, Germany).
J. Opt. Soc. Am. (USA), vol.73, no.8, p.1042-7 (Aug. 1983).
The effect of focus error in image formation under coherent illumination is described in terms of a differential operator of exponential type. Fourier or Talbot images of periodic objects are described in terms of the eigenfunctions and the eigenvalues of this operator. The approach is also employed to generate special functions that indicate the influence of focus error on the point-spread function, the line-spread function, and the edge response. One set of functions is identified with Boivin's functions; the other seems to be new. Several properties of these functions (e.g. recurrence relations, power series, and differential equations) are given. (19 refs.)

100671 Critical issues in high-density magnetic and optical data storage. I. A.E.Bell (IBM Res. Div., San Jose, CA, USA).
Laser Focus (USA), vol.19, no.8, p.61-6 (Aug. 1983).
The storage of machine-readable information is of fundamental importance in today's highly complex and computer-oriented society. During the past thirty years, data storage has been synonymous with magnetic data storage, and enormous advances have been made in the performance of magnetic storage peripherals. Research and development into current configurations for optical data storage devices began in the late 1960s with early work on the read-only consumer videodisc, and this work has now advanced to a stage where optical disc data storage densities in the range 10^8-10^9 BPI have been demonstrated, i.e. well beyond current magnetic disc product densities. The author reviews and discusses the fundamental limits and identifies the key engineering issues that must be faced by each of these technologies as they evolve towards increasingly high density data storage. (16 refs.)

100672 Scale and rotation invariant real time optical correlator using computer generated hologram. Y.Saito, S.Komatsu, H.Ohzu (Dept. of Appl. Phys., Waseda Univ., Tokyo, Japan).
Opt. Commun. (Netherlands), vol.47, no.1, p.8-11 (1 Aug. 1983).
Scale and rotation invariant optical correlation is performed with a combination of the $\ln r-\theta$ coordinate transformation and the conventional optical matched filtering. The mask for the $\ln r-\theta$ coordinate transformation is made of the computer generated hologram whose transmission function is derived by the use of the stationary phase method. For the real time processing, a BSO incoherent-to-coherent device is placed on the coordinate transformed plane. (9 refs.)

100673 Fourier amplitude and Fourier phase in image sequences. Ch.Thum (Phys. Inst., Erlangen, Germany).
Opt. Commun. (Netherlands), vol.47, no.1, p.31-5 (1 Aug. 1983).
In an image sequence, the single images often look very similar except for shifts of one particular object. The author's investigations show that the Fourier amplitudes of the single images within an image sequence do not change very much, too. But the Fourier phases may change significantly. The author wants to make use of the almost-constancy of the Fourier amplitudes. As a consequence of this result, the author replaced the Fourier amplitude of every image in the sequence by the same estimate, and reconstructed every image from its correct Fourier phase and from the estimated Fourier amplitude. This concept can be used in transform coding, where one can achieve a data compression factor of about 1/2. (2 refs.)

100674 Grating coding for image subtraction with uneven bar widths. G.Rodriguez (Centro de Investigaciones en Optica AC, Mexico City, Mexico).
Opt. Lett. (USA), vol.8, no.8, p.455-7 (Aug. 1983).
A discussion is presented of the main features of grating coding when the encoder ruling has unequal widths in clear and dark bars. It is shown that the use of such a grating does not alter difference information. Alterations occur on the addition information. The validity of this analysis for the partially coherent case is shown. (8 refs.)

100675 Line-spread function relatively insensitive to defocus. J.Ojeda-Castaneda, L.R.Berriel-Valdos, E.L.Montes (Inst. Nacional de Astrofisica, Optica y Electronica, Puebla, Mexico).
Opt. Lett. (USA), vol.8, no.8, p.458-60 (Aug. 1983).
A new approach for obtaining line-spread functions (LSFs), which vary slowly in out-of-focus planes, is described. Based on this approach, the authors report a LSF that shows relatively less sensitivity to focus errors than that shown by both the diffraction-limited LSF and a LSF previously reported. (5 refs.)

100676 Pseudocolouring of directional structures by spatial frequency filtering. R.Nowak, M.Zajac (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.13, no.1, p.39-46 (1983).
The results of pseudocolouring of the directional structures with the help of an optical setup for spatial frequency filtering with a quasipoint white light source and multicolour sectional spatial filter are presented. Apart from the test objects the examples of pseudocoloured biological and metallographic photomicrographs as well as aerial and satellite photographs are shown. (27 refs.)

100677 Apodization by a set of slits in one- and two-dimensional optical systems. A.Magiera (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.13, no.1, p.73-91 (1983).
Previously (see ibid., vol.12, p.363, 1982) the influence of selected amplitude apodizers on the resolving power of a two-point image was analysed. The critical values of two-point resolution distance were determined when using the Rayleigh criterion. In this paper the intensity distributions of slits image obtained by using apodizers in an incoherent optical system are analysed as a supplement to the previous considerations. (2 refs.)

100678 Recognition of optical signals with polymodal probability distributions. V.I.Vorob'yev.
Telecommun. & Radio Eng. Part 2 (USA), vol.37, no.8, p.67-71 (Aug. 1982). Translation of: *Radiotekhnika, Moskva (USSR)*, vol.37, no.8, p.14-19 (Aug. 1982).
Estimation algorthms and the accuracy of estimates of the parameters of random, binary 'checkerboard' patterns, with application to the joint recognition of superimposed images of objects with a partial mutual shading, are considered. (4 refs.)

100679 Optimal multiple-parameter estimation in optical communications and quantum-mechanics—case of concentrated prior probabilities and finite dimensional Hilbert spaces. D.Ilic (Ilic Computers Corp. Inc., Santa Fe, CA, USA).
1983 IEEE International Symposium on Circuits and Systems, Newport Beach, CA, USA, 2-4 May 1983 (New York, USA: IEEE 1983), p.884-8 vol.2
An entirely new concept of minimum error variance quantum-mechanical estimation is developed for optical communications and quantum-mechanical applications. From the general results the author constructs the optimal quantum estimator for the case of concentrated prior probabilities and finite dimensional underlying Hilbert space. The quantum estimation problem treated is reduced to an equivalent unconstrained minimization problem of a real-valued polynomial functional of real variables which has the property that all local solutions are also global solutions. Consequently, the problem whose solution is beyond the comprehension of contemporary mathematics is reduced to a problem that is conceptually the simplest conceivable optimization problem. (1 ref.)

Optics and Images in Law Enforcement II .... See Entry 98621

Abbe's error .... See Entry 98709

Low amplitude measurement by direct lock-in ESPI, a proposal .... See Entry 99079

White light optical processing of speckle interferograms ....See Entry 99168

Image contrast in a laser projection microscope .... See Entry 99179

Focal plane spatial response and modulation transfer function (MTF) measurements using a computer-aided flying spot scanner ....See Entry 99184

Semiapertures quadrature ....See Entry 100662

New research in holographic pattern recognition ....See Entry 100681

Aberrational analysis of optical systems with diffraction elements ....See Entry 100872

Phase coding of complex space-frequency filters ....See Entry 100878

Image transmission characteristics of dielectric slab with gradient index ....See Entry 100894

An application of the optical correlation computer to the detection of the Malkus transitions in free convection ....See Entry 101242

Quasi-two-dimensional excitons in GaAs/Al$_x$Ga$_{1-x}$As semiconductor multiple quantum well structures ....See Entry 102264

Application of two-dimensional Fourier transforms to problems of visual perception ....See Entry 103857

42.40 HOLOGRAPHY

(for acoustic holography, see 43.63)

100680 Survey of display hologram types. S.A.Benton (Res. Labs., Polaroid Corp., Cambridge, MA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353, p.2-5 (1983). (Industrial and Commercial Applications of Holography, San Diego, CA, USA, 24-25 Aug. 1982).
Some characteristics of four principal types of display holograms are outlined in order to permit accurate identification and comparison by observers in the field. Several well-known non-holograms are also discussed. (15 refs.)

100681 New research in holographic pattern recognition. D.Casasent (Dept. of Electrical Engng., Carnegie-Mellon Univ., PA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353, p.6-11 (1983). (Industrial and Commercial Applications of Holography, San Diego, CA, USA, 24-25 Aug. 1982).
The major use of holography in optical pattern recognition systems has been in matched spatial filter correlators. The author discusses new uses of holographic techniques in optical pattern recognition applications. These include: optical pattern recognition architectures of reduced size, weight and volume; optical pattern recognition architectures with reduced component tolerances; new nonlinear local optical preprocessing architectures; and optical pattern recognition systems that operate when geometrical and other differences are present in the input image. (20 refs.)

100682 Real time holographic interferometry with photorefractive Bi$_{12}$SiO$_{20}$ crystals. A.Marrakchi (Dept. of Electrical Engng., Univ. of Southern California, Los Angeles, CA, USA), J.P.Herriau, J.P.Highnard.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353, p.24-8 (1983). (Industrial and Commercial Applications of Holography, San Diego, CA, USA, 24-25 Aug. 1982).
The high sensitivity combined with the externally controlled spatial frequency response of photoconductive electrooptic $Bi_{12}SiO_{20}$ crystals (BSO) allow real-time nondestructive testing either by phase conjugation in the four-wave mixing configuration (FWM) or by energy transfer in two-wave mixing experiments (TWM). Applications to image amplification and mode pattern visualisation of a vibrating 3-D diffuse object is demonstrated. (12 refs.)

100683 Industrial applications of holographic testing. D.W.Nicholls (AiRes. Mfg. Co., St. Torrance, CA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353, p.33-9 (1983). (Industrial and Commercial Applications of Holography, San Diego, CA, USA, 24-25 Aug. 1982).
Several applications of holographic testing are described together with the holographic methods used. Test subjects include components of gas turbine engines, cooling turbines, as well as statically loaded structures. Several typical examples are shown. (no refs.)

100684 Large aperture thermoplastic film computer driven holographic recording system. P.Meyrueis, C.Liegeois, F.Lamy, B.Ineichen (Louis Pasteur Univ., Strasbourg, France).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353, p.40-6 (1983). (Industrial and Commercial Applications of Holography, San Diego, CA, USA, 24-25 Aug. 1982).
Describes a new opportunity in holographic industrial use with a large aperture thermoplastic film recording system. This system is computer-driven and can be synchronized with other stages in the holographic control. The system is designed and tested for use in an industrial context. (10 refs.)

100685 Hologram scanner design and fabrication in dichromated gelatin (DCG). R.Rallison, R.Lowe (Internat. Dichromate Corp., Draper, UT, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353, p.47-51 (1983). (Industrial and Commercial Applications of Holography, San Diego, CA, USA, 24-25 Aug. 1982).
Two major applications of holographic scanners are considered, the first is the code reader scanner now in use in supermarkets and soon to be used in automated warehousing. The second is the multipurpose line scanner currently used in line printers and soon to be included in automated inspection systems. Code reader facets perform multiple functions, each one deflects and focuses laser light at a unique angle and scans a short arc, the return light from a bar code is collimated by the same facet and is subsequently focused through a small aperture. Ambient light is diffracted at other angles and focused at points all around the aperture giving a high signal to noise ratio and the large height efficiency facets gather sufficient return light so that photodiodes and low power lasers can be used in the system. Line scanners can be made in a large variety of sizes and configurations inexpensively and with perfect fidelity, each one being a holographic replica of a master hologram. Focused arcs as well as parallel straight lines and even arbitrary computer generated scans are possible. The limitations and considerations of such devices are discussed along with design criteria related to fabrication problems and actual production line results. (3 refs.)

100686 Use of holographic optical elements as beam splitters in holography of weakly moving objects. E.S.Ebied, D.Courjon, J.Bulabois (Lab. de Phys. Generale et Optique, Faculte des Sci. et des Tech., Besancon, France).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353, p.52-60 (1983). (Industrial and Commercial Applications of Holography, San Diego, CA, USA, 24-25 Aug. 1982).
The necessity of perfect stability of the object during the holographic recording step is one of the chief problems which limits the use and the development of such an optical coding technique. The authors show that the quality of the reconstructed image depends upon several parameters, first of all the object motion, the structure of the object, the type of recording set-up, the nature of the coding and finally the linearity of the transfer intensity to density, in the hologram. Taking into account such different parameters, it is then possible to design holographic set-ups characterized by a relative insensitivity to motion and more generally to perturbations of the object during the recording step. The adopted device is based on imagery which ensures optical paths of equal lengths and on the use of holographic optical elements as beam splitters. Thanks to holographic beam splitters it is possible to modify the distribution of the object information in the hologram plane. Two holographic codings are studied: (i) a small hologram area codes one object point (point to point coding), (ii) a small hologram area codes the whole object information (object to point coding). Although the second coding gives a better result than the first in the case of a fixed object, the first one enables one to retrieve images of good quality even for object displacements of a few millimeters. The developed technique should be carried out in holographic microscopy of living cells. (7 refs.)

100687 Holographic concentrator insuring a chromatic dispersion on a photovoltaic cell array. N.Aebischer, C.Bainier, M.Guignard, D.Courjon (Lab. de Phys. Generale et Optique, Faculte des Sci. et des Tech., Besancon, France).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353, p.61-7 (1983). (Industrial and Commercial Applications of Holography, San Diego, CA, USA, 24-25 Aug. 1982).
Presents a preliminary study and a prototype of a holographic solar concentrator where both focusing and dispersive properties of holographic optical elements are exploited. In such a concentrator, the image of the sun is chromatically dispersed and projected on a photovoltaic cell array; each cell corresponds to a specific band of the solar spectrum. This configuration insures the matching between the spectral response of the cells and the solar spectrum. Due to this matching, the photovoltaic cells can work in optimal conditions, that is, with maximum energy efficiency. The aim of this work is to underline the different problems and a perspective of such a realization. The problems are connected to chromatic aberrations, amplitude of dispersion, diffraction efficiency, stability in time, etc. (12 refs.)

100688 Ion-etching as a means of blazing and optimizing holographic diffraction gratings. J.M.Lerner (Instruments SA Inc., Metuchen, NJ, USA), J.Flamand, A.Thevenon.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353, p.68-71 (1983). (Industrial and Commercial Applications of Holography, San Diego, CA, USA, 24-25 Aug. 1982).
Holographic diffraction gratings, when used in a spectroscopic application, produce excellent image quality and stray-light rejection, but sometime lack optimum efficiency. Ion-etching through a sinusoidal photoresist groove into a glass substrate can produce triangular profiles comparable with the groove shape produced by classical diamond burnishing. This can be accomplished in both plano, spherical and aspheric substrates to produce gratings comparable in efficiency to classically ruled gratings. (10 refs.)

100689 Holographic nondestructive evaluation with on-line acquisition and processing. Y.Katzir, A.A.Friesem, I.Glaser, B.Sharon (Dept. of Electronics, Weizmann Inst. of Sci., Rehovot, Israel).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353, p.74-81 (1983). (Industrial and Commercial Applications of Holography, San Diego, CA, USA, 24-25 Aug. 1982).
A holographic non-destructive evaluation (HNDE) system with on-line acquisition and processing of real-time interferograms is presented. The system comprises; photoconductor-thermoplastic recording materials, an image acquisition system based on a photodiode-array line scanner, a microprocessor for controlling acquisition and other system functions and a link to a large computer. The system is capable of fringe detection down to an accuracy of 1/100th of a fringe. Applications for the non-destructive evaluation of an actual industrial specimen, as well as mapping the derivatives of deformation of a 2-D object are presented. (7 refs.)

100690 Automatic computer analysis of double exposure hologram in industrial nondestructive control. F.Lamy, C.Liegeois, P.Meyrueis (Univ. Louis Pasteur, Strasbourg, France).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353, p.82-9 (1983). (Industrial and Commercial Applications of Holography, San Diego, CA, USA, 24-25 Aug. 1982).
A software package based on symbolic form recognition algorithms has been established for holographic fringe characterization through a video camera. This program also includes sections for separating the inner defects from the outer ones in periodic structures. It has been tested successfully on cylindrical containers made of wired keolar on which all other non-holographic testing methods are inapplicable. (6 refs.)

100691 Nd:YAG holographic interferometer for aerodynamic research. J.E.Craig (Spectron Dev. Labs. Inc., Costa Mesa, CA, USA), G.Lee, W.D.Bachalo.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353, p.96-103 (1983). (Industrial and Commercial Applications of Holography, San Diego, CA, USA, 24-25 Aug. 1982).
A holographic interferometer system has been installed in the NASA Ames 2- by 2-Foot Transonic Wind Tunnel. The system incorporates a modern 10 pps, Nd:YAG pulsed laser which provides reliable operation and is easy to align. The spatial filtering requirements of the unstable resonator beam are described, as well as the integration of the system into the existing schlieren system. A two-plate holographic interferometer is used to reconstruct flow

field data. For static wind tunnel models, the single exposure holograms are recorded in the usual manner; however, for dynamic models such as oscillating airfoils, synchronous laser hologram recording is used. (12 refs.)

100692 Holographic measurement of particulate contamination in sealed sterile containers. J.C.Zeiss, J.Z.Knapp (R&D Engng. Dept., Schering Corp., Bloomfield, NJ, USA), J.S.Crane, P.Dunn, B.J.Thompson.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353, p.106-13 (1983). (Industrial and Commercial Applications of Holography, San Diego, CA, USA, 24-25 Aug. 1982).
The presence of particulates in injectable solutions can be medically hazardous depending on their size and shape. Hence, a mandatory particulate inspection is performed prior to the release of any injectable drug. However, the determination of realistic quality limits has been hampered by the absence of any physical non-destructive measurement or comparison technique. The authors describe a far-field holographic method for the measurement of particulate contamination in sealed sterile containers. This application of holography provides the pharmaceutical industry with a non-destructive technique to inspect production containers and to classify the size and quantity of contaminants. (12 refs.)

100693 Automatic evaluation of angular movements and linearity with holographical methods. M.Celaya, D.Tentori, C.Lopez, C.G.Lopez (Dept. of Centro de Investigacion Cientifica y de Educacion Superior, Appl. Phys., Ensenada, Mexico).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353, p.114-20 (1983). (Industrial and Commercial Applications of Holography, San Diego, CA, USA, 24-25 Aug. 1982).
A real time holographic interferometer coupled to an automatic fringe analyzing system is presented to evaluate the linearity of the axial displacement of a translation stage. The basic holographic set up can separate the lateral from the longitudinal displacements and simplifies the fringe analysis. In plane rotation is identified by observing the nature of the variation of the fringe contrast with change in the viewing aperture stop. Tilt is identified and measured in the conventional manner that requires a simple modification (a change in the point of illumination) of the basic setup. The automatic fringe analyzing system identifies the center of a fringe as the midpoint between any two consecutive points of inflexion of the cosine density variation that may be ride on a variable dc bias due to noise and amplitude fluctuation in the reconstructed image. (4 refs.)

100694 Holography in Europe. H.Steinbichler (Lab. Hans Steinbichler, Endorf, Germany).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353, p.138-49 (1983). (Industrial and Commercial Applications of Holography, San Diego, CA, USA, 24-25 Aug. 1982).
Holographic interferometry offers some essential advantages over other kinds of testing and measuring methods. Therefore this technology has arrived at such an advanced development stage that it is suited for use in the industrial manufacturing process. In composite materials holographic testing has already provided its worth. In addition to such pure material testing, vibration processes in structures and complete units can be investigated by holography. The methods described are verified by concrete examples. (16 refs.)

100695 Present state of holography in Japan. M.Suzuki (Dept. of Optical Instrument, Fuji Photo Optical Co., Ltd., Saitama, Japan), Y.Hayashi, Y.Yamamoto.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353, p.150-7 (1983). (Industrial and Commercial Applications of Holography, San Diego, CA, USA, 24-25 Aug. 1982).
Studies into the practical applications of holography started in universities and research institutions in Japan in the early 1960s. In addition, the development of a holographic system for practical use was facilitated by the cooperation of optical manufacturers with many university research laboratories. Since the first holographic system was sold on the market in 1979, the systems have found wide acceptance in the industrial field. Although the use of holography yields a wide variety of industrial applications, the most popular applications utilized at the present time in Japan are display generation and interferometry. (32 refs.)

100696 Display holography: a frontier of high resolution photography. N.J.Phillips (Dept. of Phys., Loughborough Univ. of Technol., Loughborough, England).
J. Photogr. Sci. (GB), vol.31, no.4, p.134-42 (July-Aug. 1983).
Since the invention of holography by Dennis Gabor (*c*.1948) and the invention of the laser in 1960, the field of display holography has seen great advances. The early promise of the modern work in the early 1960s was clearly blocked by a lack of understanding of basic photographic science. More recent work based on a better understanding of photographic chemistry has at least revealed many of the obvious problem areas. The author seeks to outline the important holographic imagery regimes, to offer an understanding of how each depends on specific photographic manipulative methods as far as chemistry is concerned, and how they interrelate with the special photographic materials in the recording process. (18 refs.)

100697 Holographic phase aberration balancing with an inexpensive liquid gate. V.G.Kulkarni, D.Sen (Stand. Div., Nat. Phys. Lab., New Delhi, India).
J. Opt. (India), vol.12, no.1, p.1-5 (Jan.-March 1983).
A method of constructing a liquid gate of good optical quality by using inexpensive glass sheets as windows is described. Experimental results are presented to demonstrate the performance of the liquid gate. Such a liquid gate is useful for production of correction holograms for optical imaging and optical data processing applications. (6 refs.)

100698 Possibilities of holographic separation of the useful signal. O.V.Angel'skii, V.K.Polyanskii.
J. Appl. Spectrosc. (USA), vol.37, no.4, p.1185-8 (Oct. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.4, p.636-40 (Oct. 1982).
Real media encountered in the path of beams taking part in the construction of images are unavoidably light-scattering. Scattering or radiation leads to the appearance of a background (reduction in contrast) in the observed image of the object. A comparative estimate of the effectiveness of the methods of 'averaging' and 'accumulating' holograms is made, and the optimum choice of geometry for recording holograms through scattering media is discussed. The case when a nonsteady medium (mist, haze) serves as the scatterer is considered. (8 refs.)

100699 Contrast enhancement in holographic moire fringes. P.K.Rastogi, P.Jacquot, L.Pflug (Swiss Federal Inst. of Technol. of Lausanne, Lausanne, Switzerland).
Opt. Acta (GB), vol.30, no.8, p.1067-74 (Aug. 1983).
Reports on the multiplicative holographic moire fringes in quasireal time. The work overcomes the drawback of low contrast fringes inherent to holographic moire patterns for the measurement of the in-plane displacements. The factors affecting the visibility of the fringes are discussed, and experimental results are presented. (22 refs.)

100700 Diffraction efficiency of blazed holographic gratings. L.Mashev, S.Tonchev (Inst. of Solid State Phys., Bulgarian Acad. of Sci., Sofia, Bulgaria).
Opt. Commun. (Netherlands), vol.47, no.1, p.5-7 (1 Aug. 1983).
The diffraction efficiency of blazed holographic gratings for the visible region was measured as a function of wavelength and angle of incidence for S and P polarization. (6 refs.)

100701 Spurious waves in thick phase gratings. J.W.Lewis, L.Solymar (Dept. of Engng. Sci., Oxford Univ., Oxford, England).
Opt. Commun. (Netherlands), vol.47, no.1, p.23-6 (1 Aug. 1983).
Phase gratings recorded sequentially by a reference wave and two object waves are studied with the aid of a coupled wave approach. It is shown that waves not participating in the recording process may be present with large amplitudes at replay when the two object waves are sufficiently close to each other. (3 refs.)

100702 Increasing the sensitivity of interference measurements. L.T.Mustafina, N.P.Kutikova.
Opt. & Spectrosc. (USA), vol.54, no.1, p.85-7 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.149-52 (Jan. 1983).
It is shown that shearing interferometers can be used for simultaneous recording of holograms with symmetric orientation of the reference beam and for increasing the sensitivity of interference measurements. A method for additionally increasing the sensitivity of interference measurements is discussed wherein the reconstructing wave used is a wave reconstructed from the same hologram but having undergone a π phase shift. Experimental data are cited which confirm the feasibility of increasing the sensitivity of the measurements by more than an order of magnitude while leaving the quality of the interference fringes almost unaffected. (5 refs.)

100703 The use of a fibre-optic reference beam in a focused image holographic interferometer. D.M.Rowley (Dept. of Mech. Engng., Loughborough Univ. of Technol., Loughborough, England).
Opt. & Laser Technol. (GB), vol.15, no.4, p.194-8 (Aug. 1983).
Holographic interferograms recorded in the image plane of an optical system may be referenced by a beam transmitted through an incoherent fibre-optic bundle. In such a system the object to reference beam intensity ratio is noncritical, and path-length matching is easily achieved with commercial push fit connectors. Such an interferometer gives the user greater flexibility and can be used in a wide range of environments. (5 refs.)

100704 Preliminary results on underwater holography. J.Watson, P.W.Britton (School of Electronic & Electrical Engng., Robert Gordon's Inst. of Technol., Aberdeen, Scotland).
Opt. & Laser Technol. (GB), vol.15, no.4, p.215-16 (Aug. 1983).
The growth of the offshore oil and gas industries has created interest in performing optical holography underwater for purposes of inspection and archiving. An investigation is proceeding to establish the influence of a disturbing medium, such as water on holographic image quality and to determine the parameters required of an underwater holographic camera. Preliminary holograms have been produced, in the laboratory, of objects in water-filled tanks. Early indications of this work are that some of the prospective problems associated with underwater holography are likely to present constraints less severe than was first envisaged. (6 refs.)

100705 Digital and optical moire detection of flaws applied to holographic nondestructive testing. Xu Youren, C.M.Vest, E.J.Delp (Coll. of Engng., Univ. of Michigan, Ann Arbor, MI, USA).
Opt. Lett. (USA), vol.8, no.8, p.452-4 (Aug. 1983).
Superposition of two double-exposure holographic interferograms creates moire patterns that can be used to detect flaws. Relative magnification can be used to correct for imprecise replication of loading when the second interferogram is formed; it also can be used to detect flaws when only a single interferogram is used if the basic deformation field is radially symmetric. Digital image processing is a rapid and versatile technique for forming such moire patterns. (6 refs.)

100706 Single-wavelength coding of colour in one-step rainbow holography. E.Jagoszewski, H.Podbielska (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.13, no.1, p.100-6 (1983).
The basic role in colour coding in rainbow holograms is played by the change in reconstructing beam direction with respect to those of reference beams used in recording of particular zones of the object in the hologram. The pseudocolouring method does not lead to exact reconstruction of natural object colour. It enables one however to code and next to reconstruct the image in the chosen colours. If the object is two-dimensional and focused by an optical system exactly in the recording medium plane, the reconstruction obtained is good, free of diffusion caused by dispersion, which is of particular importance in application of this method. (4 refs.)

100707 Estimate of the influence of secondary scattering on the diffraction efficiency of volume holograms of diffuse objects. A.P.Yakimovich (Inst. of Automation & Electrometry, Acad. of Sci., Novosibirsk, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.180-2 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.332-6 (Feb. 1983).
An analysis is made of the influence of secondary scattering of reconstructed waves on the diffraction efficiency of transmission and reflection holograms of diffuse objects. It is shown that such secondary scattering may be approximated by an exponential attenuation of the reconstructing and reconstructed waves in the interior of a hologram. The attenuation constant of this process is proportional to the angular dimensions of an object and inversely proportional to the hologram thickness. The dependences of the diffraction efficency on the modulation amplitude of holograms are obtained for different strengths of secondary scattering. (2 refs.)

Industrial and Commercial Applications of Holography .... See Entry 98623

Low amplitude measurement by direct lock-in ESPI, a proposal .... See Entry 99079

Measurements of the size and position of aerosol droplets using holography .... See Entry 99080

Grain growth during rehalogenating bleaching .... See Entry 99209

Some applications of holography at the Idaho National Engineering Laboratory .... See Entry 99704

Scale and rotation invariant real time optical correlator using computer generated hologram .... See Entry 100672

Fabrication technique of fine gratings in two-dimensional diode lasers .... See Entry 100795

Experimental observation of amplification of beams by dynamic surface holograms .... See Entry 100828

Phase-conjugate wavefront generation in four-wave mixing with photorefractive $Bi_{12}GeO_{20}$ (BGO) crystals .... See Entry 100854

Determination of dynamic stress-intensity factors by holographic interferometry ....See Entry 101157

Measurement of electron concentration of a weakly ionized glow discharge plasma in nitrogen at intermediate pressures .... See Entry 101475

Location and estimation of the defective area in a diaphragm: an a posteriori moire method ....See Entry 103438

42.50 QUANTUM OPTICS

100708 Photoinduced angular motion of states and field splitting of levels. A.G.Rudavets (Inst. of Automation & Electrometry, Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.4, p.220-3 (20 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.4, p.184-7 (20 Feb. 1983).
Wave equations are derived for the probability amplitudes for the angular motion of degenerate states of a resonant transition induced by elliptically polarized light. The spectrum of the field-induced splitting of levels is found by quantizing the azimuthal motion of quasiparticles described by these equations. (4 refs.)

100709 Superfluorescence pulse shape. I.R.Gabitov, V.E.Zakharov, A.V.Mikhailov (L.D. Landau Inst. of Theoretical Phys., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.5, p.279-82 (5 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.5, p.234-7 (5 March 1983).
It is shown that the superfluorescence pulse in a laser without mirrors has a universal self-similar shape, which is determined by a single parameter: the pulse delay time. (7 refs.)

100710 Superfluorescence in a cavity. R.Bonifacio, L.A.Lugiato (Istituto di Fisica dell Univ., Milan, Italy).
Opt. Commun. (Netherlands), vol.47, no.1, p.79-83 (1 Aug. 1983).
The authors analyze the superfluorescent emission from an extended atomic sample contained in a unidirectional ring cavity, such that the atomic linewidth is smaller than the cavity linewidth. This system is governed by a sine-Gordon-type equation which includes a linear loss term, with a suitable boundary condition. The authors show that the time evolution is well described by the mean field model, and discuss extensively the role of the cavity parameters, emphasizing the differences from superfluorescence in free space. (11 refs.)

100711 Observation of sub-Poissonian photon statistics. R.Short, L.Mandel (Dept. of Phys. & Astron., Univ. of Rochester, Rochester, NY, USA).
Phys. Rev. Lett. (USA), vol.51, no.5, p.384-7 (1 Aug. 1983).
The number of photons emitted in a short time interval by a single atom in the process of resonance fluorescence is measured, and it is shown that the probability distribution of this number is sub-Poissonian. (18 refs.)

100712 Photon interference and correlation effects produced by independent quantum sources. L.Mandel (Dept. of Phys. & Astron., Univ. of Rochester, Rochester, NY, USA).
Phys. Rev. A (USA), vol.28, no.2, p.929-43 (Aug. 1983).
Interference effects produced by independent quantum sources are investigated, when the state of the field is not describable as a simple mixture of coherent states. The results of classical and quantum-mechanical calculations are compared. Whereas correlation effects are predicted both classically and quantum mechanically when the sources have random phases, there are important differences when the number of atoms is small. In particular, when each source consists of just one atom, the joint probability of detecting two photons at two different points in the receiving plane is found to vanish when the distance between them is an odd number of half fringes. Finally it is shown that when the number of atoms of each source is subject to Poisson fluctuations, one recovers the solution given by classical optics for thermal light, no matter how weak the sources may be on the average. (23 refs.)

100713 Quantum noise in adaptive optical systems. II. V.I.Tatarskii (Inst. of Atmospheric Phys., Acad. of Sci., USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.9, p.731-42 (Sept. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.9, p.1018-31 (Sept. 1982).
For pt.I see ibid., vol.25, no.8, p.882 (1982). Considers the example of a random electromagnetic field of constant amplitude, with Gaussian phase fluctuations whose phase difference at two points can be measured using two photon counters. The authors compute conditional coherence functions for such a field, which correspond to the detection of some number of photons by these counters. It is shown that an adaptive optical system may be used to advantage no matter how weak the radiant flux. The statistical moments of the sine of the phase difference measured using two photon counters are analyzed. (4 refs.)

100714 Three non-degenerate wave processes. A.Hengeltraub, F.S.Dos Reis (Inst. de Fisica 'Gleb Wataghin', Univ. Estadual de Gampinas, Gampinas, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.4, p.721-8 (Dec. 1982).
The authors have solved the Heisenberg equations of motion, for the creation operator of three independent optical modes, in a system described by a trilinear Hamiltonian. They did a unitary transformation that is equivalent to the short-time approximation when truncated in the second order. This rendered possible the calculation of the normal ordered characteristic functions of each of the three modes. (8 refs.)

100715 New results and analysis of the sequential optimization algorithm for multiparameter quantum estimation. D.Ilic (Dept. of Electrical Engng. & Computer Sci., Univ. of California, La Jolla, CA, USA).
24th Midwest Symposium on Circuits and Systems, Albuquerque, NM, USA, 29-30 June 1981 (North Hollywood. CA, USA: Western Periodicals 1981), p.154-8
Proposes an improved version of the quantum estimation method and proves that the proposed method leads to the solution of the best known problem of simultaneous quantum estimation of the parameters of a laser field at the aperture of a quantum optical receiver. Furthermore, the author demonstrates that the optimization functional is a coercive form. The analysis of the optimization constraints for the case of essentially bounded random variables is given. (10 refs.)

Quantum theory of light. Second edition ....See Entry 98678

On the stationary phase evaluation of path integrals in the coherent states representation .... See Entry 98810

Sufficient conditions for convergence of antinormally ordered expansions of boson number operator functions $f(\hat{a}^+\hat{a})$ .... See Entry 98939

Effect of spatial incoherence of the laser in photon-correlation spectroscopy ....See Entry 99196

Determination of the probability of quantum absorption for particles of photographic blackening ....See Entry 99217

Monoenergetic atomic beam deflection by resonant light pressure ....See Entry 100319

A solvable master equation for population inversion ....See Entry 100719

Dynamic symmetries in quantum electronics ....See Entry 100720

Directivity of the amplified spontaneous emission of active cylinders with end mirrors ....See Entry 100725

42.52 MASERS

100716 A classical electron-cyclotron maser with axial electron beam injection. J.L.Vomvoridis (Western Res. Corp., Arlington, VA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3124-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
It is shown that the Electron-Cyclotron Maser interaction can be made compatible with exclusively axial injection of the electron beam, by introducing an appropriate slow-wave structure. With an appropriate choice for the relevant parameters, the resulting interaction is found to be extremely efficient, with efficiencies approaching 100 percent, and to possess a moderate frequency upshift from the nonrelativistic gyrofrequency. The nonlinear theory of the interaction is outlined and preliminary designs are presented. (8 refs.)

100717 Demonstration of a two-stage backward-wave-oscillator free-electron laser. Y.Carmel, V.L.Granatstein, A.Gover (Naval Res. Lab., Washington, DC, USA).
Phys. Rev. Lett. (USA), vol.51, no.7, p.566-9 (15 Aug. 1983).
An experimental study of a two-stage millimeter-wave source in which the same intense relativistic electron beam first produces powerful (500 MW) radiation at 12.5 GHz and then uses that radiation as a 'pump' for a free-electron-laser interaction at frequency f>140 GHz is described. Implication for two-stage free-electron-laser experiments with reduced electron energy requirements are discussed. (21 refs.)

Transverse particle acceleration techniques using lasers and masers ....See Entry 100085

42.55 LASING PROCESSES

100718 Longitudinal voltage distribution in transverse RF discharge waveguide lasers. D.He, D.R.Hall (Dept. of Appl. Phys., Hull Univ., Hull, England).
J. Appl. Phys. (USA), vol.54, no.8, p.4367-73 (Aug. 1983).
The longitudinal variation in the voltage across a waveguide channel, excited by a transverse radio-frequency discharge has been analyzed in terms of simple transmission line theory. It is shown that the voltage variation follows a cosine curve for the waveguide structure in the absence of a discharge, and that this behavior is only slightly modified when a discharge is running. The voltage may exhibit variations of 30% for cases where the relevant waveguide length is only one tenth of the effective RF wavelength. However, it is shown that this variation may be reduced to below 5%, by the use of multiple feed points or by appropriate inductive termination of the line. Experimental results are in good agreement with theoretical predictions. (3 refs.)

100719 A solvable master equation for population inversion. W.M.Zheng (Ilya Prigogine Center for Studies in Statistical Mech., Univ. of Texas, Austin, TX, USA).
J. Phys. A (GB), vol.16, no.11, p.2497-500 (1 Aug. 1983).
The master equation derived for population inversion in a three-level model is solved exactly. The time-dependent behaviour of the process can then be discussed. (7 refs.)

100720 Dynamic symmetries in quantum electronics. F.T.Hioe (Dept. of Phys., St.John Fisher Coll., Rochester, NY, USA).
Phys. Rev. A (USA), vol.28, no.2, p.879-86 (Aug. 1983).
The author shows that two distinct realizations of the SU(3) symmetry—the Gell-Mann SU(3) symmetry in quark physics and the Elliott SU(3) symmetry in nuclear physics—can be applied to the same dynamical system in intense-field electrodynamics under different experimental conditions. The author also presents a set of simultaneous soliton solutions in the Elliott SU(3)-symmetry scheme which has not been derived previously. (25 refs.)

8th IEEE International Semiconductor Laser Conference ....See Entry 98628

Quantum theory of light. Second edition ....See Entry 98678

Sufficient conditions for convergence of antinormally ordered expansions of boson number operator functions $f(\hat{a}^+\hat{a})$ .... See Entry 98939

Laser measurement services at NBS ....See Entry 100792

42.55B General theory of lasing action

100721 Rate equation theory of two-photon lasers. Lin Fucheng (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, Shanghai, China).
Chin. Phys. (USA), vol.3, no.2, p.450-8 (April-June 1983).
Two-photon lasers and laser amplifiers are studied by using the rate equations. The steady solution is obtained and its stability is analyzed. The time evolution of large deviation from the steady solution is studied by using computer simulation. The population inversion and the trigger input must exceed certain thresholds to operate a two-photon laser. The method for producing giant pulse is discussed. The possibility of building a practical two-photon laser is analyzed based on the known data. A Doppler-free two-photon laser needs much lower threshold but much more serious frequency matching among the atom system, cavity, and the trigger input. Such a Doppler-free two-photon laser could find applications in laser spectroscopy and in the accurate metrology. Two-photon laser amplifiers distort the input waveform seriously. This distortion depends strongly on the input intensity. (10 refs.)

100722 On the high power limit of the laser linewidth. A.Yariv, K.Vahala (California Inst. of Technol., Pasadena, CA, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.6, p.889-90 (June 1983). (8th IEEE International Semiconductor Laser Conference, Ottawa, Ont., Canada, 13-15 Sept. 1982).
The quantum mechanical limit of the laser linewidth is shown to imply a residual constant linewidth rather than obey an inverse power dependence as is usually assumed. (2 refs.)

100723 Correlation of radiation field and the translational motion of atoms in a single-mode laser. E.P.Gordov, G.A.Koganov, A.M.Khazanov (Inst. of Atmospheric Optics, Acad. of Sci., Tomsk, USSR).
Opt. Acta (GB), vol.30, no.8, p.1035-8 (Aug. 1983).
Considers a model of a single-mode laser based on two-level atoms having translational degrees of freedom. Correlation of the field and the atomic motion due to the recoil effect is taken into account. The self-consistent theory describing dynamic properties of the system is performed on the basis of semiclassical approximation. It is shown that due to the weak friction of resonant atoms in the buffer gas, their translational motion is strongly coupled with the radiation field. The field intensity and the momentum of atoms in the stationary state are calculated. The stationary momentum distribution is obtained and is shown to be far from an equilibrium distribution in the case of weak friction. (6 refs.)

100724 Self-pulsing and chaos in inhomogeneously broadened single mode lasers. R.Graham, Y.Cho (Fachbereich Phys., Univ. Essen, Essen, Germany).
Opt. Commun. (Netherlands), vol.47, no.1, p.52-6 (1 Aug. 1983).
Self-pulsing and chaos in inhomogeneously broadened single mode lasers is investigated in the framework of two models with 4 and 6 degrees of freedom, respectively. These models are derived as the first two steps of an infinite hierarchy of approximations of increasing sophistication. Numerical examples of self-pulsing and chaotic dynamics are presented.

100725 Directivity of the amplified spontaneous emission of active cylinders with end mirrors. G.N.Vinokurov, V.A.Gorbunov, V.I.Zhulin.
Opt. & Spectrosc. (USA), vol.54, no.1, p.82-4 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.144-8 (Jan. 1983).
Radiation transport equations and balance equations for the population inversion are used to calculate the spatial characteristics of the amplified spontaneous emission and the steady-state population inversions for a uniformly pumped cylinder with end mirrors. A 3-*D* analysis of this problem leads in a natural way to the concept of a threshold pumping rate and makes it possible to distinguish between lasing and spontaneous emission. (9 refs.)

100726 Small-signal gain in lethargic and conventional laser amplifiers. F.A.Hopf, S.Stenholm (Optical Sci. Center, Univ. of Arizona, Tucson, AZ, USA).
Phys. Rev. A (USA), vol.28, no.2, p.1176-8 (Aug. 1983).
The lethargic regime of a swept-gain laser amplifier is investigated theoretically to determine the procedure for passing over to the conventional limit T_1(level lifetime) $\gg T_2$(phase memory time) of laser amplifiers. The calculation is done with a model in which the transit time of the atoms t_0, is less than T_1, which is soluble in closed form. The conventional limit is taken as $t_0 \rightarrow \infty$. The general and conventional limits involve contradictory conditions of operation; nonetheless, both agree with experiment. This apparent contradiction is resolved by the finding that the conventional limit is a singular case. (15 refs.)

Coherent radiation of electron bunches in free-electron lasers .... See Entry 100787

42.55D CO_2 lasers

100727 Operation of an inductively ballasted helical TE-CO_2 laser. D.J.Biswas, P.K.Bhadani, P.R.K.Rao, U.K.Chatterjee, A.K.Nath, U.Nundy (Bhabha Atomic Res. Centre, Bombay, India).
Appl. Phys. Lett. (USA), vol.43, no.3, p.224-5 (1 Aug. 1983).
The authors report here the successful operation of a Beaulieu-type TE-CO_2 laser using equalizing inductances. An improvement of 50% or more in the efficiency was observed over resistance-ballast system. (8 refs.)

100728 Investigation of the optical homogeneity of the active medium of an atmospheric-pressure electron-beam-controlled CO_2 laser during stimulated emission. S.A.Dimakov, L.N.Malakhov, V.E.Sherstobitov, V.P.Yashukov.
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.221-4 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.397-402 (Feb. 1983).
An investigation was made of the optical homogeneity of the active medium of an electron-beam-controlled CO_2 laser at the moment of emission of a pulse. Inhomogeneities due to the dependence of the rate of thermal relaxation of the vibrational levels of the CO_2 molecules on the power of the laser radiation extracted from the excited region were observed experimentally. It was found that the resultant fluctuations of the refractive index at the edge of a laser beam amounted to 3×10^{-6}. It was also observed that when the structure of the radiation field was jagged, similar inhomogeneities could appear not only at the edge of a laser beam but throughout the active medium occupied by the radiation. (11 refs.)

100729 Calculation of the maximum output power of a continuous-flow CO_2 laser. V.A.Kuklin, Yu.E.Pol'skii (Aviation Inst., Kaza, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.236-8 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.420-2 (Feb. 1983).
It is shown that the relaxation losses in the resonator zone and the influence of the radiation field on a redistribution of the populations of the upper and lower active levels must be allowed for in the calculation of the maximum output power of a continuous-flow CO_2 laser. A system of equations is obtained for the description of the relaxation kinetics under the conditions of maximum output power. (5 refs.)

100730 Influence of the inhomogeneity of the process of energy deposition on the gain coefficient of high-power gas lasers. V.M.Baginskii, V.N.Gorshkov, A.I.Shchedrin (Inst. of Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.238-40 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.423-5 (Feb. 1983).
A calculation is made of the distribution of the small-signal gain coefficient over a small aperture in a transverse section of a discharge chamber of a high-power CO_2 gas laser with a nonself-sustained discharge. It is shown that, in spite of a considerable inhomogeneity of the specific energy deposited in the discharge between the cathode and the anode, the gain coefficient of such systems can be practically constant for certain pump times. This equalization of the gain coefficient is due to an increase in temperature and a corresponding change in the relaxation constants in the region where the rate of energy deposition is high. (15 refs.)

100731 Determination of the rate constants used in design calculations relating to low-temperature CO_2-D_2 gasdynamic lasers. V.F.Gavrikov, A.P.Dronov, A.K.Piskunov, N.B.Rodionov.
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.251-2 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.438-41 (Feb. 1983).
A comparison of the theoretical values of the gain coefficient with those found experimentally yielded the rate constants of the processes of near-resonant vibrational exchange between $CO_2(01^11)$ and $D_2(1)$ (1.59×10^3 Pa/sec), and of the vibrational-translational relaxation of $CO_2(00^01)$ ($2Pa^{-1}.sec^{-1}$) and of the bending mode of CO_2($4 \times 10^2 Pa^{-1}.sec^{-1}$) by interaction with deuterium. The temperature dependences of these constants were obtained in the range 100-800K. The variation of the vibrational mode temperatures along the nozzle was determined. (16 refs.)

A simplified, miniature TEA-CO_2 laser using a semiconductive pre-ionization technique .... See Entry 100800

Laser systems for electronics manufacturing .... See Entry 100831

42.55F Inert gas lasers

100732 He-Ne laser frequencies near 2.4 μm and their application to hydrogen fluoride detection. J.E.Eberhardt, A.W.Pryor (CSIRO, Lucas Heights Res. Labs., Sutherland, NSW, Australia).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.6, p.891-3 (June 1983). (8th IEEE International Semiconductor Laser Conference, Ottawa, Ont., Canada, 13-15 Sept. 1982).
He-Ne lasers can provide three frequencies near 2.4 μm, one of which coincides with the $1R(5)$ frequency of HF at 4173.98 cm^{-1}. Either of the other frequencies may serve as a reference for absorbance measurements. One of these, at 4169.33 cm^{-1}, is a new lasing transition not previously observed ($4d_4'$-$3p_9$). Operating conditions are discussed. (17 refs.)

100733 Routes to chaotic emission in a CW He-Ne laser. C.O.Weiss, A.Godone, A.Olafsson (Phys. Tech. Bundesanstalt, Braunschweig, Germany).
Phys. Rev. A (USA), vol.28, no.2, p.892-5 (Aug. 1983).
Chaotic emission is observed from a 3.39-μm He-Ne laser. The authors find different sequences leading from coherent to chaotic states depending on the laser frequency. In particular, all three theoretically known sequences—'period doubling', 'Ruelle-Takens', and 'intermittency'—are observed. (12 refs.)

100734 Resonance phenomena, appearing in a He-Ne laser in the presence of discharge current modulation. V.V.Tuchin.
Radio Eng. & Electron. Phys. (USA), vol.27, no.10, p.110-13 (Oct. 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.10, p.1984-7 (Oct. 1982).
The results of experimental studies of the effect of low-frequency discharge current modulation on the radiation output power of a He-Ne laser with a wavelength $\lambda = 0.63$ μm are presented. It is found that for certain modulation frequencies a resonant increase of the DC component of the output power occurs (by a maximum of 10%). The short-term and long-term output power stabilities are investigated in the artificial striation excitation regime. (9 refs.)

100735 Amplitude characteristics of striations in the active elements of helium-neon lasers. Ya.A.Fofanov.
Radio Eng. & Electron. Phys. (USA), vol.27, no.10, p.113-19 (Oct. 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.10, p.1987-93 (Oct. 1982).
The suppression of striations in the active elements of He-Ne lasers by means of an external feedback via the spontaneous capillary emission is investigated. An equation is obtained that relates the amplitude of the striations to the gain and losses at the frequency of the striations in the system comprising the active element and external circuit. The results of experimental studies of the dependence of the amplitude of the striations on the relative excitation value are presented. (6 refs.)

100736 Mechanism of pulse emission from high-pressure electric-discharge He-Ar, He-Kr, and He-Xe infrared lasers. A.R.Sorokin (Inst. of Heat Phys., Acad. of Sci., Novosibirsk, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.165-72 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.308-18 (Feb. 1983).
A study was made of the time dependences of the amplitudes of stimulated and spontaneous emission from pulsed electric discharges in He-Ar, He-Kr, and He-Xe mixtures, and the processes involved in populating the active levels were analyzed. Direct and stepwise excitation by electrons was taken into account, as was population resulting from relaxation processes (collisions of the second kind with electrons, radiative cascades, recombination processes, collisions with atoms of the active and buffer gases, excitation transfer from the helium molecules). A qualitative picture was obtained of the characteristic processes for populating the atomic levels of Ar, Kr, and Xe as a function of the composition and pressure of the mixtures. It was established that the decisive mechanism at high presures involves direct excitation by electron impact from the ground states. (23 refs.)

100737 Laser action in xenon pumped by pulsed beams of runaway electrons. G.V.Kolbychev, E.A.Samyshkin (Inst. of Atmospheric Optics, Acad. of Sci., Tomsk, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.249-50 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.437-8 (Feb. 1983).
A report is given of the use of pulsed beams of runaway electrons for the pumping of gas lasers. Electron beams were generated inside a laser chamber. The average energy of these electrons was 1-4 keV. lasing was observed as a result of the $3d_2$-$2p_7$ transition in xenon. An analysis was made of the possibility of using runaway-electron beams in other types of gas laser. (2 refs.)

A long-pulse xenon ion laser as a pumping source for dye lasers .... See Entry 100801

A pulsed argon ion laser and ring dye laser system .... See Entry 100802

Pulses from an Ar^+-laser in the colliding pulse mode locking regime .... See Entry 100811

42.55H Lasing action in other gas lasers

100738 Lasing in CuCl+Na system. W.Winiarczyk (Inst. of Phys., Jagellonian Univ., Cracow, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.1, p.1235-7 (July 1983).
Preliminary results on using the CuCl+Na system as a medium for copper laser are presented. It is found that the Cu/(CuCl+NA) laser is similar to the Cu/CuCl laser, at least at temperatures lower than 550°C. The plasma processes leading to the creation of population inversion in cuprous chloride laser are not negatively affected by the addition of a low ionisation potential element like sodium. Similarly, the possible chemical reactions in Cu+Cl+Na system seem not to thwart the laser action. A similar experiment is now being prepared to find out whether the quenching of $^2D_{3/2}$ metastable level of atomic copper by potassium can increase the energy of the copper laser pulse. (7 refs.)

100739 Computer modelling of *e*-beam-pumped KrF lasers. C.B.Edwards, F.O'Neill (Rutherford Appleton Lab., SERC, Chilton, Didcot, England).
Laser & Part. Beams (GB), vol.1, pt.1, p.81-95 (Feb. 1983).
A computer kinetics model has been developed to predict the steady state behaviour of *e*-beam-pumped KrF lasers. The model can be used to calculate species densities, gain, loss and laser efficiency. Close agreement is obtained between the model predictions and a wide range of experimental measurements of optical gain, loss, and laser efficiency as a function of *e*-beam pump power, taken at various laboratories. (42 refs.)

100740 Vibrational relaxation and laser extraction in rare gas halide excimers. W.L.Morgan, N.W.Winter, K.C.Kulander (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4275-9 (Aug. 1983).
Recent experiments have demonstrated that the finite rate of vibrational relaxation in the formation of KrF affects the saturation characteristics of the KrF(B) state during extraction of laser light. The authors have assembled a collisional radiative model using calculated Einstein A coefficients for the lowest twenty KrF states and an approximate calculation of the rate of vibrational energy transfer between KrF and a buffer gas. The model describes the flow of excitation through the vibrational levels of KrF and demonstrates the effects of vibrational relaxation on KrF(B) saturation and spectra. The results of these calculations agree qualitatively with the published experimental results. In addition, the authors find that, due to the relaxation kinetics of KrF, Kr_2F, a major absorber, is not truly saturable. (10 refs.)

100741 Simple and efficient preionization system for gaseous lasers. A.D.Tavares,Jr., P.A.M.Dos Santos, C.A.Masone, A.A.Tagliaferri (Inst. of Phys., Univ. Federal Fluminense, Niteroi, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.2, p.337-42 (June 1982).
A new preionization system for pulsed gas lasers was developed. It does not require special electronic circuits and has an extreme simplicity. The system was applied to an N_2 laser, and results are shown. (2 refs.)

100742 Optically pumped molecular laser utilizing C_2H_5Br and C_2H_5I halogen derivatives of ethane. V.A.Bugaev, E.P.Shilteris (Inst. of Radio Engng. & Electronics, Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.150-4 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.283-9 (Feb. 1983).
The observation of 15 lasing transitions in the 327.6-1059 μ range by pumping C_2H_5Br and C_2H_5I vapor with radiation from a low-pressure CO_2 laser is reported. The laser optoacoustic spectrum of the molecules and the absorption spectra are presented. The rotational quantum numbers J of the observed transitions are identified. (13 refs.)

100743 Investigaton of the power stability of a CW carbon monoxide laser. V.S.Aleinikov, V.I.Masychev, V.K.Sysoev (P.N. Lebedev Phys. Inst., Acad. of. Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.224-8 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.402-7 (Feb. 1983).
The results are given of investigations of the output-power stability of a sealed CW carbon monoxide laser, simultaneously emitting as a result of a large number of cascade-coupled vibrational-rotational transitions. The investigations were carried out taking into account the spectral composition of the laser radiation after different degrees of monochromatization (with spectrally selective and broad-band optical resonators, a multimoding regime, and suppression of high-order modes). It was found that, despite the relatively large fluctuations in the output power of each of the laser transitions, the integrated laser output power of a multiresonance active medium and a broadband resonator showed only very small variations. A short discussion is given of the mechanism whereby the power fluctuations of the individual vibrational-rotational components are compensated in the integrated nonselected laser beam. Practical recommendations are given concerning the applications of CW carbon monoxide laser, with spectrally selective and nonselective optical resonators, in technology and in spectroscopic investigations. (8 refs.)

Vacuum-ultraviolet stimulated emission from two-photon-excited molecular hydrogen .... See Entry 100463

Study of $O_2(^1\Delta)$ production in a glow discharge at large molar flow rates .... See Entry 100533

Determination of the rate constants used in design calculations relating to low-temperature CO_2-D_2 gasdynamic lasers .... See Entry 100731

Influence of nozzle profile on the characteristics of a gas-dynamic laser .... See Entry 100789

Measurement of XeCl laser system high-voltage pulses employing a quartz Pockels cell .... See Entry 100791

High-efficiency pulse compression with intracavity Raman oscillators .... See Entry 100794

Low temperature operation of an S_2 laser using radio frequency simmer discharges .... See Entry 100817

Influence of transit effects on frequency resonances in gas lasers .... See Entry 100827

Laser systems for electronics manufacturing .... See Entry 100831

Investigation of soft X-ray population inversion in laser produced plasmas .... See Entry 101450

42.55K Chemical lasers

(see also 82.40T Chemiluminescence and chemical laser kinetics)

100744 Chemical laser amplifier using a photon-branched reaction in an aerosol medium. V.I.Igoshin, S.Yu.Pichugin (P.N. Lebedev Phys. Inst., Acad. of Sci., Kuibyshev, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.267-9 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.458-61 (Feb. 1983).
An analysis is made of the possibility of a photon-branched process in a chemically active aerosol medium. The medium in question is that of a chemical DF-CO_2 laser in which disperse aluminum particles of definite concentration n and with an average of r_0 are injected. When this medium is subjected to infrared laser radiation aluminum is evaporated and interacts with fluorine to form free F atoms. It is shown that the proposed initiation method may be used to construct purely chemical pulsed amplifiers of coherent radiation with an energy gain 10-20. (6 refs.)

Pulsed chemical HF laser utilizing a mixture of technical-grade C_3H_8 and SF_6 and initiated by an electric discharge .... See Entry 100804

Scattering of light and acoustic disturbances in the atomic iodine laser .... See Entry 100818

42.55M Lasing action in liquids and organic dyes

100745 Investigation of the threshold conditions for the generation of induced radiation by binary dye solutions. A.V.Aristov, D.A.Kozlovskii, M.B.Levin, A.S.Cherkasov.
J. Appl. Spectrosc. (USA), vol.37, no.4, p.1127-33 (Oct. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.4, p.569-76 (Oct. 1982).
The amplification cross section σ, which characterizes the induced radiative deactivation of excited molecules, practically coincides with the value determined from luminescence experiments. Therefore, the lasing and luminescence characteristics supplement each other as means for investigating the molecular parameters of laser media. This made it possible to determine certain kinetic and spectroscopic constants of intra- and intermolecular transitions in the generation of laser radiation. Of particular interest in this connection is research on multicomponent dye solutions for the purpose of clarifying the details of the conversion of the excitation energy into induced radiation in such system. The authors restrict their considerations to the case of binary solutions containing dyes with overlapping absorption and luminescence spectra. In such an active medium, the dye acceptor (Ac) with its greater wavelength can be excited not only directly by irradiation with pumping light but also by energy transfer from the molecules of a donor luminophor (Dn) with radiation of shorter wavelength. The spectral overlapping of the amplification bands of Dn and Ac implies their simultaneous participation in the induced radiation flux. The radiation parameters can be noticeably influenced also by an increase in the overall loss coefficient k_ν in the resonator (at the frequence ν) due to induced absorption (Dn) in the spectral range of laser-radiation generation. (29 refs.)

100746 Lasing and fluorescent characteristics of nine, new, flashlamp-pumpable, coumarin dyes in ethanol and ethanol:water. A.N.Fletcher, D.E.Bliss (Energy Chem. Branch, Naval Weapons Center, China Lake, CA, USA), J.M.Kauffman.
Opt. Commun. (Netherlands), vol.47, no.1, p.57-61 (1 Aug. 1983).
Improved flashlamp-pumped laser outputs and/or lifetimes are observed through the use of ethanol:water and the proper cover gas with many of nine new coumarin dyes. The new dyes are all rigidized and substituted in the 3-position. (11 refs.)

100747 Nature of the temperature effect on the lasing characteristics of dyes under laser excitation. V.M.Krasnoshchekov, A.B.Nikolaev, A.V.Aristov, A.S.Eremenko, S.M.Lankova, Yu.S.Lebedev, V.V.Rylkov.
Opt. & Spectrosc. (USA), vol.54, no.1, p.67-70 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.118-22 (Jan. 1983).
The mechanism of the temperature effect on the lasing and spectral characteristics of solutions of rhodamine, oxazine, polymethine, and some other dyes is studied experimentally. An important role is established for the variation of concentration ratios with temperature of different types of dye in solution in shaping the lasing characteristics of dye-based active liquids. (9 refs.)

New single-pulse generation technique for distributed feedback dye lasers .... See Entry 100796

Long pulse DCM dye laser .... See Entry 100798

A pulsed argon ion laser and ring dye laser system .... See Entry 100802

High-power rhodamine 6G laser with an extended service life .... See Entry 100803

Characterisation of a train of subpicosecond laser pulses by fringe resolved autocorrelation measurements .... See Entry 100813

Broad band electro-optic tuning of a CW dye laser .... See Entry 100822

A discussion of the problem of determining multiple lifetimes from picosecond absorption recovery data as encountered in two carbocyanine dyes .... See Entry 100829

42.55P Lasing action in semiconductors with junctions

100748 Carrier leakage and temperature dependence of InGaAsP lasers. T.R.Chen, B.Chang, L.C.Chiu, K.L.Yu, S.Margalit, A.Yariv (California Inst. of Technol., Pasadena, CA, USA).
Appl. Phys. Lett. (USA), vol.43, no.3, p.217-18 (1 Aug. 1983).
A direct measurement of electron and hole leakage in InGaAsP/InP lasers has been carried out. The effect of electron leakage on the temperature sensitivity of InGaAsP/InP lasers has been revealed. (6 refs.)

100749 Suppression of feedback-induced noise in short-cavity V-channeled substrate inner stripe lasers with self-oscillation. S.Matsui, H.Takiguchi, H.Hayashi, S.Yamamoto, S.Yano, T.Hijikata (Central Res. Labs., Sharp Corp., Nara, Japan).
Appl. Phys. Lett. (USA), vol.43, no.3, p.219-21 (1 Aug. 1983).
Self-oscillations of V-channeled substrate inner stripe (VSIS) lasers with index guiding and the influence of external feedback on low-frequency noise generation are presented. The self-oscillation is induced by means of shortening a cavity length of VSIS laser to 110 μm. VSIS lasers with self-oscillation have the fundamental linewidth of 0.56 Å below 3 mW and are not sensitive to both phase and amplitude of the externally reflected light. Signal to noise ratio of short-cavity VSIS laser at 1 MHz with a 10-kHz bandwidth was 97 dB at 0.05% optical feedback. (8 refs.)

100750 Streak camera study of short pulse generation in an optically pumped GaAs/(GaAl)As laser. M.D.Dawson, W.Sibbett, J.I.Vukusic (Blackett Lab., Imperial Coll., London, England), P.Dawson, G.Duggan, C.T.Foxon.
Appl. Phys. Lett. (USA), vol.43, no.3, p.226-8 (1 Aug. 1983).
A synchronously operated picosecond streak camera has been used in a direct time-resolved study of luminescence and laser emission from a GaAs/(GaAl)As double heterostructure laser pumped by <90 ps, 514-nm optical pulses from a mode-locked Ar ion laser. Semiconductor laser pulse widths down to 20 ps were recorded and the dependence of the temporal characteristics of these pulses on average pump power was investigated. (8 refs.)

100751 Anomalous longitudinal mode behavior of a deep Zn-diffused GaAs/GaAlAs laser. H.K.Choi, Shyh Wang (Dept. of Electrical Engng., Univ. of California, Berkeley, CA, USA).
Appl. Phys. Lett. (USA), vol.43, no.3, p.230-2 (1 Aug. 1983).
Observation of anomalous longitudinal mode behavior from deep Zn-diffused GaAs/GaAlAs lasers is reported. Single longitudinal mode operation is maintained without any mode hopping over a temperature range of more than 40°C when the current is fixed. The spectrum, however, is quite sensitive to current changes. (4 refs.)

100752 Effect of an active layer thickness on lateral and longitudinal modes of a gain guiding laser with a tapered stripe structure. T.Mamine (Semiconductor Res. Dept., Sony Corp., Atsugi-shi, Japan), H.Kawai.
Appl. Phys. Lett. (USA), vol.43, no.3, p.235-7 (1 Aug. 1983).
Effect of an active layer thickness on the lateral and longitudinal modes of the gain guiding laser with a tapered stripe structure has been studied. The authors observed broadening in the linewidth of each longitudinal mode as well as continuous emission spectra for the tapered stripe lasers with the thicker active layer of more than 0.1 μm. From the measurement of longitudinal as well as lateral modes, it is concluded that hole burning effect is enhanced in the thicker active layer as was pointed out by Copeland (1980). The experimental results observed for the tapered stripe lasers are inherent to gain guiding lasers with a stripe geometry structure. (9 refs.)

100753 Spontaneous emission into index-guided and gain-guided waveguide modes—a simple explanation [diode lasers]. G.Grau (Inst. fur Hochfrequenztech. und Quantenelektronik, Univ. Karlsruhe, Karlsruhe, Germany).
Arch. Elektron. & Uebertragungstech. (Germany), vol.37, no.7-8, p.280-1 (July-Aug. 1983).
The enhancement of spontaneous emission into gain-guided modes as compared with index-guided modes has been subject of some debate. A simple visualization existed before this debate; it is briefly described, because it leads to physical insight which might prove valuable in analogous problems. (5 refs.)

100754 Efficient backward and forward pumping CW Raman amplification for InGaAsP laser light in silica fibres. Y.Aoki, S.Kishida, H.Honmou, K.Washio, M.Sugimoto (Opto-Electronics Res. Labs., NEC Corp., Kawasaki, Japan).
Electron. Lett. (GB), vol.19, no.16, p.620-2 (4 Aug. 1983).
By pumping a small-core single-mode silica fibre with a 1.32 μm CW Nd:YAG laser, continuous-wave Raman amplification of InGaAsP laser diode light, with unsaturated gain as high as 21 dB, has been obtained in both backward as well as forward pumping configurations. (10 refs.)

100755 Influence of spectral hole burning on quaternary laser transients. M.J.E.Adams (British Telecom Res. Labs., Ipswich, England), M.Osinksi.
Electron. Lett. (GB), vol.19, no.16, p.627-8 (4 Aug. 1983).
Multimode rate equations including inhomogeneous gain saturation have been solved both numerically and by an analytic small-signal analysis. The results indicate that the principal effect of spectral hole-burning on transient behaviour is to reduce the damping time of relaxation oscillations. (11 refs.)

100756 Spectral characteristics of emission from stripe-geometry GaAs-GaAlAs double heterostructure lasers. Zhan Suzen (Yongchuan Photo-Electronics Res. Inst., China).
Chin. J. Lasers (Cina), vol.10, no.3, p.164-7 (20 March 1983). In Chinese.
Four types of emission spectra from stripe-geometry GaAs-GaAlAs double heterostructural lasers are described and their origin studied. It has been found that the multimode configuration is caused by the nonuniformity in the active region and its adjacent area. Mode shift and competition have been measured at different current levels. It has been noticed that wave lengths shift toward the shorter ones with an increase of current. The experimental results for devices with higher thermal resistance are contrary to the above conclusions. (2 refs.)

100757 Intensity noise associated with the lasing mode of a (GaAl)As diode laser. R.Schimpe (Lehrstuhl fur Allgemeine Elektrotech. und Angewandte Elektronik, Tech. Univ. Munich, Munich, Germany).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.6, p.895-7 (June 1983). (8th IEEE International Semiconductor Laser Conference, Ottawa, Ont., Canada, 13-15 Sept. 1982).
Measurement of the intensity fluctuations of an index guided CW (GaAl)As diode laser are reported. The narrowing of the laser emission spectrum causes a sharp decrease of the low-frequency noise associated with the lasing mode. This observation agrees well with a theoretical relationship derived from the multimode rate equations. (6 refs.)

100758 A nondestructive method for predicting laser emission wavelength from photocurrent spectra of GaAlAs double heterostructure wafers. S.F.Nygren (Bell Labs., Reading, PA, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.6, p.898-905 (June 1983). (8th IEEE International Semiconductor Laser Conference, Ottawa, Ont., Canada, 13-15 Sept. 1982).
Using nondestructive pressure contacts, a GaAlAs double heterostructure (DH) wafer may be operated as a solar cell. When the spectrum of the photocurrent is observed, the band edge of the active layer is clearly identifiable. A model of photocurrent in a GaAlAs DH wafer shows that a reliable measurement of the active layer band edge can be made in spite of substantial variations in spectral shape that can be caused by variations in the GaAs cap layer thickness. Using this method, the emission wavelength of a laser can be predicted to ±62 Å with 90 percent confidence, making photocurrent spectroscopy a useful tool for characterizing wafers. (14 refs.)

100759 Minority carrier lifetime and luminescence efficiency of 1.3 μm InGaAsP-InP double heterostructure layers. C.H.Henry, B.F.Levine, R.A.Logan, C.G.Bethea (Bell Labs., Murray Hill, NJ, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.6, p.905-12 (June 1983). (8th IEEE International Semiconductor Laser Conference, Ottawa, Ont., Canada, 13-15 Sept. 1982).
Minority carrier lifetimes and quantum efficiencies were measured for a series of 1.3 μm InGaAsP active layers. Radiative and nonradiative components of lifetime as a function of electron and hole density were determined from this data. The measured lifetimes were $T \approx 26(10^{18}\ \mathrm{cm}^{-3}/\mathrm{p})^{1.2}$ ns for p-type, and $T \approx 33(10^{18}\ \mathrm{cm}^{-3}/\mathrm{n})^{0.8}$ ns for n-type material. The drop in efficiency with doping is consistent with the ratio of nonradiative and radiative rates being proportional to carrier density. The nonradiative and radiative rates being proportional to carrier density. The nonradiative and radiative rates are equal at $p=(2.5 \pm 0.9)10^{18}\ \mathrm{cm}^{-3}$ and $n=(3.3 \pm 0.7)10^{18}\ \mathrm{cm}^{-3}$. A lifetime of 200 ns was observed for an undoped sample with a 0.2 μm thick active layer. The long lifetime shows that recombination with background traps is quite small, and that the interface recombination velocity is less than 50 cm/s, an order of magnitude less than for AlGaAs-GaAs double heterostructures. The minority carrier lifetime increases with temperature is lightly doped samples, as expected for radiative recombination, and shows little change with temperature in heavily doped samples. If the measured nonradiative rate is assumed to be due to the free carriers and not due to doping related traps, it can nearly account for the temperature dependence of laser threshold currents and for light-emitting diode efficiency. (23 refs.)

100760 Losses in GaInAs(P)/InP and GaAlSb(As)/GaSb lasers—the influence of the split-off valence band. A.Mozer (Stuttgart Univ., Stuttgart, Germany), K.M.Romanek, O.Hildebrand, W.Schmid, M.H.Pilkuhn.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.6, p.913-16 (June 1983). (8th IEEE International Semiconductor Laser Conference, Ottawa, Ont., Canada, 13-15 Sept. 1982).
GaInAs(P)/InP and GaAlSb(As)/GaSb are interesting material systems for long wavelength optical fiber communication. However, laser fabricated from these materials exhibit a substantially higher temperature dependence of the threshold current than GaAs/GaAlAs lasers ('T_0-problem'). Intervalence band absorption and CHSH-Auger-recombination have been suggested as two possible causes for the strong temperature dependent losses in long wavelength lasers. Both mechanisms, if present, should lead to a population of the split-off valence band. In GaInAsP/InP lasers, the authors have studied this population by directly observing the radiative high-energy recombination of electrons with holes in the split-off valence band. In the case of the band structure of GaAlSb(As), the band gap energy E_0 is close or equal to the spin-orbit splitting energy Δ_0, which favors hole-Auger recombination and intervalence band absorption, as confirmed by the authors experimental results. (41 refs.)

100761 The effects of loss and nonradiative recombination on the temperature dependence of threshold current in 1.5-1.6 μm GaInAsP/InP lasers. M.Asada, Y.Suematsu (Dept. of Phys. Electronics, Tokyo Inst. of Technol., Tokyo, Japan).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.6, p.917-23 (June 1983). (8th IEEE International Semiconductor Laser Conference, Ottawa, Ont., Canada, 13-15 Sept. 1982).
Various factors influencing the temperature dependence of the threshold current of GaInAsP/InP lasers in the wavelength region of 1.5-1.6 μm were measured in terms of the gain, the loss, the spontaneous emission, and the carrier lifetime. The effects of the intervalence band absorption influence the differential quantum efficiency or the loss, while the nonradiative recombination and the carrier leakage over the heterobarrier influence the carrier lifetime. It is shown from the measured results that both the absorption and the nonradiative components significantly influence the temperature characteristics of threshold current. The rapid increase in the threshold current near room temperature is a reflection of the increase in the intervalence band absorption. The heating effect due to the injection current is also significant. The possible maximum temperature of CW operation is expected to be as high as 150°C with optimized structural parameters. (22 refs.)

100762 Auger recombination effect on threshold current of InGaAsP quantum well lasers. A.Sugimura (Musashino Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Tokyo, Japan).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.6, p.932-41 (June 1983). (8th IEEE International Semiconductor Laser Conference, Ottawa, Ont., Canada, 13-15 Sept. 1982).
The Auger recombination effect on the threshold current of the InGaAsP quantum well (QW) laser is studied theoretically. All possible transitions between the quantized subbands of two-dimensional carriers are taken into account in evaluating the radiative process with the *k*-selection rule and the Auger process. The calculated threshold current agrees well with the reported experimental results for 1.07 μm InGaAsP QW lasers. The Auger component of the threshold current and its temperature dependence strongly depend on the QW structure, resulting in the necessity for an elaborate QW structure design, although both cannot be optimized at the same time. A design procedure is elucidated for a structure which gives the lowest threshold current density of the 1.07, 1.3, and 1.55 μm InGaAsP QW lasers. (23 refs.)

100763 Circuit modelling of the effect of diffusion on damping in a narrow-stripe semiconductor laser. R.S.Tucker, D.J.Pope (Dept. of Electrical Engng., Univ. of Queensland, St. Lucia, Queensland, Australia).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.7, p.1179-83 (July 1983).
This paper describes a circuit modelling technique for directly modulated narrow-stripe semiconductor lasers with strong carrier confinement and index guiding. It is shown that diffusion damping of the modulation response, due to a nonuniform electron density distribution in the active layer, can be accounted for in terms of an equivalent optical gain saturation. Based on this equivalence, a small-signal AC circuit model of a narrow-stripe laser is derived. The model can be used to determine the intensity modulation and frequency modulation response characteristics of a packaged device. (14 refs.)

100764 Analysis of a multistable semiconductor light amplifier. K.Otsuka, H.Iwamura (Musashino Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Musashino-shi, Tokyo, Japan).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.7, p.1184-6 (July 1983).
A multistable operation in semiconductor laser amplifiers, based upon the carrier density dependence of the active region refractive index is proposed. Simple analytical expressions describing the optical multistability are given, using the so-called antiguidance factor, which is the ratio of the decrease in the real refractive index to the increase in the imaginary refractive index. (17 refs.)

100765 Optical waveguiding in (In, Ga)(As, P) inverted rib waveguide lasers at 1.3 μm wavelength. S.Turley (Standard Telecommunication Labs. Ltd., Harlow, England).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.7, p.1186-95 (July 1983).
A theory is presented for waveguiding in inverted rib waveguide (IRW) lasers. For the first time, theory has been compared with experiment for these structures in (In,Ga)(As,P). Consideration is given to dielectric constant models in the quaternary system. After including the large negative effect of carriers on the dielectric constant, the modified single effective oscillator model is found to be suitable. By applying the dielectric constant values so obtained to the waveguide theory, IRW design curves are produced. Measurements of lateral farfield widths and spectral separations of zero and first order modes are used to test the validity of the predictions. The agreement is very good. The guide strengths are in the range $\Delta\epsilon_G = 3\text{-}11 \times 10^{-2}$ ($\Delta n_G = 5\text{-}17 \times 10^{-3}$). (30 refs.)

100766 Phase noise in semiconductor lasers: a theoretical approach. P.Spano, S.Piazzolla, M.Tamburrini (Fondazione Ugo Bordoni, Rome, Italy).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.7, p.1195-9 (July 1983).
Noise phenomena in semiconductor lasers have been extensively studied from an experimental point of view because of their importance in designing optical communication systems. Recently, a semiclassical theory of laser noise has been presented (Yahala & Yariv, ibid., to be published). In this paper, following a different and simpler approach, the authors obtain analytical expressions for the intensity and phase noise power spectra which agree with experimental results. (12 refs.)

100767 All-binary AlAs-GaAs laser diode. W.D.Laidig, P.J.Caldwell, K.Kim, J.W.Lee (Dept. of Electrical & Computer Engng. North Carolina State Univ., Raleigh, NC, USA).
IEEE Electron Device Lett. (USA), vol.EDL-4, no.7, p.212-14 (July 1983).
Thin layers of AlAs and GaAs, grown by molecular beam epitaxy (MBE), are used to simulate the properties of Al$_x$Ga$_{1-x}$As. These AlAs-GaAs superlattices (SLs) are used as cladding layers (instead of Al$_x$Ga$_{1-x}$As) in heterostructure lasers capable of room temperature operation. It is thus possible to obtain laser diodes which are composed only of the binary compounds GaAs and AlAs. The all-binary lasers are compared to conventional Al$_x$Ga$_{1-x}$As-GaAs double-heterostructure (DH) lasers grown and fabricated under similar conditions. (12 refs.)

100768 High pressure measurements on photopumped low threshold Al$_x$Ga$_{1-x}$As quantum well lasers. M.D.Camras, N.Holonyak,Jr., J.J.Coleman (Electrical Engng. Res. Lab., Univ. of Illinois, Urbana, IL, USA), H.G.Drickamer, R.D.Burnham, W.Streifer, D.R.Scifres, C.Lindstrom, T.P.Paoli.
J. Appl. Phys. (USA), vol.54, no.8, p.4386-9 (Aug. 1983).
Data are presented on the continuous (CW) 300K photopumped laser operation of a low threshold Al$_x$'Ga$_{1-x}$'As-GaAs ($x' \sim 0.30$) single quantum well heterostructure (quantum well size $L_z \sim 60$ Å) subjected to high pressure (0-11 kbar) in a simple opposed anvil apparatus. Beyond ~11 kbar where the central Al$_x$'Ga$_{1-x}$' As waveguide region undergoes a direct-indirect transition, and the waveguide confinement begins to weaken and deep levels tend to become important, the laser threshold increases rapidly and 'quenches' CW 300K operation. Pulsed 300K photopumped laser operation of an undoped 121-period Al$_x$Ga$_{1-x}$As-GaAs ($x \sim 0.5$) superlattice in the pressure range from 0-11 kbar is shown for reference. The pressure coefficients of the quantum well heterostructure and the superlattice lasers are comparable (~11 meV/kbar). (13 refs.)

100769 Spatial and spectral characteristics and a new model of laser generation for CdS-type single crystals under one-photon excitation. M.S.Brodin, N.I.Vitrikhovskii, A.A.Kypen, S.G.Shevel, N.I.Yanushevskii (Inst. of Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Phys. Status Solidi a (Germany), vol.78, no.1, p.349-63 (16 July 1983).
Spatial and spectral characteristics of lasing from Zn$_x$Cd$_{1-x}$S ($0 \leq x \leq 0.5$), CdSe$_x$S$_{1-x}$ ($0 \leq s \leq 0.25$), and CdS single crystals are investigated at temperatures 4.2, 77, and 300K under nitrogen laser excitation. The samples are vapour-grown platelets as well as hexagonal-prism-shaped 'needles'. The inconsistence of the previously wide-spread Fabry-Perot cavity model is shown and an interpretation is proposed in terms of a new model, namely, that of partial cavities (PC), each of them being a rectangular microbox (or microprism for 'needles'). The importance of intermode scattering and optical coupling between the different PC in the process of lasing is shown experimentally. (20 refs.)

100770 Radiative characteristics of injection lasers with short resonators. T.V.Batyunina, Yu.L.Bessonov, V.I.Borodulin, M.V.Zverkov, V.P.Konyaev, O.A.Pashko, S.A.Pashko, V.A.Simakov, V.I.Shveikin (Inst. of Radio Engng., Electronics & Automation, Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.201-4 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.364-70 (Feb. 1983).
An investigation was made of the threshold, power, and spectral characteristics of radiation emitted by GaAs-AlAs heterostructure injection lasers with double confinement and short (up to 16 μm) plane-parallel resonators. The lasers had mesastripe contacts 10-14 μm wide. The gain coefficient was a linear function of the pump current density in the gain coefficient range 10-400 cm^{-1}. The minimum threshold currents in the lasers were 27-30 mA and single-frequency lasing regime was observed right up to pump currents of $(1.6\text{-}1.7)I_{\mathrm{th}}$. The maximum single-frequency output power was 35 mW. It should be possible to retain single-frequency regime in such lasers when the pump current was subjected to high-frequency modulation. (11 refs.)

100771 External-cavity diode laser emitting in the middle infrared range. I.I.Zasavitskii, Yu.V.Kosichkin, P.V.Kryukov, A.I.Nadezhdinskii, A.N.Perov, S.Raab, E.V.Stepanov, A.P.Shotov (P.N.Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.256-7 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.445-7 (Feb. 1983).
Stimulated emission from an external-cavity diode laser was obtained for the first time in the region of the 10 μ wavelength and high-resolution spectra were recorded under intracavity absorption conditions. (5 refs.)

100772 Subharmonic excitation of injection lasers. F.K.Vaitekunas, Yu.B.Vishnyauskas, S.K.Kurshyalis (V. Kapsukas State Univ., Vilnius, Lithuanian SSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.258-9 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.447-9 (Feb. 1983).
An analysis was made of resonant subharmonic excitation of injection lasers and a physical interpretation of the process was developed. The range of frequencies in which pulse excitation was possible at the frequency of the first subharmonic of the modulating signal was determined experimentally as a function of a constant pump current. The possibility of excitation of injection lasers at the frequencies of the second and third subharmonics was demonstrated. (7 refs.)

Fabrication technique of fine gratings in two-dimensional diode lasers ....See Entry 100795

Cleaning of GaAs surfaces with low-damage effects using ion-beam milling ....See Entry 100797

New class of gain guiding laser with a tapered-stripe structure ....See Entry 100799

New approach towards frequency stabilisation of linewidth-narrowed semiconductor lasers ....See Entry 100814

Spectral hole burnings at high energy tails in spontaneous emission and hot carrier relaxation in InGaAsP lasers ....See Entry 100815

Influence of self-sustained pulsation in semiconductor lasers on optical transmission system ....See Entry 100816

Mismatch of TE and TM modes in multilayer dielectric and metal-dielectric heterostructures ....See Entry 100893

Signal transmission in a system of two injection lasers optically coupled with a fiber lightguide ....See Entry 100930

Applications of superlattices ....See Entry 102498

42.55R Lasing action in other solids

(inc. solid Raman lasers)

100773 Intracavity mode-locked and frequency-doubled Nd:YAG laser: pump-and mode-size effects. D.G.Hall (Inst. of Optics, Univ. of Rochester, Rochester, NY, USA), K.C.Scholten.
Appl. Opt. (USA), vol.22, no.15, p.2390-2 (1 Aug. 1983).
The performance of an intracavity mode-locked and frequency-doubled Nd:YAG laser has been analyzed using a method that takes into account the transverse spatial variation of both the gain and the laser mode. The technique leads to a simple numerical procedure that determines the second harmonic power and pulse width in terms of the parameters that characterize the various spatial distributions. (10 refs.)

100774 A YAG:Nd^{3+} ring laser. Zhang Guifen (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, Shanghai, China).
Chin. Phys. (USA), vol.3, no.2, p.438-43 (April-June 1983).
A directional ratio of about thirty has been obtained in a ring resonator with an additional mirror. The linewidth is compressed by ten times that of the standing-wave resonator without decrease of output power. A new opinion is put forward for the time characteristics of oscillation. (4 refs.)

100775 The NMR-laser—a nonlinear solid state system showing chaos. E.Brun, B.Derighetti, R.Holzner, D.Meier (Phys.-Inst., Univ. Zurich, Zurich, Switzerland).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.825-36 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The authors report novel experimental observations along the road to chaos of a tuned low-Q solid state spin-flip NMR laser which, according to their earlier work, (Meier et al. 1982) should show the universal Feigenbaum (1978) scenario under certain conditions. They have studied the nonlinear low-frequency response of the NMR laser activity to an external sinusoidal perturbation of one of its system parameters. Comparison of experimental results with computer solutions of an approximate theoretical model based on Bloch-type order parameter differential equations reflect some of the difficulties an experimental may encounter when he is out to detect unpaved physical roads to chaos. (9 refs.)

100776 Lithium niobate laser with frequency-degenerate pumping. S.G.Odulov, M.S.Soskin (Inst. of Phys., Acad. of Sci., Ukrainian SSR).
JETP Lett. (USA), vol.37, no.5, p.289-93 (5 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.5, p.243-7 (5 March 1983).
For the first time, lasing has been achieved in a frequency-degenerate four-wave interaction of beams for a helium-cadmium laser in lithium niobate crystals with nonlocal nonlinearities. The nonlinearities result from a redistribution of space charge during diffusion of the photoexcited carriers or from photovoltaic currents that oscillate over space. (17 refs.)

100777 Stimulated emission of Ho^{3+} in BaTm$_2$F$_8$ and Tm^{3+} ions in BaYb$_2$F$_8$:Er^{3+} crystals. A.A.Kaminskii, B.P.Sobolev, T.V.Uvarova (A.V. Shubnikov Inst. of Crystallography, Acad. of Sci., Moscow, USSR).
Phys. Status Solidi a (Germany), vol.78, no.1, p.K13-17 (16 July 1983).
The authors deal with the stimulated emission (SE) investigation of Ho^{3+} ions in BaTm$_2$F$_8$ and Tm^{3+} in BaYb$_2$F$_8$:Er^{3+} single crystals. The spectral composition of SE generation (λ_g) was studied by the photoelectric method (accuracy ±0.0005 μm). The excitation of 2 μm SE of Ho^{3+} and Tm^{3+} ions in the crystals is promoted by an effective energy transfer from sensitizer ions. For Ho^{3+} this role is played by Tm^{3+}, and for Tm^{3+} by Yb^{3+} and Er^{3+} ions. Under experimental conditions laser action of Ho^{3+} was obtained til ≈230K, that of Tm^{3+} till ≈150K. (13 refs.)

100778 Single-frequency YAG:Nd^{3+} laser with ring resonator. P.A.Andreev, S.V.Kruzhalov, L.N.Pakhomov, V.Yu.Petrun'kin (Leningrad Polytech. Inst., Leningrad, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.9, p.727-31 (Sept. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.9, p.1012-17 (Sept. 1982).
Emission of a YAG laser in the single-frequency mode is analyzed on the basis of equations of a semiclassical theory, taking into account the effect of backscattering and of the small difference between Q factors of the ring resonator with respect to opposing waves. It is demonstrated that the small difference between the respective Q factors has a large effect on the stability of unidirectional emission, with hardly any effect on the intensity ratio of opposing waves. Corrections are added to the relaxation frequencies which account for the interaction of opposing waves through the backscattering mechanism. (9 refs.)

100779 Steady-state emission from a Y$_3$Al$_5$O$_{12}$:Er^{3+} laser (λ=2.94 μ, T=300K). Kh.S.Bagdasarov, V.I.Zhekov, V.A.Lobachev, T.M.Murina, A.M.Prokhorov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.262-3 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.452-4 (Feb. 1983).
Experimental and theoretical studies demonstrated that steady-state emission was possible from an YAG:Er^{3+} laser utilizing the self-terminating $^4I_{11/2}$-$^4I_{13/2}$ transition with a cross-relaxing lower level ($^4I_{13/2}$). (1 ref.)

Formation of the spatial structure of radiation in solid-state laser systems by apodizing and hard apertures ....See Entry 100825

Mode locking in a fiber laser ....See Entry 100826

Laser systems for electronics manufacturing ....See Entry 100831

Interstitial Tl^0 atoms in alkali halides: ESR study of a ⟨111⟩-oriented Tl$_2^+$ center ....See Entry 102748

Magneto-optical studies of atomic thallium centers in KCl: Magnetic circular dichroism tagged by spin resonance ....See Entry 102855

Spectral properties of glassy tetraphosphate with high neodymium (Nd^{3+}) concentration ....See Entry 102909

Observation of population inversion of holes in Ge in crossed *E* and *H* fields from the spontaneous far-infrared emission ....See Entry 102953

42.55T Free electron lasers

100780 Operating conditions for free-electron lasers. Lei Shezhan, Zhou Zhongyi (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, Shanghai, China).
Chin. Phys. (USA), vol.3, no.2, p.444-9 (April-June 1983).
Conditions for amplifying light radiation by relativistic electrons in the interaction between light and electrons have been analyzed. It is shown that only when both the phase relation and the frequency relation are satisfied would the incident radiation have higher net gain. (2 refs.)

100781 High-efficiency free-electron laser results. K.Boyer, C.A.Brau, B.E.Newnam, W.E.Stein, R.W.Warren, J.G.Winston, L.M.Young (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3076-7 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Results obtained with a tapered-wiggler free-electron laser demonstrate the concepts proposed by Morton (1980) for enhanced efficiency. They show deceleration of electrons by as much as 7%, and extraction of more than 3% of the total electron-beam energy as laser energy when the laser is operated as an amplifier. The experiment is presently being reconfigured to examine its performance as a laser oscillator. (4 refs.)

100782 The UK free electron laser project. M.W.Poole, G.Saxon, R.P.Walker (SERC, Daresbury Lab., Daresbury, Warrington, England), S.D.Smith, C.R.Pidgeon, W.J.Firth, J.M.Reid, M.G.Kelliher, W.A.Gillespie.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3091-3 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Construction of apparatus for a free electron laser experiment is being undertaken by a collaboration involving principally groups at the Heriot-Watt and Glasgow Universities and at the SERC Daresbury Laboratory. The experiments will be centred on 10.6 μm but a tuning range of at least 2-20 μm will be investigated. The gain has been optimised in a regime of large linewidth broadening arising from the electron beam and wiggler magnet properties. The performance of the electron linac source is being improved and a new beam line is under construction. A periodic magnet design utilising samarium cobalt blocks has been chosen and will be assembled and tested shortly. (8 refs.)

100783 Subharmonic triple buncher for a high-efficiency free electron laser. J.S.Fraser (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3115-17 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A high-efficiency free electron laser oscillator experiment is being constructed at Los Alamos National Laboratory. A buncher system has been designed to deliver 30-ps, 5-nC electron bunches to a 20-MeV standing-wave linac at the 60th subharmonic of the 1300-MHz accelerator frequency. The first 108.3-MHz buncher cavity accepts a 5-ns, 5-A peak current pulse from a triode gun. Following a 120-cm drift space, a second 108.3-MHz cavity is used, primarily to enhance the bunching of the trailing half of the bunch. A 1300-MHz cavity with 20-cm drift spaces at each end completes the beamline components. The bunching process continues into the linac's first three accelerating cells. Two thin iron-shielded lenses and seven large-diameter solenoids provide axial magnetic fields for radial focusing. (7 refs.)

100784 Time-resolved electron beam diagnostics for the Los Alamos free-electron laser oscillator experiment. A.H.Lumpkin, J.S.Fraser, R.W.Warren, C.A.Brau (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3139-41 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Measurement of the time-dependent electron beam energy distributions in the Los Alamos Free-Electron Laser (FEL) Oscillator Experiment will be accomplished by employing gated proximity focussed microchannel-plate intensified vidicon cameras, an electron spectrometer employing a fluorescent target, and synchronized electron beam deflection techniques. General diagnostic system design features are described that provide information in the 30-ps, 50-ns, 10-μs, and 100-μs time regimes. These techniques provide a real-time electron micropulse optimization diagnostic and an on-line, time resolved measurement of the energy lost by the electrons within the optical cavity. (7 refs.)

100785 Wiggler-free free electron waveguide laser in a uniform axial magnetic field: single particle treatment. A.Fruchtman (Center for Plasma Phys., Racah Inst. of Phys., Hebrew Univ. of Jerusalem, Jerusalem, Israel).
J. Appl. Phys. (USA), vol.54, no.8, p.4289-94 (Aug. 1983).
A wiggler-free free electron laser operating in a waveguide is analyzed by using a single particle treatment. The use of either a TE or a TM mode is shown to enhance the gain for a resonant frequency much higher than the cyclotron frequency. It is demonstrated that a source of a submillimeter radiation, based on this analysis, may have output power comparable to that of a wiggler-type free electron laser. (14 refs.)

100786 Stimulated emission from a relativistic electron beam in a variable-parameter longitudinal magnetic wiggler. W.A.McMullin, R.C.Davidson, G.L.Johnston (Plasma Fusion Center, MIT, Cambridge, MA, USA).
Phys. Rev. A (USA), vol.28, no.2, p.517-23 (Aug. 1983).
The single-particle equations of motion are used to study the stimulated emission from a tenuous relativistic electron beam propagating in the combined solenoidal and variable-parameter longitudinal wiggler magnetic fields produced near the axis of a multiple-mirror (undulator) field configuration. The specific case of constant field amplitude and variable wiggler periodicity is studied. It is found that the efficiency of radiation generation can be increased by orders of magnitude relative to the case where the wiggler periodicity is constant. This is due to the fact that the phase velocity of the ponderomotive potential in which the electrons are trapped is decreasing, allowing the electrons to exchange energy with the radiation field. (8 refs.)

100787 Coherent radiation of electron bunches in free-electron lasers. L.A.Gevorgyan, N.K.Zhevago (Phys. Inst., Erevan, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.946-8 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR,* vol.267, no.1-3, p.599-601 (Nov. 1982).
The possibility of increasing the efficiency of conversion of the energy of an electron beam into energy of coherent radiation and also of generation in the shorter-wavelength range of the ultraviolet region is usually associated with the use of electron-storage rings. The authors consider another possibility: increasing the efficiency of free-electron lasers. In the case considered, use is made of coherence of the radiation from different electrons—an effect which arises when the electron beam is grouped in a particular way into individual bunches with a rather high particle density. (8 refs.)

Permanent magnet storage rings for microlithography and FEL sources ....See Entry 99879

Anomalous laser induced bunch lengthening on the ACO storage ring free electron laser ....See Entry 100069

Amplifier optimization study for an FEL wiggler with a helical magnetic field and an axial electric field ....See Entry 100073

Free electron laser for a mildly relativistic electron beam ..... See Entry 100075

The RF system for the Los Alamos free electron laser (FEL) ....See Entry 100118

Demonstration of a two-stage backward-wave-oscillator free-electron laser ....See Entry 100717

Cylindrical Gaussian-Hermite modes in rectangular waveguide resonators ....See Entry 100805

42.60 LASER SYSTEMS AND LASER BEAM APPLICATIONS

100788 High dynamic range laser energy distribution mapping using dual charge injected device (CID) cameras as an imaging radiometer. R.W.Priddy (US Army Missile Command, Redstone Arsenal, AL, USA), G.L.Boylston.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.356, p.106-15 (1983). (Field Measurement and Calibration Using Electro-Optical Equipment: Issues and Requirements, San Diego, CA, USA, 24-25 Aug. 1982).
Radiometric imaging techniques have direct application for measurement of reflected laser energy distribution. Common camera techniques have certain shortcomings stemming from limited dynamic range and imaging characteristics associated with specific detector and camera systems. The authors discuss various techniques which can be used to overcome camera deficiencies and a technique for cascading multiple camera systems over a range of sensitivities, thereby increasing the overall dynamic range. When coupled with suitable software routines, multiple camera systems can be used as an imaging radiometer suitable for measuring laser energy distribution and developing distribution maps. (4 refs.)

100789 Influence of nozzle profile on the characteristics of a gas-dynamic laser. V.I.Kireev, S.N.Minin, U.G.Pirumov.
Fluid Dyn. (USA), vol.17, no.6, p.948-52 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza,* vol.17, no.6, p.163-7 (Nov.-Dec. 1982).
The results are given of numerical profiling and analysis of the influence of nozzle shape and the gas-dynamic parameters on the characteristics of gas-dynamic lasers. Investigation of the two-dimensional nonequilibrium flow in a family of similar nozzles and nozzles with different angles of inclination of the contracting part show that it is expedient to choose a shape of the subsonic part that ensures a straight sonic line. Relationships between the geometrical parameters of the subsonic and transonic part of the nozzle are recommended which ensure separationless flow and a shape of the sonic surface that is nearly flat. A parametric investigation was made of the supersonic section of two classes of planar gas-dynamic laser nozzles constructed on the basis of uniform and symmetric characteristics at the exit. The parametric investigations of the influence of the degree of expansion, the total pressure and the temperature, and also the gas composition show that the smallest losses of useful vibrational energy in the cavity was achieved for nozzles constructed on the basis of uniform characteristics. (15 refs.)

100790 A cyclotron resonance laser accelerator. P.Sprangle, L.Vlahos, C.M.Tang (US Naval Res. Lab., Washington, DC, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3177-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A laser acceleration mechanism which utilizes a strong static, almost uniform, magnetic field together with an intense laser pulse is analyzed. The interaction and acceleration mechanism relies on a self resonance effect. Since the laser field is assumed to be diffraction limited, the magnetic field must be spatially varied to maintain resonance. The effective accelerating gradient is shown to scale like $1/\sqrt{E_b}$, where E_b is the electron energy. For a numerical illustration the authors consider a 1×10^{13} W/cm^2, CO_2 laser and show that electrons can be accelerated to more than 500 MeV in a distance of 15 m (approximately two Rayleigh lengths). (9 refs.)

100791 Measurement of XeCl laser system high-voltage pulses employing a quartz Pockels cell. E.A.Ballik (Dept. of Engng. Phys., McMaster Univ., Hamilton, Ontario, Canada), D.W.Liu.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.7, p.1166-8 (July 1983).
A high-voltage measuring system, employing a quartz Pockels cell, is described. The system is capable of a large voltage range, a fast response time (ns), a high SNR, an excellent accuracy, a good linearity, and high reliability. Furthermore, the Pockels cell can be isolated from ground potential. Equally important, the detection system can be isolated from sources of electrical noise present in, for example, fast discharges. (7 refs.)

100792 Laser measurement services at NBS. C.N.Smith (Dept. of Commerce, NBS, Boulder, CO, USA).
Laser Focus (USA), vol.19, no.8, p.53-5 (Aug. 1983).
Describes the calibration procedures and standards provided by the National Bureau of Standards (NBS) which are available to end users and manufacturers of lasers, energy and power meters, mirrors, beam splitters and other devices. (no refs.)

100793 A simple passive technique for generating short pulses. S.A.Shakir (Dept. of Phys., Yarmouk Univ., Irbid, Jordan).
Opt. Commun. (Netherlands), vol.47, no.1, p.1-4 (1 Aug. 1983).
It is shown that the pulse reflected from a thin optical slab is related in a simple way to the transmitted pulse. When the thickness of the slab is chosen such that the CW reflectance amplitude at the carrier frequency is zero (anti-reflecting), the reflected pulses can be of durations much shorter than the incident pulse. (7 refs.)

100794 High-efficiency pulse compression with intracavity Raman oscillators. R.Frey, A.de Martino, F.Pradere (Lab. d'Optique Quantique, CNRS, Ecole Polytech., Palaiseau, France).
Opt. Lett. (USA), vol.8, no.8, p.437-9 (Aug. 1983).
High-efficiency pulse compression has been obtained by using an intracavity Raman oscillator. The energy of a primary laser stored in its high-*Q* cavity is extracted at the Stokes frequency by means of a Stokes laser having a high Raman gain and a low-*Q* cavity. This technique, using hydrogen gas as the Raman medium, permits shortening of the pulse duration of a ruby laser by a factor of 6.7 with 87% effective quantum efficiency. It would be especially useful with low-gain (alexandrite) and with short-storage-lifetime lasers. (6 refs.)

Field Measurement and Calibration Using Electro-Optical Equipment: Issues and Requirements ....See Entry 98622

8th IEEE International Semiconductor Laser Conference ....See Entry 98628

Compact uniform field electrode profiles [laser system applications] ....See Entry 100629

New single-pulse generation technique for distributed feedback dye lasers ....See Entry 100796

Transient four-wave mixing and optical pulse compression in the femtosecond regime ....See Entry 100861

42.60B Design of specific laser systems

100795 Fabrication technique of fine gratings in two-dimensional diode lasers. M.Kohno, K.Uomi, H.Taniguchi, I.Suemune, M.Yamanishi.
Bull. Fac. Eng. Hiroshima Univ. (Japan), vol.30, no.2, p.75-81 (Nov. 1982). In Japanese.
Reports the establishment of the fabrication technique for two-dimensional diode lasers. A key point for realizing two-dimensional diode lasers is to fabricate gratings with a sufficient angular accuracy on GaAs. The gratings on GaAs were fabricated by chemical etching after holographic exposure of photoresist film. The required angular accuracy of the perpendicularity was assured by a He-Ne laser beam reflected from the cleaved facet of the sample and the error was within 0.02°. Finally, the authors demonstrate a successful operation of their transverse-distributed-feedback cavity (TDFB/Cavity) laser fabricated by the present technique. (10 refs.)

100796 New single-pulse generation technique for distributed feedback dye lasers. Z.Bor, F.P.Schafer (Max-Planck-Inst. fur Biophys. Chem., Gottingen, Germany).
Appl. Phys. B (Germany), vol.B31, no.4, p.209-13 (Aug. 1983).
The distributed feedback dye laser (DFDL) generates a train of picosecond pulses when pumped well above threshold. This DFDL emission can be quenched by injecting a laser pulse into DFDL. By proper timing of the quencher laser pulse only the first DFDL pulse is generated while the successive pulses are suppressed. Operational characteristics and practical design considerations of such a quenched DFDL are given. With 2.5 ns long pump pulses from a N_2 laser, a shortest DFDL pulse of 17 ps was obtained at 380 nm. (10 refs.)

100797 Cleaning of GaAs surfaces with low-damage effects using ion-beam milling. C.Lindstrom, P.Tihanyi (Xerox Palo Alto Res. Centers, Palo Alto, CA, USA).
IEEE Trans. Electron Devices (USA), vol.ED-30, no.6, p.711-13 (June 1983).
A low-damage ion-beam cleaning technique for GaAs surfaces is presented. The technique is utilized on GaAs/GaAlAs diode lasers, using the cleaved mirrors to analyze the milling performance. The authors found that (which also have been indicated by another author) nitrogen ions give no or very little surface damage. Contrarily, the commonly used argon ions are shown to create mirror surface damage detrimental to the laser diode performance. Auger depth profile of the GaAs oxygen contaminants reveals that 100-Å etch depth is sufficient to remove the native surface oxide. This etch depth is within the limits studied in this investigation. (7 refs.)

100798 Long pulse DCM dye laser. P.G.Weber (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.7, p.1200-2 (July 1983).
The author describes a flashlamp pumped dye laser, incorporating both prepulse and simmer enhancement, which is capable of kW outputs for the 0.1 ms duration of the flashlamp pulse. The laser has been operated with the new dye DCM; the author finds that using oxygen or nitrogen gas in the dye solution greatly increases both laser amplitude and pulse duration. (14 refs.)

100799 New class of gain guiding laser with a tapered-stripe structure. T.Mamine, T.Oda, O.Yoneyama (Semiconductor Res. Dept., Sony Corp., Atsugi-shi, Japan).
J. Appl. Phys. (USA), vol.54, no.8, p.4302-4 (Aug. 1983).
A new class of gain guiding laser with a tapered-stripe structure has been developed which exhibits a linear dependence of light output on CW current, a stable single-lobe far-field pattern along the junction at the power level of more than 10 mW, and an amount of astigmatism below 20 μm. It is also shown that a thin active layer thickness is desirable to achieve a stable lateral mode. The main feature of the tapered-stripe structure is that it offers an additional degree of freedom in controlling the beam spot size and the radius of curvature of the phase front separately, by varying the widths as well as the length of the tapered stripe. (12 refs.)

100800 A simplified, miniature TEA-CO_2 laser using a semiconductive pre-ionization technique. P.Pace, M.Hale, J.Cruickshank (Defence Res. Establ., Valcartier, Quebec, Canada).
Opt. & Laser Technol. (GB), vol.15, no.4, p.189-90 (Aug. 1983).
Using a pre-ionization system based on a silicon carbide compound and a pulse-forming network using a vacuum relay, the authors have been able to significantly reduce TEA-CO_2 laser complexity while maintaining high output energy densities. The design and construction are detailed along with the experimentally obtained laser characteristics. (12 refs.)

100801 A long-pulse xenon ion laser as a pumping source for dye lasers. G.Bergamasco (Istituto di Fisica Univ., Ferrara, Ferrara, Italy), W.Cecchetti, R.Polloni.
Opt. & Laser Technol. (GB), vol.15, no.4, p.191-3 (Aug. 1983).
A simple xenon ion laser that is either sealed or has a gas flow mode is described. The laser delivered long pulses (~15 μs) of almost 1 kW peak power. It has been used to pump a dye laser employing the same configuration as CW dye lasers. The system is inexpensive and can be mode-locked, enabling it to yield ultrashort pulses comparable in duration to those delivered by CW argon laser-pumped dye lasers but with much higher peak powers. (8 refs.)

100802 A pulsed argon ion laser and ring dye laser system. P.Myslinski, Cz.Radzewicz, J.Krasinski (Inst. of Experimental Phys., Warsaw Univ., Warszawa, Poland).
Opt. Appl. (Poland), vol.13, no.1, p.33-8 (1983).
The structure and performance of the pulsed argon ion laser are described. The discharge conditions were optimized and the peak power of 20 W was obtained at 1 kHz repetition rate with excellent reproducibility. A structure for a single mode ring dye laser pumped by the argon ion laser is presented. (8 refs.)

100803 High-power rhodamine 6G laser with an extended service life. B.A.Knyazev, S.V.Lebedev, E.P.Fokin (Inst. of Nuclear Phys., Acad. of Sci., Novosibirsk, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.146-50 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.276-82 (Feb. 1983).
A laser was constructed in which rhodamine G dissolved inisopropyl alcohol was used as the active medium. It was pumped by a coaxial flashlamp and the output energy of the laser was up to 8 J. An investigation was made of the photochemical stability of rhodamine G solutions as a function of the spectral composition of the pump radiation. Optimal selection of the solvent and of a filter through which the pump radiation was passed, and the use of previously tested components ensured that the service life was superior to that of similar lasers; practically no maintenance was needed during operation. The operating characteristics of the laser and the dynamics of their changes over a period of three years of its use in applications were recorded. When the output energy was ~5 J per pulse, the laser could emit 1.5×10^3 pulses without dismantling and replacement of the active medium and this represented an integrated irradiance of the active medium in excess of 2 kJ/cm^3. (29 refs.)

100804 Pulsed chemical HF laser utilizing a mixture of technical-grade C_3H_8 and SF_6 and initiated by an electric discharge. D.D.Malyuta, V.F.Tolstov (I.V. Kurchatov Inst. of Atomic Energy, Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.253-4 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.441-3 (Feb. 1983).
An electrochemical HF laser was constructed utilizing a mixture of technical-grade propane and butane with SF_6. A resistive anode was made of a Ge single crystal ($\rho = 25$ Ω.cm) and the mixture was subjected to ultraviolet preionization. The output radiation was highly stable. In the nonselective lasing regime a discharge volume of 86 cm^3 yielded laser pulses of 220 mJ energy with a peak power of 3 MW. The energy corresponding to the individual $P_1(4\text{-}9)$, $P_2(3\text{-}8)$, and $P_3(3\text{-}8)$ transitions was in the range 15-43 mJ and the peak powers for these lines were 0.2-0.5 MW. (8 refs.)

Operation of an inductively ballasted helical TE-CO_2 laser ....See Entry 100727

Anomalous longitudinal mode behavior of a deep Zn-diffused GaAs/GaAlAs laser ....See Entry 100751

Effect of an active layer thickness on lateral and longitudinal modes of a gain guiding laser with a tapered stripe structure ....See Entry 100752

All-binary AlAs-GaAs laser diode ....See Entry 100767

42.60D Laser resonators and cavities

100805 Cylindrical Gaussian-Hermite modes in rectangular waveguide resonators. L.R.Elias, J.C.Gallardo (Quantum Inst., Univ. of California, Santa Barbara, CA, USA).
Appl. Phys. B (Germany), vol.B31, no.4, p.229-33 (Aug. 1983).
Approximate solutions to the wave equation inside a rectangular metallic waveguide has been obtained in terms of cylindrical Gaussian-Hermite functions. E_{mn}^{π} modes propagate with negligible straight guide losses in the far-infrared region. A new type of low-loss optical resonator suitable for FEL operation at long wavelengths is presented here. (5 refs.)

100806 Generation and applications of pico- and femto-second laser impulses. W.Kaiser (Phys. Dept., Tech Univ. Munchen, Munchen, Germany).
Phys. Bl. (Germany), vol.39, no.7, p.194-8 (July 1983). In German.
Different types of laser materials are suitable for pico-second (ps) laser impulses at variable frequencies and small band width. Impulses of 30 femto-seconds (fs) can be generated in a ring-shaped resonator. An impulse length of 15 μm can be attained with a 50 fs impulse in air. At a wavelength of 0.6 μm about 25 maxima and minima of the field amplitude were found. Assuming an energy of only 3×10^{-5} joule (or 10^{14} photons) one gigawatt can be calculated. The corresponding high electric field strengths (2×10^6 v/cm) are responsible for nonlinear optical phenomena. With regard to the lifetime of eigen vibrations of polyatomic molecules in liquids, it is important that one can discriminate between phase relaxation and energy relaxation. The rise and fall of induced absorption in GaAs crystals within about 70 ps could be measured. Thermal equilibrium was established between electrons and holes of a plasma within 25 ps. The plasma temperature fell from 65K to 35K within 200 ps. (13 refs.) *R.S.*

100807 Method for altering the Q factor of a laser by a glass plate. N.N.Il'ichev, A.A.Malyutin (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.264 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.454-5 (Feb. 1983).
An analysis is made of a method for altering the Q factor of a laser resonator containing Brewster plates. The method is based on introduction of an additional plate, again oriented at the Brewster angle, and its rotation about the longitudinal axis of the resonator. It is shown that the plane of polarization of the output radiation exhibits a 'pulling' effect which gives rise to a different dependence of the losses on the angle of rotation of the new plate than that predicted by earlier calculations. (2 refs.)

100808 Active alignment of the feedback mirror in a half symmetrical unstable resonator with an inner axicon. S.J.Cusumano, J.M.Santiago (Air Force Weapons Lab., Kirtland AFB, NM, USA).
24th Midwest Symposium on Circuits and Systems, Albuquerque, NM, USA, 29-30 June 1981 (North Hollywood, CA, USA: Western Periodicals 1981), p.288-300
A multidither resonator alignment scheme has been developed which automatically aligns the optical components of a laser to optimize its performance and then maintains the alignment despite further disturbances to the optical components. This was demonstrated on a reflaxicon-cone. Half Symmetric Unstable Resonator with Internal Axicon (HSURIA) laser, controlling azimuth and elevation of the feedback mirror to maximize Far Field Power-in-the-Bucket. (6 refs.)

Autocollimation multibeam interferometer with spatial beam separation and its use in frequency selection of laser radiation ....See Entry 99171

Calculation of the maximum output power of a continuous-flow CO_2 laser ....See Entry 100729

Investigaton of the power stability of a CW carbon monoxide laser ....See Entry 100743

Suppression of feedback-induced noise in short-cavity V-channeled substrate inner stripe lasers with self-oscillation ....See Entry 100749

Radiative characteristics of injection lasers with short resonators ....See Entry 100770

External-cavity diode laser emitting in the middle infrared range ....See Entry 100771

Intracavity mode-locked and frequency-doubled Nd:YAG laser: pump-and mode-size effects ....See Entry 100773

A YAG:Nd^{3+} ring laser ....See Entry 100774

Single-frequency YAG:Nd^{3+} laser with ring resonator ....See Entry 100778

A pulsed argon ion laser and ring dye laser system ....See Entry 100802

Characterisation of a train of subpicosecond laser pulses by fringe resolved autocorrelation measurements ....See Entry 100813

Problem of stabilization of laser radiation parameters ....See Entry 100824

Influence of transit effects on frequency resonances in gas lasers ....See Entry 100827

Observation of period doubling in an all-optical resonator containing NH_3 gas ....See Entry 100835

Chaos in coherent two-photon processes in a ring cavity ....See Entry 100841

A new nonlinear Q-switch element—LiF:F_2^- crystal .... See Entry 100864

42.60F Laser beam modulation

100809 90-fs tunable optical pulses obtained by two-stage pulse compression. B.Nikolaus, D.Grischkowsky (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Appl. Phys. Lett. (USA), vol.43, no.3, p.228-30 (1 Aug. 1983).
Reports a factor of 65 compression of the 5.9-ps [full width at half-maximum (FWHM)] pulses from a mode-locked dye laser by a two-stage technique. In each stage the laser pulses were frequency broadened and linearly chirped by passage through a single-mode optical fiber, and then compressed by traversal of a diffraction grating based dispersive delay line. The final compressed output pulses had pulse widths of 90 fs (FWHM), peak powers of more than five times that of the input pulses, and were continuously tunable over the 300-Å range of the laser dye. (7 refs.)

100810 Picosecond pulse generation by distributed feedback dye lasers. Z.Bor, B.Racz, G.Szabo (Jate Univ., Szeged, Hungary), A.Muller, H.-P.Dorn.
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.383-92 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The recently observed self-Q-switching effect occurring in distributed feedback dye lasers (DFDL) now opens an alternative way to ultrashort pulse generation. This new technique has many advantages over the mode-locking technique. (20 refs.)

100811 Pulses from an Ar^+-laser in the colliding pulse mode locking regime. D.Kuhlke, W.Rudolph (Phys. Dept., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Opt. Commun. (Netherlands), vol.47, no.1, p.70-2 (1 Aug. 1983).
The pulse emission from an Ar^+-laser passively mode locked by the dye Rh 6G is investigated. Autocorrelation and cross correlation measurements show that a two pulse regime where the pulses interact coherently in the absorber is most favourable with respect to small pulse widths and stability. (7 refs.)

Superfluorescence pulse shape ....See Entry 100709

Resonance phenomena, appearing in a He-Ne laser in the presence of discharge current modulation ....See Entry 100734

Amplitude characteristics of striations in the active elements of helium-neon lasers ....See Entry 100735

Circuit modelling of the effect of diffusion on damping in a narrow-stripe semiconductor laser ....See Entry 100763

Radiative characteristics of injection lasers with short resonators ....See Entry 100770

Influence of self-sustained pulsation in semiconductor lasers on optical transmission system ....See Entry 100816

Broad band electro-optic tuning of a CW dye laser ....See Entry 100822

42.60H Optical problems related to properties and interactions of laser beams

100812 Pulsed laser beam control by hot spot tracking. J.S.Accetta (J.S. Accetta Inc., Ann Arbor, MI, USA), A.Erteza.
Appl. Opt. (USA), vol.22, no.15, p.2286-93 (1 Aug. 1983).
The use of a self-developed body-centered reference for precision pulsed laser hot spot tracking is examined through a numerical computer simulation based on a solution of the heat equation with time varying input flux. Tracking resolution and sensitivity in two commonly used infrared sensor bands are compared. To cope with inherent instability, a simple compensation scheme is suggested with a demonstrated improvement in boresight error drift. Optimum performance is obtainable by judicious selection of sensor wavelength bands and sampling times relative to laser pulse time. (2 refs.)

100813 Characterisation of a train of subpicosecond laser pulses by fringe resolved autocorrelation measurements. T.Mindl, P.Hefferle, S.Schneider, F.Dorr (Inst. fur Phys. und Theoretische Chem., Tech. Univ. Munchen, Munchen, Germany).
Appl. Phys. B (Germany), vol.B31, no.4, p.201-7 (Aug. 1983).
Fringe resolved autocorrelation functions generated by a train of subpicosecond laser pulses from a synchronously pumped ring dye laser were recorded. By comparison with calculated correlation functions one can not only derive the pulse duration of the centre pulse, but also draw conclusions about the quasicontinuous background or satellite pulses of lower intensity. (9 refs.)

100814 New approach towards frequency stabilisation of linewidth-narrowed semiconductor lasers. C.J.Nielsen, J.H.Osmundsen (Electromagnetics Inst., Tech. Univ. of Denmark, Lyngby, Denmark).
Electron. Lett. (GB), vol.19, no.16, p.644-6 (4 Aug. 1983).
By means of controlling the injection current and the phase of optical feedback, simultaneous frequency stabilisation and line-width reduction of a semiconductor laser are demonstrated. Line-width reduction from 24 MHz to 300 kHz and mean frequency stability better than 800 Hz relative to a Fabry-Perot etalon are obtained. (5 refs.)

100815 Spectral hole burnings at high energy tails in spontaneous emission and hot carrier relaxation in InGaAsP lasers. M.Yamanishi (Dept. of Phys. Electronics, Hiroshima Univ., Higashi-Hiroshima, Japan), I.Suemune, K.Nonomura, N.Mikoshiba.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.6, p.924-9 (June 1983). (8th IEEE International Semiconductor Laser Conference, Ottawa, Ont., Canada, 13-15 Sept. 1982).
Spectral hole burnings in spontaneous emission spectra from 1.3 μm InGaAsP lasers were found. The results are understood on the basis of population burnings of holes associated with the saturation of intervalence-band absorption. Theoretical results on hot carrier relaxation are shown to explain the population burnings, pointing out an importance of nonequilibrium optical phonon populations in the active layers of long wavelength InGaAsP lasers and light emitting diodes (LEDs). (30 refs.)

100816 Influence of self-sustained pulsation in semiconductor lasers on optical transmission system. K.Iwashita, K.Nakagawa (Yokosuka Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Kanagawa, Japan).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.7, p.1173-8 (July 1983).
Degradations in semiconductor lasers caused by defects, such as dark lines or dark spots in an active region, sometimes introduce self-sustained pulsations. In this paper, dynamic properties of a modulated self-sustained pulsation InGaAsP/InP semiconductor laser are presented and the influence on the optical transmission system is described. In high-speed pulse modulation above the pulsation frequency, output waveforms showed a marked pattern effect. When the pulsing semiconductor laser is modulated below the pulsation frequency, the laser output had relatively large noise which had flat noise spectra. Therefore, error-rate characteristics were influenced by this noise. These results show that the self-sustained pulsations in semiconductor lasers sometimes cause transmission characteristics degradation on the optical transmission system. Therefore, careful attention should be paid to this matter. (7 refs.)

100817 Low temperature operation of an S_2 laser using radio frequency simmer discharges. K.P.Killeen, J.E.Epler, J.T.Verdeyen (Univ. of Illinois, Urbana, IL, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.7, p.1203-9 (July 1983).
Technological problems stemming from high temperature operation of the sulfur resonator have hindered its development as a tunable, efficient, discharge pumped laser. The use of RF simmer discharge is shown to reduce previous temperature constraints by dissociating polyatomic sulfur molecules into the dimer, such that lasing is achieved when pumped by an XeCl excimer laser. The peak power output of the S_2 laser and the transmission spectra through sulfur discharges are used to infer the effectiveness of the discharge in dissociating the vapour. (20 refs.)

100818 Scattering of light and acoustic disturbances in the atomic iodine laser. M.E.Riley (Sandia Nat. Labs., Albuquerque, NM, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.7, p.1209-16 (July 1983).
Large photodissociation atomic iodine laser oscillators have been observed to develop gas dynamic instabilities during pumping and lasing. In the present work the growth rate of fluctuations is analysed in a linearised description of the total coupled gas dynamics, chemistry and lasing. The total growth factor of the gas dynamic instabilities is found to be several orders of magnitude for typical laser parameters. In addition, the predicted scale size of the disturbances is in harmony with the observations. (14 refs.)

100819 Temporal and interference fringe analysis of TEM_{01}* laser modes. J.M.Vaughan, D.V.Willets (Royal Signals & Radar Establ., Malvern, England).
J. Opt. Soc. Am. (USA), vol.73, no.8, p.1018-21 (Aug. 1983).
The properties of TEM_{01}*Y doughnut modes have been examined by frequency analysis and by two-beam interference. Interpretation in terms of an evolving helix, made up to two orthogonal TEM_{01} modes of different frequency, is supported by computer simulation of fringe patterms. These patterns are shown to correspond closely with photographic recordings; the implications of the phenomena for the crossed-beam technique in laser velocimetry are outlined. Finally, the possibility of developing a beam of pure helical cophasal surface is discussed and its interference patterns analyzed. (7 refs.)

100820 Self-transparency of Bragg mirrors. K.B.Dedushenko, A.I.Maimistov.
J. Appl. Spectrosc. (USA), vol.37, no.4, p.1199-204 (Oct. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.4, p.653-60 (Oct. 1982).
The authors use the technique of coupled waves to analyze the influence of radiation upon the characteristics of Bragg mirrors. They show that at some intensity of the incident light wave, the transmission coefficient, i.e. the self-transparency of the Bragg mirror, increases sharply. The self-transparency of the mirror attenuates the generation of radiation in semiconductor lasers with distributed Bragg mirrors. (14 refs.)

100821 Time-dependent spectra of ultra-short laser pulses. R.Gase, M.Schubert (Dept. of Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Opt. Acta (GB), vol.30, no.8, p.1125-38 (Aug. 1983).
Deals with the investigation of ultrafast radiation phenomena using a dynamic spectrograph. The general relations previously derived by the authors on the characterization of the spectral properties of incident non-stationary radiation, as well as on the derivation of the input spectrum from the square-law detector time-dependent output spectrum, are applied to examples that are of importance in ultrashort phenomena. In particular, single bandwidth-limited pulses and a train of pulses are studied. The use of a grating and a realistic prism spectrometer are considered. The theoretical and experimental investigations take into account the influence of the 'uncertainty product' of the spectrometer. For a single ultrashort laser pulse, the time-dependent spectrum was determined experimentally; the pulse was found to be nearly bandwidth-limited. (17 refs.)

100822 Broad band electro-optic tuning of a CW dye laser. C.Chappuis, J.P.Goedgebuer (Lab. d'Optique, Univ. de Franche-Comte, Besancon, France).
Opt. Commun. (Netherlands), vol.47, no.1, p.12-17 (1 Aug. 1983).
The many advantages of broad-band systems are not fully exploitable without the availability of intense sources with high radiance and emitting on a broad spectral band. An electro-optic tuning of a commercial CW dye laser is proposed for simulating such sources. A conventional intra-cavity Pockels cell is used for simulating such sources. The main characteristics of laser emission are discussed (linewidth, polarization, tuning speed, etc.); the applications given as examples deal with metrology (surface testing) and optical transmission by spectral modulation of light. (13 refs.)

100823 An estimate of the effect of interference on the reflection of the radiated power of a laser beam from a stratified receiver. Ye.I.Ivlev.
Radio Eng. & Electron. Phys. (USA), vol.27, no.10, p.44-8 (Oct. 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.10, p.1906-10 (Oct. 1982).
The reflection coefficient of a stratified receiver such as multilayered mirrors is derived and analyzed with a consideration of spatial distribution of incident laser radiation beams. The suppression of the interference effect on the reflection coefficient is examined. Results of an experimental test and the spectral curve of the reflection coefficient of the developed receiver are given. (25 refs.)

100824 Problem of stabilization of laser radiation parameters. O.O.Silichev (Physicotech. Inst., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.172-7 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.319-26 (Feb. 1983).
An analysis is made of the possibility of stabilization of the spatial parameters of laser radiation by the use of an optimal resonator configuration and an optical transmission system in the presence of fluctuations of the intracavity lens type. Conditions are formulated which such a resonator configuration must satisfy. Optical transmission systems capable of stabilizing the required parameter of output radiation are proposed and analyzed. (9 refs.)

100825 Formation of the spatial structure of radiation in solid-state laser systems by apodizing and hard apertures. V.I.Kryzhanovskii, B.M.Sedov, V.A.Serebryakov, A.D.Tsvetkov, V.E.Yashin.
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.194-8 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.354-9 (Feb. 1983).
Theoretical and experimental studies were made of the characteristics of formation of the spatial structure of a high-power light beam emitted by a neodymium glass laser system. (20 refs.)

100826 Mode locking in a fiber laser. M.I.Dzhibladze, Z.G.Esiashvili, E.Sh.Teplitskii, S.K.Isaev, V.R.Sagaradze (State Univ., Tbilisi, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.245-7 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.432-4 (Feb. 1983).
An investigation was made of the time structure of giant pulses emitted by a neodymium glass-fiber laser. Partial mode locking occurred within some mode groups. An explanation of this effect is provided. (7 refs.)

100827 Influence of transit effects on frequency resonances in gas lasers. V.M.Ermachenko, A.S.Kurlyandskii (Engng. Phys. Inst., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.247-9 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.434-7 (Feb. 1983).
An investigation is made of the influence of the transit effects and of the wavefront curvature of a Gaussian mode on the characteristics of a frequency resonance of a linear gas laser with an intracavity absorption cell. It is shown that these effects do not shift a resonance from the central frequency of the spectral line of the gas cell relative to the neck of a Gaussian mode on the frequency resonance profile. (5 refs.)

100828 Experimental observation of amplification of beams by dynamic surface holograms. N.F.Pilipetskii, A.N.Sudarkin, V.V.Shkunov, V.V.Yakimenko (Inst. of Problems in Mech., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.265-6 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.456-8 (Feb. 1983).
Amplification of the power of a laser beam in the course of self-diffraction by a dynamic surface hologram was observed experimentally. The gain reached 14 without signal distortion. This self-diffraction was accompanied by a strong reduction in the pulse duration. A beam of high directionality was amplified by the transfer of energy from a reference wave which was of low optical quality. Wavefront reversal was performed by the hologram surface and this was accompanied by a sevenfold increase in the brightness. (8 refs.)

Effect of spatial incoherence of the laser in photon-correlation spectroscopy ....See Entry 99196

High repetition rate subnanosecond gated photon counting ......See Entry 99200

Anomalous laser induced bunch lengthening on the ACO storage ring free electron laser ....See Entry 100069

Free electron laser for a mildly relativistic electron beam .....See Entry 100075

Monoenergetic atomic beam deflection by resonant light pressure ....See Entry 100319

Exactly soluble model of continuum-continuum transitions in strong laser beams ....See Entry 100327

Calculation of the parameters of a laser beam transmitted by a focusing rod ... .See Entry 100665

Investigation of the optical homogeneity of the active medium of an atmospheric-pressure electron-beam-controlled CO_2 laser during stimulated emission ....See Entry 100728

Subharmonic excitation of injection lasers ....See Entry 100772

Laser systems for electronics manufacturing ....See Entry 100831

Launching light from semiconductor lasers into multimode optical fibers having hemispherical ends and taper-with-hemisphere ends ....See Entry 100897

Statistical properties of modal noise in fibre-laser systems ...See Entry 100914

Dissociation of UF_6 molecules involving excitation of combination modes by NH_3-N_2 laser radiation ....See Entry 103569

42.60K Optical problems related to applications of laser beams

100829 A discussion of the problem of determining multiple lifetimes from picosecond absorption recovery data as encountered in two carbocyanine dyes. V.Sundstrom, T.Gillbro (Div. of Phys. Chem., Univ. of Umea, Umea, Sweden).
Appl. Phys. B (Germany), vol.B31, no.4, p.235-47 (Aug. 1983).
Absorption recovery kinetics data on the picosecond time-scale of a high signal-to-noise ratio can be obtained by using continuously operating synchronously modelocked dye lasers. The authors show that such data make it possible to determine multiple exponential decays with small differences in rate constants. The authors also show that an absolute prerequisite to accomplish this is that the measurements are performed at a number of different wavelengths, and that the decays are monitored in a time interval corresponding to several lifetimes. These considerations are demonstrated by measurements on two carbocyanine dyes, DQOCI and pinacyanol, respectively. (19 refs.)

100830 Structure of scattered emission in scanning laser systems. A.A.Shishagin.
Izv. VUZ Priborostr. (USSR), vol.26, no.6, p.83-8 (June 1983). In Russian.
The process of the formation of the field scattered by an object in scanning laser systems is analysed from the standpoint of radio-optics and a block diagram is proposed which makes it possible to relate the spatial and time characteristics of the field in the spectrum splitting region. The relationship of the parameters of the system to the parameters of the corresponding modulators of the equivalent block diagram is given. (5 refs.) *L.M.H.*

100831 Laser systems for electronics manufacturing. P.M.Baker (Quantrad Corp., Torrance, CA, USA).
Wescon/80 Conference Record, Anaheim, CA, USA, 16-18 Sept. 1980 (El Segundo, CA, USA: Electron. Conventions 1980), p.22-2/1-7
Today in the electronics industry there are many different applications for laser-based equipment in the production process. From initial wafer marking and annealing through device welding to marking of stuffed circuit boards, lasers offer important advantages that companies in the electronics industry are exploiting to increase quality and/or production throughput of their products. There are three primary laser types used in electronics production today: Xe ion, YAG, and CO_2. Each has different properties and these largely dictate which laser is used for a given manufacturing process. (1 ref.)

Nonlinear optical experiments with solid-state lasers ....See Entry 98701

Optical transmission channel for a standard frequency signal, by means of a laser [carrier beam]. ....See Entry 99084

Image contrast in a laser projection microscope ....See Entry 99179

Effect of spatial incoherence of the laser in photon-correlation spectroscopy ....See Entry 99196

Laser beat-wave accelerator for ultra-high energies ....See Entry 99777

High energy gamma ray beams from Compton backscattered laser light ....See Entry 100068

Transverse particle acceleration techniques using lasers and masers ....See Entry 100085

Nd:YAG holographic interferometer for aerodynamic research ....See Entry 100691

He-Ne laser frequencies near 2.4 μm and their application to hydrogen fluoride detection ....See Entry 100732

Suppression of feedback-induced noise in short-cavity V-channeled substrate inner stripe lasers with self-oscillation ....See Entry 100749

An estimate of the effect of interference on the reflection of the radiated power of a laser beam from a stratified receiver ....See Entry 100823

Launching light from semiconductor lasers into plane-ended multimode optical fibers ....See Entry 100896

Launching light from semiconductor lasers into multimode optical fibers having hemispherical ends and taper-with-hemisphere ends ....See Entry 100897

Local-oscillator excess-noise suppression for homodyne and heterodyne detection ....See Entry 100920

Method of characterizing the optical quality of glass ....See Entry 100932

Compact, pulsed laser Doppler anemometer for airborne and wind-tunnel applications ....See Entry 101361

On the calculation of the signal rate with the laser Doppler anemometer in burst operation ....See Entry 101364

Burst-correlation laser Doppler velocimetry ....See Entry 101366

Laser spark with a continuous channel in air ....See Entry 101499

Some optical techniques of displacement and strain measurements on metal surfaces ....See Entry 103428

Picosecond laser-spectroscopy measurement of hydroxyl fluorescence lifetime in flames ....See Entry 103527

Responses to 'Viewpoint: Lasers in Biomedicine' ....See Entry 104018

42.65 NONLINEAR OPTICS

100832 Self-pulsing and chaos in acoustooptic bistability. J.Chrostowski, R.Vallee, C.Delisle (Dept. de Phys., Univ. Laval, Quebec City, Quebec, Canada).
Can. J. Phys. (Canada), vol.61, no.8, p.1143-8 (Aug. 1983).
The output of a hybrid acoustooptic bistable device with delayed feedback is investigated. Depending on the input intensity, such a system exhibits periodic and chaotic behaviour. Period doubling up to period-8 with the reverse Lorentz sequence is presented. The sequence of bifurcations is truncated by the additive electrical shot noise and the multiplicative noise due to the laser intensity fluctuations. Frequency locked oscillations are also presented. (21 refs.)

100833 Two-photon optical multistability. L.Fuli (Blackett Lab., Imperial Coll., London, England).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.6, p.887-9 (June 1983). (8th IEEE International Semiconductor Laser Conference, Ottawa, Ont., Canada, 13-15 Sept. 1982).
The theory of two-photon optical bistability and multistability has been extended to include dispersive mechanisms and all Stark shift terms. The double bistability and tristability in the two-phonon processes has been studied. (6 refs.)

100834 Coherent effects in the generation and amplification of ultrashort pulses in YAG:Nd and ruby at low temperatures. O.P.Varnavskii, A.N.Kirkin, A.M.Leontovich, R.G.Mirzoyan, A.M.Mozharovskii, I.R.Sataev (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
JETP Lett. (USA), vol.37, no.5, p.271-4 (5 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.5, p.229-31 (5 March 1983).
Coherent effects during generation and amplification in YAG:Nd and ruby have been studied at ~100K for the first time. Intensity oscillations have been observed at the railing edge of the pulse. The spectrum has a doublet structure. The transverse relaxation time T_2 in ruby is estimated from the decay of the oscillations. (12 refs.)

100835 Observation of period doubling in an all-optical resonator containing NH_3 gas. R.G.Harrison, W.J.Firth, C.A.Emshary, I.A.Al-Saidi (Dept. of Phys., Heriot-Watt Univ., Edinburgh, Scotland).
Phys. Rev. Lett. (USA), vol.51, no.7, p.562-5 (15 Aug. 1983).
Two-round-trip-time modulation of the cavity field has been observed in a passive ring resonator, containing an ammonia cell, pumped by smooth 100-ns CO_2 laser pulses. The results are in excellent accord with the theory of Ikeda instability in a two-level system, which is generalized to include reservoir kinetics. (15 refs.)

100836 Chaos and nonlinear optics: a chaotic Raman attractor. P.W.Milonni, J.R.Ackerhalt, H.W.Galbraith (Theoretical Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
Phys. Rev. A (USA), vol.28, no.2, p.887-91 (Aug. 1983).
The authors consider a 'chaotic Raman attractor' as an example of the type of chaotic behavior that may occur in nonlinear optics. (14 refs.)

100837 Temporal aspects of absorptive optical bistability. T.Erneux, P.Mandel (Service de Chimie-Phys. II, Univ. Libre de Bruxelles, Bruxelles, Belgium).
Phys. Rev. A (USA), vol.28, no.2, p.896-909 (Aug. 1983).
The authors study the semiclassical mean-field theory of absorptive optical bistability in the limit of a fully developed hysteresis cycle, i.e. in the limit of large values of the bistability parameter *C*. The authors show by multiple time-scale perturbation analysis that it is possible to describe the transition between the two stable branches by simple equations. Near the low-transmission branch, the behavior of the system is governed by an equation for the atomic population, whereas, near the high-transmission branch, it is an equation for the field amplitude which determines the long-time evolution of the system. The authors then present an analytic study, completed by numerical results whenever necessary, of the time-dependent response of the system when the input field is swept across the bistable region. The authors study the

influence of the initial conditions, the sweeping velocity, and the ratio of the atomic relaxation times on the dynamical hysteresis as well as its relation with the stationary hysteresis. (21 refs.)

100838 Saturation of interband transitions in semiconductors and the effect of optical bistability. J.Goll, H.Haken (Phys. Inst. Theoretische, Univ. Stuttgart, Stuttgart, Germany).
Phys. Rev. A (USA), vol.28, no.2, p.910-28 (Aug. 1983).
Starting from a Hamiltonian which describes the interaction of the many-electron system of a crystal with the quantized light field, the authors derive nonlinear coupled equations of motion for the light-field amplitude, the electron-hole-pair amplitude, and the inversion. These equations yield the basis for the investigation of space-dependent nonlinear interaction effects between light and electrons in direct band-to-band transitions. With the aid of these equations the authors investigate the saturation behavior of direct band-to-band transitions for an incident monochromatic electromagnetic plane wave. The authors determine the nonlinear absorption coefficient and nonlinear refractive index. The authors compute the nonlinear transmissivity taking into account the boundary conditions at the end faces of the crystal and discuss the effect of optical bistability. (12 refs.)

100839 Analysis of biexcitonic optical bistability in CuCl in the presence of collision broadening. D.Sarid, N.Peyghambarian, H.M.Gibbs (Optical Sci. Center, Univ. of Arizona, Tucson, AZ, USA).
Phys. Rev. B (USA), vol.28, no.2, p.1184-6 (15 July 1983).
The dielectric function CuCl in the presence of biexciton formation that involves collision-broadening effects is analyzed in terms of incident photon energy and intensity. The authors discuss the nonlinear response of the material and its application to bistable devices. (20 refs.)

Quantum theory of light. Second edition .... See Entry 98678

Analysis of a multistable semiconductor light amplifier .... See Entry 100764

Generation and applications of pico- and femto-second laser impulses .... See Entry 100806

90-fs tunable optical pulses obtained by two-stage pulse compression .... See Entry 100809

A discussion of the problem of determining multiple lifetimes from picosecond absorption recovery data as encountered in two carbocyanine dyes .... See Entry 100829

Parametric mixing in monolayers deposited on thin-film waveguides .... See Entry 100924

42.65B General theory

100840 Parametric interaction of oppositely propagating light waves of identical frequency. N.V.Tabiryan (Erevan State Univ., Erevan, USSR).
JETP Lett. (USA), vol.37, no.3, p.181-3 (5 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.3, p.150-2 (5 Feb. 1983).
Waves of identical frequency in media exhibiting a reactive (nonabsorbing) nonlinearity may exchange energy with each other. The exchange results from a spatial modulation of the interfering light fields by the gyration vector of the magnetic medium. There is a threshold in the dependence of the gain on the wave power, the gain also depends on the deviation of the wave polarisation from circular. The gain reaches a maximum in the case of a linearly polarised intense wave and vanishes in the case of a circular polarisation. (3 refs.)

100841 Chaos in coherent two-photon processes in a ring cavity. S.Singh (Dept. of Phys., Univ. of Arkansas, Fayetteville, AR, USA), G.S.Agarwal.
Opt. Commun. (Netherlands), vol.47, no.1, p.73-6 (1 Aug. 1983).
The output of a ring cavity containing a resonant medium undergoing two photon transitions is shown to become chaotic, after following a series of bifurcations involving 2^n cycles, as the strength of the driving field is increased. The chaotic regime is followed by a sequence of period doubling bifurcations in reverse order. (14 refs.)

100842 Electromagnetic theory of diffraction in nonlinear optics and surface-enhanced nonlinear optical effects. R.Reinisch (Lab. de Genie Phys., Ecole Nat. Superieure d'Ingeniers Electriciens de Grenoble, Saint-Martin-d'Heres, France), M.Neviere.
Phys. Rev. B (USA), vol.28, no.4, p.1870-85 (15 Aug. 1983).
The authors present the first rigorous electromagnetic theory of diffraction in nonlinear optics. This theory allows the study of any type of nonlinear grating: bare or coated, whatever the groove depth and the profile of grating and coatings may be. The formalism developed here is derived from Maxwell's equations. The existence of the excitation and its nonlinear feature on the one hand, and the diffraction of the pump beams and of the signal on the other hand, are fully taken into account. The calculation reported here is valid for all cases of polarization (TM or TE) of the pump beams and of the signal. Two expressions of the nonlinear polarization at the signal frequency are derived. One is valid below the modulated region; the other one, inside this region. These two expressions take into account all the diffracted orders at the pump frequencies: propagating and evanescent. One then gets the expression of the electromagnetic field at the signal frequency everywhere: not only outside the modulated region but also inside it. The results thus obtained show that this electromagnetic field is a superposition of a diffracted field, with radiated and evanescent orders, and an infinite number of elementary driven waves. The authors also derive the nonlinear grating equation which allows the determination of the directions of propagation of the radiated diffracted orders. This is achieved using a new geometrical construction. It is shown that the evanescent diffracted orders at the signal frequency and at the pump frequencies can be resonantly excited. The rigorous feature of the electromagnetic theory developed allows one to get the following new and important result: there exists an optimal groove depth for which the electromagnetic resonance contribution to the enhancement of the nonlinear optical process is the strongest. These results can be applied to the study of different nonlinear optical processes, such as enhanced second-harmonic generation, surface-enhanced Raman scattering, Pockels effect, and optical rectification. (12 refs.)

42.65C Stimulated Raman, Brillouin and Rayleigh scattering; parametric oscillations and harmonic generation

100843 Nearly noncritically phase-matched UV generation at 3547 Å in $NaCHO_2$. K.Kato (First Res. Center, Japan Defense Agency, Tokyo, Japan).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.6, p.893-4 (June 1983). (8th IEEE International Semiconductor Laser Conference, Ottawa, Ont., Canada, 13-15 Sept. 1982).
Sodium formate ($NaCHO_2$) has been found to be very nearly noncritically phase matchable for type-2 frequency mixing of the Nd:YAG laser fundamental and second-harmonic radiation at room temperature. The nonlinear optical constant was determined to be $d_{32}(NaCHO_2)=(1.25\pm0.25)\times10^{-9}$ ESU. (3 refs.)

100844 Generation of second harmonic of light in crystals with resonant impurities. B.Ya.Zel'dovich, S.D.Kuz'michev (Moscow Physicotech. Inst., Moscow, USSR).
JETP Lett. (USA), vol.37, no.2, p.103-5 (20 Jan. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.2, p.85-6 (20 Jan. 1983).
A light wave induces an oscillating dipole moment in a resonant impurity; its field in the near zone exceeds the macroscopic field and second harmonic can be efficiently excited on the quadratic nonlinearity of the matrix. A calculation and estimates of the effect are given for the case in which the exciting wave propagates in the self-induced transparency regime. (3 refs.)

100845 Second-harmonic generation on reflection from a monomolecular Langmuir layer. O.A.Aktsipetrov, N.N.Akhmediev, E.D.Mishina, V.R.Novak (M.V. Lomonosov State Univ., Moscow, USSR).
JETP Lett. (USA), vol.37, no.4, p.207-9 (20 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.4, p.175-6 (20 Feb. 1983).
The generation of the second harmonic on reflection of light from a monomolecular Langmuir layer (MLL) is observed for the first time. The component of the quadratic-susceptibility tensor $\chi_{yyy}^{(2)}=4.2\times10^{-8}$ esu is measured for an MLL of nitro-octadecylazobenzene. (10 refs.)

100846 Multicomponent doubled-frequency scattering excited in ZnSe by a single picosecond laser pulse. V.A.Zyul'kov, V.P.Gribkovskii (Inst. of Phys., Acad. of Sci., Belorussian SSR).
JETP Lett. (USA), vol.37, no.4, p.213-16 (20 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.4, p.179-82 (20 Feb. 1983).
Multicomponent scattering at twice the laser frequency has been observed, for the first time, when ZnSe single crystals are pumped by a single picosecond first-harmonic pulse from a neodymium laser. (3 refs.)

100847 Selective nonlinear spectroscopy of inhomogeneously broadened phonon resonances in a disordered medium. T.T.Basiev, E.M.Dianov, E.A.Zakhidov, A.Ya.Karasik, S.B.Mirov, A.M.Prokhorov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
JETP Lett. (USA), vol.37, no.4, p.229-33 (20 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.4, p.192-5 (20 Feb. 1983).
Panoramic Stokes and anti-Stokes scattering spectra have been measured in glass fiber lightguides with biharmonic monochromatic pumping. The results can be used to develop tunable narrow-band subnanosecond sources which emit in the Stokes and anti-Stokes spectral regions with respect to thepump. An arrangement for a selective stimulated-Raman gain is discussed. This arrangement has yielded the first measurements of the homogeneous broadening ($\sim$16 cm^{-1}) of an inhomogeneously broadened phonon vibration ($\nu\approx$460 cm^{-1}) in amorphous SiO_2. (7 refs.)

100848 Tunable infrared difference-frequency generation in lithium iodate. L.Mannik, S.K.Brown (Ontario Hydro Res. Div., Toronto, Ontario, Canada).
Opt. Commun. (Netherlands), vol.47, no.1, p.62-4 (1 Aug. 1983).
Tunable infrared output has been produced by the difference-frequency mixing of 532 nm and dye laser radiation from a Nd:YAG-pumped dye laser in a crystal of $LiIO_3$. More than 100 μJ can be generated in a diffraction-limited beam from 3.5 to 4.2 μm and from 4.4 to 5.4 μm with a maximum energy of greater than 800 μJ at 3.8 μm. (11 refs.)

100849 Theory for selective-vibrational-dephasing experiments with the use of transient stimulated Raman scattering in high laser depletion. S.M.George, C.B.Harris (Dept. of Chem., Univ. of California, Berkeley, CA, USA).
Phys. Rev. A (USA), vol.28, no.2, p.863-78 (Aug. 1983).
A theory for selective-vibrational-dephasing experiments using transient stimulated Raman scattering in high laser depletion is presented. The transient stimulated Raman scattering equations are numerically solved including laser depletion for homogeneously and inhomogeneously broadened vibrational line shapes. A detailed account of the effects of low and high laser depletion on the vibrational amplitudes is given. An interpretation for excite-and-probe vibrational-dephasing experiments undertaken in the low- and high-laser-depletion regimes is developed. For a collinear laser probe pulse, high depletion of the excitation laser pulse leads to enhanced coherent Stokes probe scattering from one vibrational subgroup in the inhomogeneously broadened line shape. This selective scattering is greatly dependent upon the excitation laser pulse width and the off-resonance frequency of the vibrational subgroup. The enhanced selectivity in high laser depletion allows the homogeneous dephasing time T_2 to be measured to a high level of accuracy. (29 refs.)

100850 Symmetry analysis of second-harmonic generation in silicon. T.A.Driscoll, D.Guidotti (Phys. Dept., Brown Univ., Povidence, RI, USA).
Phys. Rev. B (USA), vol.28, no.2, p.1171-3 (15 July 1983).
The authors present observations of second-harmonic generation in Si and argue that under intense laser excitation inversion symmetry is broken, and dipolar bulk second-harmonic generation becomes possible. A mechanism is proposed for removing inversion symmetry in highly excited Si. (11 refs.)

100851 Nature of the instability associated with parametric excitation of acoustic waves by electromagnetic fields. A.L.Kalapusha, N.Ya.Kotsarenko (T.G. Shevchenko State Univ., Kiev, Ukrainian SSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.31-4 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.55-9 (Jan.-Feb. 1983).
The nature of the instability of acoustic waves in piezoelectric semiconductors is analyzed in the case of stimulated Mandel'shtam-Brillouin scattering and the nonlinear piezoelectric effect. The conditions for the onset of convective instability and the values of the gain in the presence of carrier drift are determined. (14 refs.)

100852 Generation of Stokes and anti-Stokes waves initiated by two-photon additional illumination. N.E.Kornienko, A.M.Steba, V.L.Strizhevskii (T.G. Shevchenko State Univ., Kiev, Ukrainian SSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.161-5 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.300-7 (Feb. 1983).
A theoretical analysis is made of the simultaneous generation of Stokes and anti-Stokes waves initiated by two-photon additional illumination. This is done allowing for Raman and parametric processes, saturation effects and also for a possible difference between the Raman polarizabilities for the Stokes and anti-Stokes waves. The conditions for the establishment of various asymptotic regimes are determined and general expressions are derived for the ultimate conversion efficiencies, assuming that pump and additional illumination are fed into a medium (inverted or uninverted) under exact resonance and phase-matching conditions. The spatial evolution of the amplitudes of the interacting waves is investigated by an accurate analytic solution of the problem in an important particular case and using solutions in the approximation of a constant pump wave or constant additional illumination. (6 refs.)

100853 Sum-frequency output of parametric thermal image upconversion with dispersion matching. K.Koyanagi, I.Sakuraba (Faculty of Engng., Hokkaido Univ., Sapporo, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part C (Japan), vol.J66C, no.5, p.432-3 (May 1983). In Japanese.
Describes the sum-frequency output of parametric thermal image upconversion with dispersion matching. It is shown that the dispersion matching, in which case the spectral passband is large, is advantageous for thermal image upconversion. (5 refs.)

Infrared stimulated Raman scattering in rubidium vapor with a tunable pump frequency .... See Entry 100296

Resonance-enhanced multiphoton ionization: interference effects due to harmonic generation .... See Entry 100333

The nature of scattering centers in resonance stimulated Raman scattering by dyes and shape of the emitted spectra .... See Entry 100407

Optical Stark effects on pure-spin Raman transitions in molecular oxygen .... See Entry 100437

Subharmonic excitation of injection lasers .... See Entry 100772

Intracavity mode-locked and frequency-doubled Nd:YAG laser: pump-and mode-size effects .... See Entry 100773

High-efficiency pulse compression with intracavity Raman oscillators .... See Entry 100794

Characterisation of a train of subpicosecond laser pulses by fringe resolved autocorrelation measurements .... See Entry 100813

Chaos and nonlinear optics: a chaotic Raman attractor .... See Entry 100836

Parametric interaction of oppositely propagating light waves of identical frequency .... See Entry 100840

Phase conjugation in stimulated scattering .... See Entry 100862

Dielectric and nonlinear optical properties of new nonstoichiometric phases of tetragonal tungsten bronze containing lead and thorium .... See Entry 102830

Stimulated photoluminescence of CdTe .... See Entry 102952

42.65F Phase conjugation

100854 Phase-conjugate wavefront generation in four-wave mixing with photorefractive $Bi_{12}GeO_{20}$ (BGO) crystals. Y.H.Ja (Telecom Australia Res. Labs., Melbourne, Australia).
Aust. Telecommun. Res. (Australia), vol.17, no.1, p.53-60 (1983).
Phase-conjugate wavefront generation by degenerate four-wave mixing experiments in a reflection geometry with photorefractive $Bi_{12}GeO_{20}$ crystals is reported. The phase volume hologram responsible for the phase-conjugate wavefront generation is a reflection hologram with a very small fringe spacing of about 0.26 μm. No external electric field is applied and electron diffusion is the main mechanism responsible for the formation of the hologram. The theoretical and experimental results for wavefront reflectivity as a function of the intensity ratio of the writing beams are given. The dependence of the modulation depth of the reflection hologram and its average value over the crystal on the absorption and the intensity ratio of the writing beams is investigated also. (28 refs.)

100855 Photolithography experiments using forced Rayleigh scattering. M.D.Levenson (IBM Res. Lab., San Jose, CA, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4305-13 (Aug. 1983).
Phase conjugate wavefront generation by degenerate four-wave mixing has been used to project images with spatial resolution greater than 500 line pairs per millimeter. The nonlinear medium, a solution of rhodamine 6G in acetone, produced the images of forced Rayleigh scattering. These images were bright enough to expose photoresist in 30 sec and their quality was adequate for fine-line lithography and consistent with theoretical expectations. (10 refs.)

100856 A class of self-time-reserving wave fields. W.D.Montgomery (La Jolla Inst., La Jolla, CA, USA).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.13, p.472-6 (30 July 1983).
Shows that every vector homogeneous wave field is generated by a boundary field f, where $f=\phi+i\psi$ is a unique decomposition of f into its 'real' and 'imaginary' parts. These parts (ϕ and ψ) belong to a class (in fact, a real Hilbert space) of fields which when reflected from an ideal metallic mirror (MM) produce the same time-reversed wave field as when reflected from an ideal phase-conjugate mirror (i.e. they may be called self-time-reversing via a MM). (6 refs.)

100857 Elimination of distortions produced by a nonlinear medium by phase conjugation without losses or gains. G.S.Agarwal (School of Phys., Univ. of Hyderabad, Hyderabad, India).
Opt. Commun. (Netherlands), vol.47, no.1, p.77-8 (1 Aug. 1983).
A recently proved theorem on the complete cancellation of distortions, produced by a linear medium, using the technique of phase conjugation is generalized to a class of a nonlinear media. (4 refs.)

100858 Copropagation and counterpropagation conjugation with specular reflection. Yu.A.Ananev, V.D.Solovev.
Opt. & Spectrosc. (USA), vol.54, no.1, p.77-81 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.136-43 (Jan. 1983).
Conjugation arrangements making use of a volume interaction of light beams accompanied by the formation of a wave with the difference phase distribution are discussed. Several properties of the conjugation process are determined not so much by the nature of the interaction as by the particular arrangement used. A self-cancellation of large-scale optical inhomogeneities of a nonlinear medium is described in an arrangement in which the wave to be conjugated and the reference beam are initially propagating in opposite directions. (16 refs.)

100859 Phase conjugation by degenerate four-wave mixing and temporal coherence. B.Crosigani (Fondazione Ugo Bordoni, Istituto Superiore Poste e Telecomuniocazioni, Roma, Italy), P.Di Porto.
Opt. Lett. (USA), vol.8, no.8, p.422-4 (Aug. 1983).
The influence of the temporal-coherence properties of the pump and signal waves on the efficiency and the temporal fidelity of the phase-conjugation process associated with degenerate four-wave mixing is examined. (7 refs.)

100860 Probe-beam intensity-dependent reflectivity in degenerate four-wave mixing in a saturable absorber. Jin Kyuk Kwon, Sang Soo Lee (Dept. of Phys., Korea Advanced Inst. of Sci. & Technol., Seoul, Korea).
Opt. Lett. (USA), vol.8, no.8, p.428-30 (Aug. 1983).
A degenerate four-wave mixing experiment is performed in the saturable absorber of cryptocyanine. When the pump-beam intensity is below the saturation intensity, the reflectivity of the probe beam does not change, even through the probe-beam intensity is increased; however, the reflectivity begins to decrease slowly for moderate pump-beam intensity and finally decreases $1/q$ (q is the ratio of probe-to-forward pump-beam intensity) for pump-beam intensity far above the saturation intensity. The results are explained by extending Kogelnik's coupled-wave theory of volume grating to the four-wave case. (13 refs.)

100861 Transient four-wave mixing and optical pulse compression in the femtosecond regime. J.G.Fujimoto, E.P.Ippen (Dept. of Electrical Engng. & Computer Sci., MIT, Cambridge, MA, USA).
Opt. Lett. (USA), vol.8, no.8, p.446-8 (Aug. 1983).
The transient behavior of parametric-scattering four-wave mixing is investigated experimentally with femtosecond laser pulses. Special emphasis is placed on the measurement of parametric pulse durations and the application of this process to the compression of femtosecond optical pulses. Compression factors up to 1.85 have been achieved, yielding high-power pulses of less than 40-fsec duration. (11 refs.)

100862 Phase conjugation in stimulated scattering. B.Ya.Zel'dovich, N.F.Pilipetskii, V.V.Shkunov (Inst. of Problems in Mech., Acad. of Sci., USSR).
Sov. Phys.-Usp. (USA), vol.25, no.10, p.713-37 (Oct. 1982). Translation of: *Usp. Fiz. Nauk (USSR)*, vol.138, no.2, p.249-88 (Oct. 1982).
Various aspects of optical phase conjugation are discussed: the properties of the conjugate wave, its potential applications, the basic conjugation methods, and a brief history of the question. The theory for phase conjugation in stimulated scattering is set forth in detail. The basic experimental results on this conjugation method are also discussed in detail. Phase conjugation occurs because that configuration of the back-scattered field which has the conjugate wavefront is amplified to the greatest extent (at a doubled gain) in the intense speckle-inhomogeneous conjugate wave in a medium in which stimulated scattering occurs. Because of the large overall amplification in stimulated scattering, all the other, uncorrelated, configurations of the spontaneously scattered nucleating waves are amplified by a factor of 10^7 less and are discriminated against. The intervals of values of the various parameters in which the conjugate configuration (the specklon) exists are discussed theoretically, as is the effect of nonlinear selection and saturation on phase conjugation in stimulated scattering. There is a review of experimental results on the first observation of the effect, on the measurement of the angular structure of the uncorrelated waves and of the extent to which they are discriminated against, on the phase fluctuations of the conjugate wave, on the conjugation of subthreshold and depolarized radiation, and on phase conjugation in stimulated scattering in focused beams and for other scattered-wave amplification mechanisms. (123 refs.)

100863 Spectral characteristics of light wave reversal in a nondegenerate four-wave interaction in a resonant medium. P.A.Apanasevich, A.A.Afanas'ev, S.P.Shvavyi (Inst. of Phys., Acad. of Sci., Belorussian SSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.157-60 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.294-300 (Feb. 1983).
An investigation is made of wavefront reversal of optical radiation in a nondegenerate four-wave interaction in a resonant medium. It is shown that for a pump intensity comparable with the saturation intensity of the absorption line of the resonant medium, the reversed wave spectrum has two side peaks positioned symmetrically relative to the central peak which corresponds to a degenerate interaction. These side peaks are attributable to regions of negative absorption (amplification) of weak radiation by the resonant medium situated in a high-power field of opposite pump waves. The dependences of the magnitudes and positions of these peaks on the pump intensity can be used to control the spectral and energy characteristics of the reflected radiation. The conditions for self-excitation of a reversing system based on resonant four-wave interaction are determined. In particular, the ranges of the pump intensity and the optical density of the resonant medium in which self-excitation of the reversing system may occur, are determined for a degenerate interaction. (15 refs.)

Nonlinear optical experiments with solid-state lasers .... See Entry 98701

Spectroscopy of two-photon transitions in C_2H_4 using the degenerate four-photon interaction method .... See Entry 100397

Lithium niobate laser with frequency-degenerate pumping .... See Entry 100776

Experimental observation of amplification of beams by dynamic surface holograms .... See Entry 100828

42.65G Photon echoes, self-induced transparency, optical saturation and related effects

100864 A new nonlinear Q-switch element$-$LiF:F_2^- crystal. Zhang Guifen, Shu Meidong, Chai Xijie (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, Shanghai, China).
Chin. Phys. (USA), vol.3, no.2, p.459-62 (April-June 1983).
A new non-linear Q switch is presented. It combines the advantage of electro-optical crystal and dye Q switches, and is a promising crystal for Q switching and mode locking. (2 refs.)

100865 Photoacoustic observation of third-order absorption in thallium halides at 1.06 μm. P.Horn, A.Schmid, P.Braunlich (Dept. of Phys., Washington State Univ., Pullman, WA, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.7, p.1169-72 (July 1983).
1.06 μm laser photoacoustic spectroscopy has been applied to studies of third-order multiphoton absorption in selected thallium halides. This readily detected bandgap crossing absorption is observed at laser fluences significantly below the n-on-one damage threshold. Its importance for modelling of high intensity effects in wide bandgap ionic crystals is discussed. (24 refs.)

100866 Multiple photon echoes in molecular iodine. H.Nakatsuka, S.Asaka, M.Tomita, M.Matsuoka (Dept. of Phys., Faculty of Sci., Kyoto Univ., Kyoto, Japan).
Opt. Commun. (Netherlands), vol.47, no.1, p.65-9 (1 Aug. 1983).
Backward multiple photon echoes have been realized in the X $^1\Sigma_g{}^+$-$B^3\Pi_{0u}{}^+$ transition of molecular iodine. The first and second excitation pulses were the second harmonic pulse trains of an actively mode-locked and *Q*-switched YAG laser, and the third excitation pulse was a single pulse from a nitrogen-laser pumped dye laser. After the third pulse multiple photon echo pulses were emitted in the opposite direction to the excitation pulse train. The modulation on the envelope of the multiple photon echoes was explained as the quantum beats originated from the hyperfine splittings of the echo levels. (15 refs.)

100867 Theory of self-induced transparency without the approximation of slowly varying amplitudes and phases. A.I.Maimistov (Engng. Phys. Inst., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.198-200 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.360-4 (Feb. 1983).
An analysis is made of the propagation of an ultrashort optical radiation pulse under conditions of inhomogeneous broadening of a resonance line. By dispensing with the approximation of a slowly varying complex pulse envelope, constraints on the duration are removed and any phase modulation is automatically taken into account. It is shown that if the boundary conditions determining the attenuation of the pulse at its leading edges are defined, the appropriate reduced Maxwell-Bloch equations can be integrated using the method of the inverse problem of scattering theory. Higher conservation laws, whose existence has been doubted, are found. (15 refs.)

Contraction of, and hole burning in a phosphorescence line corresponding to the forbidden $T_1 \leftrightharpoons S_0$ transition in the spectrum of pyrene in a glassy matrix .... See Entry 100452

Influence of spectral hole burning on quaternary laser transients .... See Entry 100755

Circuit modelling of the effect of diffusion on damping in a narrow-stripe semiconductor laser .... See Entry 100763

Spectral hole burnings at high energy tails in spontaneous emission and hot carrier relaxation in InGaAsP lasers .... See Entry 100815

Self-transparency of Bragg mirrors .... See Entry 100820

Generation of second harmonic of light in crystals with resonant impurities .... See Entry 100844

Generation of Stokes and anti-Stokes waves initiated by two-photon additional illumination .... See Entry 100852

Probe-beam intensity-dependent reflectivity in degenerate four-wave mixing in a saturable absorber .... See Entry 100860

Optical soliton-like surface phenomena .... See Entry 100891

High resolution laser spectroscopy of colour centres .... See Entry 101695

Determination of picosecond relaxation times of bleachable dyes by the method of cross polarizers .... See Entry 103557

42.65J Beam trapping, self focusing, thermal blooming, and related effects

Problem of stabilization of laser radiation parameters .... See Entry 100824

42.70 OPTICAL MATERIALS

Industrial and Commercial Applications of Holography .... See Entry 98623

Vacuum-ultraviolet refractive index of LiF and MgF_2 in the temperature range 80-300K .... See Entry 99160

Optical constants of amorphous hydrogenated carbon and silicon-carbon alloy films and their application in high temperature solar selective surfaces .... See Entry 102977

A consideration about the antireflective coating of silicon solar cells .... See Entry 103706

Transient performance of normal/reverse flat plate collector with selective absorber surface .... See Entry 103721

The total anodization of copper films on platinum: Use as selective surface absorbers at high temperature .... See Entry 103723

Selective solar absorbers made from stainless steel: influence of the chemical composition and the metallurgical state of the alloy on the optical properties .... See Entry 103724

42.70C Glass

100868 Preparation of new fluoride glasses in ZrF_4-BaF_2-TlF system. J.-F.Trani, A.Vedrine, J.-C.Cousseins (Lab. de Chimie des Solides, Univ. de Clermont-Ferrand-II, Aubiere, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.19, p.1501-3 (30 May 1983). In French.
New fluoride glasses have been found in the ZrF_4-BaF_2-TlF system. The glassy transition and the crystallisation temperatures have been measured by differential thermal analysis. The optical window lies between 325 and 7700 nm. The average index of refraction is 1.51. (4 refs.)

100869 Kinetics of the photochromic processes in glasses under the action of light irradiation at intensities which vary in time. T.L.Dobrovol'skaya, A.V.Dotsenko, V.K.Zakharov, A.V.Morozov, V.S.Paivin, A.S.Snurnikov (S.I. Vavilov State Optical Inst., Leningrad, USSR).
Sov. J. Glass Phys. & Chem. (USA), vol.8, no.4, p.313-17 (July-Aug. 1982). Translation of: *Fiz. & Khim. Stekla (USSR)*, vol.8, no.4, p.456-61 (July-Aug. 1982). [received: May 1983]
A study of the interaction between photochromic glasses based on silver halide and radiation with a time-varying intensity has been made. Some features of the kinetics of photochromic darkening have been demonstrated; a comparison is made between the theoretical and experimental curves which has shown satisfactory agreement. (13 refs.)

Symposium on Halide and other Nonoxide Glasses .... See Entry 98625

Preliminary calculations on dispersion effects in infrared transmitting materials .... See Entry 100910

Fluorozirconate glasses with improved viscosity characteristics for fibre drawing .... See Entry 100912

Method of characterizing the optical quality of glass .... See Entry 100932

Effect of thermoradiation treatment on the radiation stability of glasses .... See Entry 102845

Determining the dimensions of light-sensitivity and color centers of silver-halide photochromic glasses from measurements of the angular characteristics of light scattering .... See Entry 102898

Spectral properties of glassy tetraphosphate with high neodymium (Nd^{3+}) concentration .... See Entry 102909

Optical absorption of 3*d* transition metal and rare earth elements in zirconium fluoride glasses .... See Entry 102913

Spectral absorption of iron in silicate optical glasses .... See Entry 102919

Fluoride glasses of 3d transition metals .... See Entry 103105

42.70G Light-sensitive materials

Spectral sensitisation in conjunction with supplementary chemical sensitisation .... See Entry 99215

Investigation of the interaction of diglycidol ether of methylphosphonic acid with gelatin .... See Entry 99216

The influence of a strong electric field on a photographic layer during blocked ionic conduction .... See Entry 99220

Change of state of colour centres in alloyed sodium chloride crystals .... See Entry 99222

Retention of photographic images in aluminium hydride layers .... See Entry 99224

Real time holographic interferometry with photorefractive $Bi_{12}SiO_{20}$ crystals .... See Entry 100682

Large aperture thermoplastic film computer driven holographic recording system .... See Entry 100684

Phase-conjugate wavefront generation in four-wave mixing with photorefractive $Bi_{12}GeO_{20}$ (BGO) crystals .... See Entry 100854

Kinetics of the photochromic processes in glasses under the action of light irradiation at intensities which vary in time .... See Entry 100869

Light-induced dynamic instability of the domain structure in $FeBO_3$:Ni .... See Entry 102694

Determining the dimensions of light-sensitivity and color centers of silver-halide photochromic glasses from measurements of the angular characteristics of light scattering .... See Entry 102898

Concerning the role of Ag^+ ions in a photographic process with physical development on thin TiO_2 layers .... See Entry 103560

Mechanism of the initial stage of the surface photochemical process of the microcrystals of low-sensitivity photographic layers .... See Entry 103562

42.72 OPTICAL SOURCES AND STANDARDS

(for spectroscopic light sources, see also 07.65)

Measurement standards of light and radiation .... See Entry 99147

High repetition rate subnanosecond gated photon counting .... See Entry 99200

An optical system of a 16 mm film projector .... See Entry 99213

The spatial coherence properties of Gaussian Schell-model beams .... See Entry 100661

Broad band electro-optic tuning of a CW dye laser .... See Entry 100822

42.78 OPTICAL LENS AND MIRROR SYSTEMS

(for microscopes, see 07.60P; for photographic instruments, see 07.68; for astronomical telescopes, see 95.55)

100870 Studies on certain modified Luneberg lenses. M.Barakat (Industrial Technol. Centre, Nat. Res. Council of Canada, Winnipeg, Manitoba, Canada), L.Shafai.
IEE Proc. H (GB), vol.130, no.5, p.363-8 (Aug. 1983).
The solution for the electromagnetic field in the presence of certain modified Luneberg lenses is obtained analytically. The permittivity profiles are selected to improve the lens directivity at low frequencies, where the lens diameter is of the order of the wavelength. For a Huygens' source excitation their directivity, as a function of profile parameters, is computed and the degree of improvements are indicated. Radiation patterns are also computed and are compared with those of the standard Luneberg lens. To examine their performance with a practical source an open ended rectangular waveguide is then used and the computed radiation patterns are presented. In the latter case, to simplify computation, the exciting waveguide is represented by a two-dimensional Huygens' source array. (4 refs.)

100871 General solution of the non-full-aperture Luneburg lens problem. S.Doric, E.Munro (Dept. of Phys., Imperial Coll., London, England).
J. Opt. Soc. Am. (USA), vol.73, no.8, p.1083-6 (Aug. 1983).
The generalised Luneburg lens problem has been redefined to include non-full-aperture lenses, and as a result a new class of solutions has been made possible. A particular solution is obtained for which the refractive-index gradient is a smooth and continuous function and its two-dimensional form is equivalent to Sottini's geodesic lens with smooth edges. (7 refs.)

100872 Aberrational analysis of optical systems with diffraction elements. G.I.Greisukh, S.A.Stepanov.
Opt. & Spectrosc. (USA), vol.54, no.1, p.93-5 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.164-6 (Jan. 1983).
A procedure is described for calculating the aberrations of optical systems which include both classical and diffraction optical elements. The aberrations are calculated from the known coefficients in the expansion of the point characteristics of the components in the system. (6 refs.)

100873 Design of a digital control system for an advanced optical tracker. C.D.Corsetti, S.B.Talley, C.W.Martin (Air Force Weapons Lab., Kirtland AFB, NM, USA).
24th Midwest Symposium on Circuits and Systems, Albuquerque, NM, USA, 29-30 June 1981 (North Hollywood, CA, USA: Western Periodicals 1981), p.305-12
Presents the design of a digital control system for an advanced optical tracker which was recently tested in the laboratory and in the field. A brief description of the tracker which uses phase conjugate adaptive optics for correcting optical aberrations in the wavefront is presented. Models are given for the major system components, which include an optical sensor, a high bandwidth steering mirror and a high bandwidth deformable mirror. Finally, the digital control algorithm is described. (9 refs.)

A system for controlling the luminance stability of colour temperature reference lamps .... See Entry 99156

Wide-field planapochromats and special-type objectives for the Jena-microscope series 250-CF .... See Entry 99175

An optical system of a 16 mm film projector .... See Entry 99213

Optical systems of high-speed cameras with opto-mechanical commutation .... See Entry 99219

Calculation of the parameters of a laser beam transmitted by a focusing rod .... See Entry 100665

Active alignment of the feedback mirror in a half symmetrical unstable resonator with an inner axicon .... See Entry 100808

The design of the kinematics of the knife movement in the production of a circular paraboloid .... See Entry 100934

Theoretical concentration of solar radiation by central receiver systems .... See Entry 103654

Laboratory evaluation of commercial aspheric aphakic lenses .... See Entry 104117

42.78H Coatings

100874 **Cold mirrors.** B.Zalar, J.Matkovic.
Elektroteh. Vestn. (Yugoslavia), vol.50, no.1, p.54-6 (Jan.-Feb. 1983).
Describes the usage of a series of double-film packets as cold mirrors. (4 refs.)

100875 **Synthesis of optical interference coatings.** E.G.Stolov.
Opt. & Spectrosc. (USA), vol.54, no.1, p.102-5 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.180-5 (Jan. 1983).
In this article a method of calculating antireflection optical interference coatings with given spectral characteristics is described based on a new approach to solving systems of nonlinear equations, partially guaranteeing parallel data processing in the process of finding solutions. (8 refs.)

RF-plasma deposited amorphous hydrogenated hard carbon thin films: preparation, properties, and applications .... See Entry 103073

42.80 OPTICAL DEVICES, TECHNIQUES AND APPLICATIONS

(for optical instruments and techniques, see 07.60; for optical spectroscopy, see 07.65; for photography, see 07.68; for holography, see 42.40; for lasers, see 42.55 and 42.60; for masers, see 42.52)

100876 **Optimization of Schlieren apparatus parameters.** V.I.Gorodetskaya, R.P.Kosoburd, F.A.Markus.
Opt. & Spectrosc. (USA), vol.54, no.1, p.95-8 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.167-72 (Jan. 1983).
The article discusses the optimum parameters of a Schlieren apparatus for the hairline-at-the-focus method from the standpoint of maximum contrast of the shadowgram and correct determination of the phase profile from its image. The errors of the method of reconstructing the phase relief shape are estimated. (5 refs.)

Industrial and Commercial Applications of Holography .... See Entry 98623

Speckle-shear interferometry with double Dove prisms .... See Entry 99169

Optical technique for increasing fill factor of mosaic arrays ... See Entry 99183

Use of holographic optical elements as beam splitters in holography of weakly moving objects .... See Entry 100686

Nd:YAG holographic interferometer for aerodynamic research .... See Entry 100691

Pulsed laser beam control by hot spot tracking .... See Entry 100812

Theoretical investigations on spatial filtering with a complex binary filter under the condition of finite filter size .... See Entry 100877

Graphical representation of prism coupling into thin films .... See Entry 100884

42.80B Spatial filters, zone plates

100877 **Theoretical investigations on spatial filtering with a complex binary filter under the condition of finite filter size.** S.Kessler, V.Masurat (Friedrich-Schiller-Univ., Jena, Germany).
Exp. Tech. Phys. (Germany), vol.31, no.3, p.193-211 (1983). In German.
The intensity distribution on the output of a spatial filtering system with a complex binary filter of finite size is considered. The special cases schlieren-method, phase contrast, and modulation contrast are discussed for a binary amplitude and phase object. (5 refs.)

100878 **Phase coding of complex space-frequency filters.** E.F.Ochin.
Izv. VUZ Priborostr. (USSR), vol.26, no.6, p.80-2 (June 1983). In Russian.
A space-frequency phase filter for a coherent optical processor is examined. The filter is a plane-parallel transparent substrate divided up into rectangular sections. Part of the material of the substrate is etched in such a way that there is a depression or protrusion, off-set from the centre of the section, inside the filter section. The magnitude of the depression or protrusion determines the phase difference, equal to π, its dimensions in the plane are proportional to the magnitude of the amplitude modulation and the displacement of the depression or protrusion relative to the centre of the filter section is proportional to the magnitude of the phase modulation of the filter in that section. (1 ref.) *L.M.H.*

Pseudocolouring of directional structures by spatial frequency filtering .... See Entry 100676

New research in holographic pattern recognition .... See Entry 100681

42.80C Spectral and other filters

100879 **Design of ripple-free multilayer optical filters. A practical illustration.** K.Kannan, R.Balasubrahmaniyam (Dept. of Electrical Engng., Indian Inst. of Technol., Bombay, India).
Opt. Acta (GB), vol.30, no.8, p.1151-70 (Aug. 1983).
A simple and fast method of designing ripple-free, broad-band, thin-film edge filters is presented. It uses a successive refinement procedure for ripple reduction without any special merit functions, and a fast computational algorithm for finding the derivative of reflectance. The design of cyan and yellow broad-band edge filters is taken as an example to illustrate the procedure. The influence of various parameters in the ripple reduction process is analysed. The choice of these parameters at various stages of refinement to obtain a fast-converging solution is indicated. The effect of practical errors in controlling the thickness of the layers on the final product is also studied. The method illustrated can readily be used for the design of any broad-band edge filter and may be extended for other types of multilayer filter. (18 refs.)

100880 **Synthesis of contrast bandpass interference filters. Complex periodic systems.** Yu.N.Markov.
Opt. & Spectrosc. (USA), vol.54, no.1, p.99-102 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.173-9 (Jan. 1983).
The article proposes a method of transmission-band iosolation that makes it possible over a wide range of given bandwidth values to synthesize contrast bandpass interference filters whose spectral characteristics cannot be shaped with sufficient accuracy by using known categories of two-component multihalfwave bandpass systems. A method is proposed for optimizing bandpass interference filters in the smoothing portion of oscillations of the transmission coefficient in the transmission band. (10 refs.)

Method of fabrication and photographic characteristics of the Fabry-Perot type photosystems .... See Entry 99165

Mode filter characteristics of metal-clad GaAs waveguide and its application to light intensity modulator .... See Entry 100931

42.80E Shutters, windows, diaphragms, deflectors, choppers

Holographic phase aberration balancing with an inexpensive liquid gate .... See Entry 100697

42.80F Gratings, echelles

100881 **Characteristic curve of meteoric spectrograms obtained by an optical diffraction transmission grating.** A.Skopal (Inst. of Astron., Charles Univ., Praha, Czechoslovakia).
Bull. Astron. Inst. Czech. (Czechoslovakia), vol.34, no.3, p.173-8 (June 1983).
Relations determining the percentage representation of the light reflected by a grating are derived. To construct the characteristic curve of a plate, zero order spectra of star trails were used. The stellar magnitudes of star trails on the plate were derived from their theoretical magnitudes corrected for the speed of the stars on the plate and for the effect of the diffraction transmission grating with a triangular scratch cross-section. A numerical example is also given. (6 refs.)

100882 **New vistas for diffraction gratings.** J.M.Lerner (Optical Div., Instruments SA Inc., Metuchen, NJ, USA), J.-P.Laude.
Electro-Opt. (USA), vol.15, no.5, p.31-5 (May 1983).
The development and performance of holographically produced ion-etched diffraction gratings is discussed. The use of fibre optics with gratings is described including the Stimax configuration and Schmidt-corrected gratings. The resulting development of communication systems and new forms of spectroscopic devices is discussed. Finally the use of gratings in metrology is considered. (12 refs.)

100883 **Calculation of electro-optical diffraction deflector with edge effects taken into account.** V.A.Dianova, Ye.R.Mustel', A.G.Sveshnikov, N.Ye.Shapkina.
Radio Eng. & Electron. Phys. (USA), vol.27, no.10, p.140-5 (Oct. 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.10, p.2016-21 (Oct. 1982).
The behaviour of an electro-optically controlled 'blazed' grating type of deflection system is investigated with the edge effects at the electrode boundaries taken into account. The phase delay and the distribution of light intensity among the diffraction maxima are calculated. (5 refs.)

Scattering from sinusoidal gratings: an evaluation of the Kirchhoff approximation .... See Entry 100656

A note on wedge functions and echelette gratings .... See Entry 100658

Grating coding for image subtraction with uneven bar widths .... See Entry 100674

Use of holographic optical elements as beam splitters in holography of weakly moving objects .... See Entry 100686

Ion-etching as a means of blazing and optimizing holographic diffraction gratings .... See Entry 100688

Diffraction efficiency of blazed holographic gratings .... See Entry 100700

Spurious waves in thick phase gratings .... See Entry 100701

Fabrication technique of fine gratings in two-dimensional diode lasers .... See Entry 100795

90-fs tunable optical pulses obtained by two-stage pulse compression .... See Entry 100809

High resolution etching of GaAs and CdS crystals .... See Entry 100935

42.80K Optical beam modulators

90-fs tunable optical pulses obtained by two-stage pulse compression .... See Entry 100809

Theoretical investigations on spatial filtering with a complex binary filter under the condition of finite filter size .... See Entry 100877

Mode filter characteristics of metal-clad GaAs waveguide and its application to light intensity modulator .... See Entry 100931

Growth peculiarities of graded band gap GaAsSb/GaAs heterostructures and effective light modulation in the 1.06 μm wavelength region .. See Entry 102502

42.80L Optical waveguides

(for fibre optical waveguides, see 42.80M)

100884 **Graphical representation of prism coupling into thin films.** A.Feldman (Inorganic Materials Div., NBS, Washington, DC, USA).
Appl. Opt. (USA), vol.22, no.15, p.2380-2 (1 Aug. 1983).
A natural framework for evaluating prism-coupler performance is provided by a recently developed geometrical construction in which refraction through a prism for an arbitrary angle of incidence is represented by an ellipse. The useful operatinmg range of a prism coupler is represented by the portion of the representational ellipse that appears within a window determined by the mode propagation conditions of a thin-film-substrate system. (7 refs.)

100885 Passive planar multibranch optical power divider: some design considerations. M.Belanger, G.L.Yip (Dept. of Electrical Engng., McGill Univ., Montreal, Quebec, Canada), M.Haruna.
Appl. Opt. (USA), vol.22, no.15, p.2383-9 (1 Aug. 1983).
Design analysis has been performed on a passive planar multibranch waveguide optical power divider in a z-cut $LiNbO_3$ substrate. Specifically, 5- and 3-branch waveguide structures were investigated with the effective index and field matching methods, taking into account the phase changes in the branches at the branching interface. Conditions for equal power division were examined regarding the appropriate branching angle and the relative index distribution in the branches. Illustrative numerical examples are presented and discussed. (16 refs.)

100886 Integrated optical polariser on $LiNbO_3$:Ti channel waveguides using proton exchange. M.Papuchon, S.Vatoux (Lab. d'Optique Integree, Thompson-CSF, Orsay, France).
Electron. Lett. (GB), vol.19, no.16, p.612-13 (4 Aug. 1983).
A polariser on a Ti:$LiNbO_3$ channel waveguide has been realised using a double fabrication process (Ti indiffusion and proton exchange). A region is created where the extraordinary polarisation experiences a leaky propagation leading to an extinction ratio of 30 dB and excess loss of about 1 dB. (7 refs.)

100887 Microbending loss in optical waveguides. J.M.Arnold, R.Allen (Dept. of Electrical & Electronic Engng., Univ. of Nottingham, Nottingham, England).
IEE Proc. H (GB), vol.130, no.5, p.331-9 (Aug. 1983).
The problem of coupling from a bound mode to the radiation field in an open waveguide subject to slow variations of its axis is considered. The derivation does not depend on statistical averaging over an ensemble of waveguides, as do earlier treatments of the same problem. Nevertheless, it is shown that an average loss can be defined, and the average being taken over the length of the waveguide. For this reason, the results are applicable to the realistic experimental situation, when experiments are performed on single waveguides. As an example, the authors calculate the microbending loss of a single-mode step-index optical fibre as a function of wavelength and compare it with some recent experimental measurements of the same quantity. Good agreement is shown when the Fourier transform of the curvature autocorrelation function is assumed to have an inverse power dependence on the Fourier frequency, but the agreement is less convincing for some other possible choices of autocorrelation function. (13 refs.)

100888 Carrier dependent parameters in a silicon optical waveguide. M.Willander (Phys. Dept., Royal Inst. of Technol., Stockholm, Sweden).
J. Appl. Phys. (USA), vol.54, no.8, p.4660-3 (Aug. 1983).
The infrared absorption (at $\lambda=10.63$ μm) of an electron-hole plasma, created in a thin silicon waveguide by intermittent electron beam bombardment, is measured experimentally and analyzed theoretically. In the absence of all external fields (except those of the probing laser beam) the imaginary dielectric constant is shown to be a linear function of the carrier concentration in the range 2×10^{22}-2×10^{23} m^{-3} at room temperature. Furthermore, it is shown that the method can be used to study the possible carrier dependence of either the carrier lifetime or the surface recombination velocity. (15 refs.)

100889 Lightwaveguide—operational line for 34 Mbit/s. G.Heister, W.Knop, W.Unterlass.
Nachrichtentech. Z. (NTZ) (Germany), vol.36, no.7, p.434-7 (July 1983). In German.
After trials in various cities from 1978 onwards, Siemens have handed over to the Federal German Post Office a 8.7 km long cable network in Munich; its capacity is 34 Mbit/s. The operating wavelength has been shifted from 850 to 880 nm, resulting in a 15% loss reduction, now down to 2.5 db/km. The glass fibre conductor has core/sheath diameters of 50 μm/125 μm. The transmitter module contains a CW laser in the shape of a planer GaAl/As oxide strip, the receiver is headed by a avalanche photodiode. Terminals contain special fault-locating circuits. A table quotes planned and actually achieved (better) performance figures of the glass fibre cable and of the whole transmitting system. Illustrations comprise electrical and optical response curves and 5 photos. (4 refs.) *A.L.*

100890 Evaluation methods for pulse measurement of lightwaveguides. S.Geckeler.
Nachrichtentech. Z. (NTZ) (Germany), vol.36, no.7, p.442-5 (July 1983). In German.
The measurement of the most important lightguide characteristics like attenuation and bandwidth is best undertaken by applying a very brief light pulse (typically <1 ns) and interpreting the output pulse deformation. This contribution from the Siemens Research Laboratories deals not with the equipment side but with mathematical analysis and with computerized evaluation of observed measurement results, a 4.4 km long glass fibre cable being pulsed and the pulse output waveform being measured in 0.25 ns steps. The analysis considers the normalized spectral function and the transmission characteristic function of the light guide, the theoretical case of a Dirac pulse being a limit condition. Diagrams show the applied pulse and the derived function responses from same: spectral function and phase angle plotted vs. frequency. Of particular interest is the short computer program in BASIC demonsrating the rapid evaluation of the basic perfomance characteristics from observed pulse measurements. (5 refs.) *A.L.*

100891 Optical soliton-like surface phenomena. H.-E.Ponath, M.Schubert (Dept. of Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Opt. Acta (GB), vol.30, no.8, p.1139-49 (Aug. 1983).
The properties of an optical pulse propagating along a diclectric or metallic surface is studied. Soliton-like behaviour and self-induced transparency are found, depending on the properties and geometric conditions of a dopant layer and of homogeneously doped material. (9 refs.)

100892 Chalcogenide amorphous film waveguides. T.Suhara, H.Nichihara (Faculty of Engng., Osaka Univ., Osaka, Japan).
Oyo Buturi (Japan), vol.52, no.3, p.233-4 (March 1983). In Japanese.
As-S of As-Se-Ge based chalcogenide-materials are used to fabricate chalcogenide amorphous thin-film optical waveguides. These materials have high forbidden-band energy. The use of a silicon substrate on which a SiO_2 layer is grown can provide excellent waveguide property. In this case, if the thickness of the SiO_2 layer is equal to 0.4 μm, device emission loss can be reduced to 0.1 dB/cm or less. The propagation loss of waveguide light is caused by scattering due to incompleteness of the surface of the substrate and waveguiding-film. An $As_2S_3/SiO_2/Si$ waveguide of 1 μm in thickness has shown a relative scattering intensity of approximately −20 dB when $\lambda=1.06$ μm and the propagation distance is 10 mm. (8 refs.) *K.B.*

100893 Mismatch of TE and TM modes in multilayer dielectric and metal-dielectric heterostructures. V.G.Fedoseev, P.V.Adamson (Inst. of Phys., Acad. of Sci., Tartu, Estonian SSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.228-32 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.408-15 (Feb. 1983).
A theoretical investigation is made of the mismatch between orthogonal modes (i.e. the relative difference between the refractive indices of guided TE and TM modes characterized by the same frequency and transverse index) propagating in four- and five-layer planar waveguides. An approximate expression is obtained for the mismatch between orthogonal modes in a five-layer waveguide characterized by relatively small discontinuities of the permittivity at the interfaces between the media and by relatively thick intermediate layers. It is shown that when an outer metal layer is deposited on a three-layer dielectric planar waveguide, the direction of change in the mismatch between orthogonal modes depends on the sign of the difference between the refraction indices of a guided TM mode in a three-layer waveguide and a surface plasmon traveling along the interface between the metal and an intermediate layer. If this difference between the refractive indices is positive, then matching of orthogonal modes is possible. The presence of a dielectric outer layer which is optically less dense that the intermediate one increases the mismatch between orthogonal modes. Subject to the assumptions made, the conclusions reached apply also to heterolasers with limited-thickness emitters. (11 refs.)

100894 Image transmission characteristics of dielectric slab with gradient index. T.Hosono, S.Yamaguchi, K.Mori (Coll. of Sci. & Technol, Nihon Univ., Tokyo, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part C (Japan), vol.J66C, no.5, p.416-23 (May 1983). In Japanese.
Analyses the image transmission characteristics of dielectric slab waveguide (DSW) as a simplified model for image transmission in optical fibers. The transmission characteristics of DSW were numerically analyzed by using the homogeneous multilayer approximation method for the following items: (1) Difference of the characteristics between two dielectric constant profiles, $\mathrm{sech}^2(\alpha z)$ and $1-(\beta z)^2$, and effect of dielectric constant difference between core and cladding. (2) Aberration attributed to the profile of dielectric constant. (3) Effect of dip at edge of core. (10 refs.)

Introduction to optical fibers .... See Entry 98680

Determining the optical constants of high index thin films (II-VI compound thin film) with optical waveguides .... See Entry 99143

Experimental determination of variations in optical-waveguide film thickness by the interference of scattering fields of modes with different polarization .... See Entry 99170

Optical waveguiding in (In, Ga)(As, P) inverted rib waveguide lasers at 1.3 μm wavelength .... See Entry 100765

Cylindrical Gaussian-Hermite modes in rectangular waveguide resonators .... See Entry 100805

Statistical properties of modal noise in fibre-laser systems .... See Entry 100914

Photodetector for guided-wave optics .... See Entry 100923

Parametric mixing in monolayers deposited on thin-film waveguides .... See Entry 100924

An investigation of multimodal interference of surface light waves in a micro-waveguide interferometer .... See Entry 100928

Integrated optics and its application limits .... See Entry 100929

Mode filter characteristics of metal-clad GaAs waveguide and its application to light intensity modulator .... See Entry 100931

Long-range surface plasmons in electrode structures .... See Entry 102275

Improved flow-through GC/IR lightpipe .... See Entry 103616

42.80M Fibre optics

100895 Synchronous phase detection for optical fiber interferometric sensors. I.J.Bush, R.L.Phillips (Dept. of Electrical Engng. & Communication Sci., Univ. of Central Florida, Orlando, FL, USA).
Appl. Opt. (USA), vol.22, no.15, p.2329-36 (1 Aug. 1983).
A system has been developed to accurately detect phase signals produced in optical interferometric sensors. The system employs optical heterodyning and synchronously detects optical phase by feeding an error signal to a phase modulator in the reference leg of the interferometer. This system is seen to have properties similar to a phase-locked loop. The system is mathematically analyzed and a simple second-order model developed with accurately predicts the system response. (10 refs.)

100896 Launching light from semiconductor lasers into plane-ended multimode optical fibers. H.R.D.Sunak, M.A.Zampronio (Inst. de Fisica, Univ. Estadual de Campinas, Campinas, Sao Paulo, Brazil).
Appl. Opt. (USA), vol.22, no.15, p.2337-43 (1 Aug. 1983).
A systematic and detailed study of launching light from semiconductor lasers into plane-ended multimode optical fibers has been carried out—the authors believe for the first time. Three different semiconductor lasers and four multimode fibers having numerical apertures in the 0.16-0.40 range were used. Simple theoretical models developed for the launching efficiency η give good agreement with experimental results. The authors show how erroneous results can be obtained when considering only the stimulated emission of the lasers in calculating η. The dependence of η on axial, lateral, and angular misalignments is also investigated and explained qualitatively with ray optics. (7 refs.)

100897 Launching light from semiconductor lasers into multimode optical fibers having hemispherical ends and taper-with-hemisphere ends. H.R.D.Sunak, M.A.Zampronio (Inst. de Fisica, Univ. Estadual de Campinas, Sao Paulo, Brazil).
Appl. Opt. (USA), vol.22, no.15, p.2344-8 (1 Aug. 1983).
The plane ends (PE) of various multimode optical fibers have been transformed into (a) hemispherical ends (HE) and (b) taper-with-hemisphere ends (TE) by using a microtorch and also a CO_2 laser for HE only. The authors confirmed that the launching efficiency η from semiconductor lasers into multimode fibers is much greater than TE and HE compared with PE, with TE being the most efficient. A rigorous comparison between these three launching arrangements is reported here for the first time together with detailed analysis of similar published work. The effect of various misalignments is also investigated and compared for the three fiber terminations. (22 refs.)

100898 Influence of mode coupling on differential mode delay. B.Stoltz, D.Yevick (Inst. of Optical Res., Royal Inst. of Technol., Stockholm, Sweden).
Appl. Opt. (USA), vol.22, no.15, p.2349-55 (1 Aug. 1983).
The manner in which the differential mode delay (DMD) pulse response is affected by ellipticity and micro-bending induced mode coupling has been

analyzed numerically. The authors have considered both a fiber profile containing a central index dip and fiber profiles with sinusoidal ripples. The authors find that slowly varying profile components can be correctly estimated from DMD results even in the presence of substantial mode coupling. (7 refs.)

100899 Excess loss of single-mode jacketed optical fiber at low temperature. T.Yabuta, N.Yoshizawa, K.Ishihara (Ibaraki Electrical Communication Lab., NTT, Ibaraki, Japan).
Appl. Opt. (USA), vol.22, no.15, p.2356-62 (1 Aug. 1983).
This paper describes excess loss of single-mode jacketed optical fibers at low temperature. A structural model is proposed for the jacketed fiber in order to investigate the relationship between the structure and excess loss. This model clarifies the excess loss increase mechanism that any initial irregularity existing in the jacketed fiber increases due to shrinkage of the jacket and causes excess loss. These results show that reducing the buffer diameter and controlling the fiber deformation inside the jacket are effective in suppressing excess loss at low temperature. (7 refs.)

100900 Dispersionless single-mode fibers with trapezoidal-index profiles in the wavelength region near 1.5 μm. U.C.Paek (Western Electric Engng. Res. Center, Princeton, NJ, USA).
Appl. Opt. (USA), vol.22, no.15, p.2363-9 (1 Aug. 1983).
The transmission performance of trapezoidal-index profile single-mode fibers that can operate with zero dispersion in the 1.5-μm region has been investigated. The exact numerical calculations of propagation characteristics for these lightguides established a variety of relationships in terms of the parameters of a trapezoidal-index profile. One of the profile parameters that defines the shape of a trapezoid is the aspect ratio S, which ranges between 0 and 1. It was found that as the aspect ratio decreases from 1.0 to 0.3 the optimum core radius of the fiber gradually increases. But when S is <0.3, it approaches a constant equal to the value of the triangular-index profile ($S=0$). (16 refs.)

100901 Polarization-maintaining optical fibers with low dispersion over a wide spectral range. K.Okamoto, M.P.Varnham, D.N.Payne (Dept. of Electronics, Univ. of Southampton, Southampton, England).
Appl. Opt. (USA), vol.22, no.15, p.2370-3 (1 Aug. 1983).
The total dispersion characteristics of the doubly clad Panda (or bow-tie) fibers have been investigated. It is shown that the contribution of the photoelastic effect to the total dispersion becomes of the order of several psec/km.nm in the 1.5-1.7-μm wavelength region. By careful adjustment of the cutoff wavelength, the total dispersion is reduced to within ±1 psec/km.nm over the 1.38-1.70 μm wavelength region for the $HE_{11}{}^{x}$ mode and 1.38-1.68 μm for the $HE_{11}{}^{y}$ mode respectively. (16 refs.)

100902 Thermal properties of highly birefringent optical fibers and preforms. A.Ourmazd, M.P.Varnham, R.D.Birch, D.N.Payne (Dept. of Electronics, Univ. of Southampton, Southampton, England).
Appl. Opt. (USA), vol.22, no.15, p.2374-9 (1 Aug. 1983).
Temperature cycling of high birefringent optical fibers and preforms has been used to investigate the thermal properties of bow-tie and elliptically clad structures. The thermal hysteresis of the birefringence is shown to be a direct consequence of the thermal history of the fiber or preform and has been related to volume changes in the stress-producing borosilicate sections. Annealing increases the axial stress as well as the stress anisotropy and hence the birefringence. Increases of up to a factor of 2 in the birefringence on suitable thermal treatment indicate a new method for further improvement of high birefringence fibers. The implications of the results in the design, fabrication, and use of such fibers are discussed. (11 refs.)

100903 Glass fiber manufacturing: continuous purification of lightguide chemicals. D.L.Flamm, L.T.Manzione, J.W.Baumgart (Western Electric, Princeton, NJ, USA), L.F.Thompson.
Bell Lab. Rec. (USA), vol.61, no.5, p.17-21 (May-June 1983).
A new processing technique promises an unprecedented purity in the chemicals used to make lightguide fibers. The process also can be scaled up to meet increased production needs. (no refs.)

100904 Polarisation-holding directional coupler made from elliptically cored fibre having a D section. R.B.Dyott, J.Bello (Andrew Corp., Orland Park, IL, USA).
Electron. Lett. (GB), vol.19, no.16, p.601 (4 Aug. 1983).
A polarisation-holding directional coupler has been made using single-mode fibre having an elliptical core. An isolation of 21 dB between polarisation has been achieved together with an estimated insertion loss <0.2 dB. (2 refs.)

100905 New absorption bands in pure and F-doped silica optical fibres. W.Heitmann (Forschungsinst. der Deutschen Bundespost beim FTZ, Darmstadt, Germany), H.U.Bonewitz, A.Muhlich.
Electron. Lett. (GB), vol.19, no.16, p.616-17 (4 Aug. 1983).
Two very narrow absorption bands positioned at 765 nm and at 1273 nm have been found in pure silica and fluorine-doped silica optical fibres. Their origin is probably connected with the preform production technique. Annealing of the preform and different fibre drawing conditions did not influence the absorption bands. (3 refs.)

100906 Radiation-hardened pure silica-core fibre optics. R.H.West, A.P.Lenham (Royal Military Coll. of Sci., Swindon, England).
Electron. Lett. (GB), vol.19, no.16, p.622-3 (4 Aug. 1983).
Transmission losses induced by ionising radiation in fibre optics having cores drawn from pure synthetic silica may be reduced by pre-exposure to large hardening doses. Characteristics of the hardened fibres are described and the necessary features of the hardening irradiations identified. (3 refs.)

100907 Effects of loss on equivalent-step-index fibre determination. C.Pask, F.Ruhl (Res. School of Phys. Sci., Australian Nat. Univ., Canberra, Australia).
Electron. Lett. (GB), vol.19, no.16, p.643-4 (4 Aug. 1983).
The effects of waveguide losses on equivalent-step-index (ESI) determination are investigated with Millar's method (see ibid., vol.17, no.13, p.458-60, 1981) as an example. The fitting of spot-size data when the second-mode cutoff wavelength is underestimated leads to the use of an inappropriate formula or the deduction of a too-small ESI radius. In the latter case the ESI numerical aperture will still be given with good accuracy. (5 refs.)

100908 Fiberoptic receiver performance. A tutorial review. H.Hodara (Tetra Tech. Inc., Pasadena, CA, USA).
Fiber & Integrated Opt. (USA), vol.4, no.3, p.233-337 (1983).
A tutorial review of fiberoptic receivers is presented, and their performance analyzed in terms of two quantities: quantum noise, a fundamental limit, and Noise Equivalent Power, or NEP, and engineering parameter. The NEP, a quantity specified by manufacturers as constant, is shown to vary with bandwidth (data rate). The exact dependence of NEP on bandwidth is derived for two types of receivers: transimpedance and integrating, in both analog and digital modes. The results are applied to the calculation of the minimum required power for digital and analog receivers operation, and universal curves of power vs. bandwidth are presented. It is shown that the NEP specified by manufacturers can be fitted to these universal curves, from which receiver performance can be predicted. For tutorial purposes, the treatment is self-contained and many well-known classical results such as signal-to-noise ratio of PCM signals and noise-equivalent circuits are re-derived from fundamental principles. (no refs.)

100909 Optical properties of fibre and bulk zirconium fluoride glass. K.H.Levin, D.C.Tran, R.J.Ginther, G.H.Sigel,Jr. (Naval Res. Lab., Washington, DC, USA).
Glass Technol. (GB), vol.24, no.3, p.143-5 (June 1983). (Symposium on Halide and other Nonoxide Glasses, Cambridge, England, 23-26 March 1982).
Substantial lengths of both clad and unclad fibres of zirconium fluoride based glass have been produced. The clad fibres were pulled from a preform rod and had a relatively large numerical aperture of 0.20, which was achieved by adding PbF_2 to the base glass composition. In order to obtain a better understanding of the loss mechanisms of the fibres, the optical properties of both the fibre and bulk glass were measured. These properties include the refractive index, absorption and scattering in bulk samples, total loss and scattering loss spectra of the fibres, and radiation effects. The measurements indicate that the relatively high loss of the fibres is due mainly to scattering and water impurity. However, the scattering loss of the bulk samples was found to be very low and showed a dependence upon λ^{-4}. It is believed that better temperature control during the drawing of the fibres and a greater degree of purification of the starting materials will result in low loss fibres. Irradiation of the bulk samples produced a shift of the ultraviolet edge but no change in the infrared transmission was observed for doses up to 10^7 rad, indicating a potentially good resistance to radiation. (10 refs.)

100910 Preliminary calculations on dispersion effects in infrared transmitting materials. K.C.Byron, J.R.Gannon (Dept. of Optical Waveguide, Standard Telecommunication Labs. Ltd., Harlow, England).
Glass Technol. (GB), vol.24, no.3, p.146-8 (June 1983). (Symposium on Halide and other Nonoxide Glasses, Cambridge, England, 23-26 March 1982).
A variety of heavy metal fluoride glasses are currently being investigated with a view to fabricating high performance optical fibre systems. In order to assess the bandwidth potential of these fibres, a computer model of fibre dispersion has been developed in which accurate calculations of the material, waveguide, profile, and total dispersions are made over a broad wavelength range from information on the refractive index variation with wavelength in these glasses. Predictions are also made of the range of choice available in refractive index difference and core diameter to give zero total dispersion at particular wavelengths in practical fibres made with these materials. (4 refs.)

100911 Chalcogenide glass optical fibres. J.P.Parant, C.le Sergent, D.Guignot, C.Brehm (Labs. de Marcoussis, Centre de Recherches de la CGE, Marcoussis, France).
Glass Technol. (GB), vol.24, no.3, p.161-3 (June 1983). (Symposium on Halide and other Nonoxide Glasses, Cambridge, England, 23-26 March 1982).
Chalcogenide glasses have been drawn into fibres with attenuations of 5 dB/m at 7μm and 10 dB/m at 10.6 μm. Ultraviolet cured expoxy-acrylate and polyolefin coatings have been used to improve their mechanical properties. Two glass compositions have been investigated, $As_{15}Ge_{30}Se_{55}$ and $As_{13}Ge_{30}Se_{27}Te_{30}$. The influence of the composition and the purity of the glasses on the fibre losses in the range 6-12 μm is reported. (8 refs.)

100912 Fluorozirconate glasses with improved viscosity characteristics for fibre drawing. D.C.Tran, R.J.Ginther, G.H.Sigel (Naval Res. Lab., Washington, DC, USA).
Glass Technol. (GB), vol.24, no.3, p.169-71 (June 1983). (Symposium on Halide and other Nonoxide Glasses, Cambridge, England, 23-26 March 1982).
An attempt has been made to extend the range between the glass transition, T_g and the temperature, T_x, at which the glass crystallises on heating, and to manipulate the viscosity-temperature profile with the additions of selected fluoride dopant materials. (4 refs.)

100913 Dispersion characteristics of monomode optical-fibre systems. M.J.Bennett (Res. Labs., CEC, Wembley, England).
IEE Proc. H (GB), vol.130, no.5, p.309-14 (Aug. 1983).
The theory of dispersion in monomode fibres is considered giving formulas for the pulse response of an optical monomode fibre system in terms of source spectral width and centre frequency and first- and second-order dispersion parameters for the fibre. Generally, source spectral width is much larger than signal bandwidth, in which case a simple linear response function may be derived. For such systems calculations of bandwidth and pulse response are given for some typical values of source and fibre parameters. The measurement of the monomode fibre parameters is also considered. (33 refs.)

100914 Statistical properties of modal noise in fibre-laser systems. B.Crosignani, A.Yariv (Dept. of Appl. Phys., California Inst. of Technol., Pasadena, CA, USA).
J. Opt. Soc. Am. (USA), vol.73, no.8, p.1022-7 (Aug. 1983).
The direct analysis in the time domain of the fluctuations of a signal propagating in a fiber-optic link in the presence of an imperfect connector makes it possible to formalize in a simple manner the description of its statistical properties. This permits, in particular, the clarification of the role played by the various time scales involved in the problem (coherence time of the fiber-exciting source, fiber modal delay, detector response time, etc.) in evaluating the statistical averages. The formalism includes in a straightforward way the case of simultaneous excitation of the fiber by more than one source. This last circumstance is expedient for checking the beneficial effect on modal noise derived from exciting the fiber with N laser sources. (8 refs.)

100915 The use of the Monte-Carlo method for computation of impulse response of a regular multimodal fiber. Ye.L.Yefremov, V.P.Mal'tsev, T.V.Selezneva, V.N.Tutubalin.
Radio Eng. & Electron. Phys. (USA), vol.27, no.10, p.16-20 (Oct. 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.10, p.1875-80 (Oct. 1982).
An approximate method of computation of impulse response of a multimodal, regular glass fiber is presented. A comparison of this method with the exact method indicates that the approximate method is suitable for operational estimation of the impulse response. (7 refs.)

100916 Optical heterodyne fiber gyro. K.Hotate, N.Ookuma, M.Higashiguchi, N.Niwa (Faculty of Engng., Univ. of Tokyo, Tokyo, Japan).
Trans. Soc. Instrum. & Control Eng. (Japan), vol.19, no.4, p.319-26 (April 1983). In Japanese.
A phase-nulling detection is useful for obtaining a good linearity and scalefactor stabilisation in a fibre gyro. The authors utilise an optical heterodyne technique followed by an electronic phase-nulling detection, which provides electric signal frequency proportional to the rotation rate. To reduce the output drift, the optical system of the gyro has little pathlength difference

and no frequency difference in the fibre loop between counterpropagating waves. Reduction of the output noise that is due to the backward Rayleigh scattering in the fibre is achieved by direct frequency modulation of a single-mode laser diode, the optical source. The constructed experimental gyro shows a short-time resolution of about 5 deg/h rotation rate for an integration time of 1 sec, and a good linearity even in fast rotation. (24 refs.)

100917 **A sharp bend in an optical fiber waveguide as a basis for sensors of physical quantities.** M.E.Zhabotinskiy, A.A.Zatykin, S.K.Morshnev, A.S.Ryabov, A.V.Frantsesson.
Telecommun. & Radio Eng. Part 2 (USA), vol.37, no.8, p.62-6 (Aug. 1982). Translation of: *Radiotekhnika, Moskva (USSR)*, vol.37, no.8, p.8-13 (Aug. 1982).
It is proposed to use a sharp bend as an operating element of a refractometer which can be used to construct sensors for measuring the level of a liquid, temperature, pressure, and concentrations of solutions. (6 refs.)

100918 **Beat length determination of birefringent fibers by measuring delay of transmitted light pulse.** Y.Fujii (Fundamental Sci. & Opto-Electronics Div., Electrotech. Lab., Ibaraki, Japan), S.Shikano.
Trans. Inst. Electron. & Commun. Eng. Jpn. Part C (Japan), vol.J66C, no.5, p.424-5 (May 1983). In Japanese.
Proposes a method for determining the beat length of stress-induced birefringent fibers by measuring the delay time between transmitted polarizing pulses. This method is easily applied to long birefringent single mode fibers at infrared wavelengths by using a single-pass fiber Raman laser. (3 refs.)

Symposium on Halide and other Nonoxide Glasses ....See Entry 98625

Introduction to optical fibers ....See Entry 98680

How to detect the gravitationally induced phase shift of electromagnetic waves by optical-fiber interferometry ....See Entry 98929

Long distance wideband optical fibre links for accelerator synchronization ....See Entry 99930

The use of a fibre-optic reference beam in a focused image holographic interferometer ....See Entry 100703

Efficient backward and forward pumping CW Raman amplification for InGaAsP laser light in silica fibres ....See Entry 100754

90-fs tunable optical pulses obtained by two-stage pulse compression ....See Entry 100809

Influence of self-sustained pulsation in semiconductor lasers on optical transmission system ....See Entry 100816

Mode locking in a fiber laser ....See Entry 100826

New vistas for diffraction gratings ....See Entry 100882

Microbending loss in optical waveguides ....See Entry 100887

Fiber-optic detectors ....See Entry 100921

Wavelength-division multiplexing of channels in fiber-optic communication lines (review) ....See Entry 100922

Fabrication techniques for integrated optics devices ....See Entry 100927

Signal transmission in a system of two injection lasers optically coupled with a fiber lightguide ....See Entry 100930

Using optical fibers in laser processing ....See Entry 101764

42.80Q Image detectors, convertors, and intensifiers

100919 **Influence of spectral composition of bias lighting emission on resolution of image-convertor tube in visual display systems.** S.M.Gvozdev, S.S.Romanov.
Izv. VUZ Priborostr. (USSR), vol.26, no.6, p.77-80 (June 1983). In Russian.
An examination is made of the problem of the effectiveness of using monochromatic bias-lighting sources in the pulsed operation of image-convertor tubes. An apparatus for investigating the resolution of image-convertor tubes is described and the results of investigations for different spectral compositions of the emission in the static and pulsed modes of operation are presented. (4 refs.) *L.M.H.*

Jitter suppression: a data processing approach ....See Entry 99182

Sum-frequency output of parametric thermal image upconversion with dispersion matching ....See Entry 100853

42.80S Optical communications devices

100920 **Local-oscillator excess-noise suppression for homodyne and heterodyne detection.** G.L.Abbas, V.W.S.Chan, T.K.Yee (MIT Lincoln Lab., Lexington, MA, USA).
Opt. Lett. (USA), vol.8, no.8, p.419-21 (Aug. 1983).
Semiclassical calculations of the signal-to-noise density ratio for a homodyne/heterodyne receiver utilizing two detectors are made. These calculations show that excess intensity noise in the local oscillator can be cancelled and need not degrade the performance of the receiver. An experimental demonstration of excess-noise cancellation is reported. (7 refs.)

100921 **Fiber-optic detectors.** E.Beata Radojewska (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland), J.M.Pawlikowski.
Opt. Appl. (Poland), vol.13, no.1, p.3-31 (1983).
A short review of the current state of the art of fiber-optic detectors is presented including design parameters for 1.3 μm-wavelength systems. Experimental data of such detectors comprising technology data, operation modes and basic detector parameters are concisely discussed. Properties of the semiconductors used in optical fiber transmission systems are also reviewed. Special attention is given to the properties and technology of ternary Ga(As,Sb) alloys. Finally, the proposal of a high-efficiency fiber-optic detector made of graded-bandgap Ga(As,Sb) mixed crystal is discussed. (122 refs.)

100922 **Wavelength-division multiplexing of channels in fiber-optic communication lines (review).** E.M.Dianov, A.A.Kuznetsov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.125-38 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.245-64 (Feb. 1983).
A review is given of the prospects for the application of wavelength-division multiplexing of channels in fiber-optic communications, i.e. for the simultaneous transmission of several data signals at different optical carrier frequencies. The various systems of multiplexers and demultiplexers developed by the application of spectroscopic methods to optical communications are described together with systems based on new physical principles. The existing communication systems with wavelength-division multiplexing of channels are described. It is concluded that such multiplexing can be used to handle tens of channels in the same fiber waveguide tens of kilometers long. (48 refs.)

Fiberoptic receiver performance. A tutorial review ....See Entry 100908

Integrated optics and its application limits ....See Entry 100929

42.82 INTEGRATED OPTICS
(for optical waveguides see also 42.80L)

100923 **Photodetector for guided-wave optics.** H.Yajima.
Oyo Buturi (Japan), vol.52, no.3, p.235-6 (March 1983). In Japanese.
There are two types of optical integrated-circuits: one converts an input optical signal into an electrical signal and then reconverts it into the optical signal with a thin-film waveguide and then delivers the resultant electrical signal. For the latter, an $LiNbO_3$ electrooptical crystal substrate is suitable for forming a waveguide. The author describes a method for integrating amorphous-silicon photodetector elements on the $LiNbO_3$ waveguide. For photodetectors to exhibit maximum sensitivity to semiconductor laser light, it is indispensable to develop a Ge-contained amorphous-silicon detector element. (4 refs.) *K.B.*

100924 **Parametric mixing in monolayers deposited on thin-film waveguides.** J.E.Sipe (Dept of Phys., Univ. of Toronto, Toronto, Ontario, Canada), G.I.Stegeman, C.Karaguleff, R.Fortenberry, R.Moshrefzadeh, W.M.Hetherington,III, N.E.Van Wyck.
Opt. Lett. (USA), vol.8, no.8, p.461-3 (Aug. 1983).
The authors analyze the parametric mixing of light by molecular monolayers deposited on a thin-film dielectric waveguide. It is shown that large signal levels are possible, even with CW lasers. (10 refs.)

100925 **Morphological stability in epitaxy of monolithically integrated optical devices.** M.A.Herman (Inst. of Phys., Polish Acad. of Sci., Warszawa, Poland).
Opt. Appl. (Poland), vol.13, no.1, p.55-67 (1983).
Three technological/methods: LPE, MO CVD, and MBE have been compared from the point of view of their crystallization peculiarities related to the fabrication of optical monolithically integrated devices. Ignoring the dependence of the crystal growth rate on the substrate orientation, the morphological stability functions of Mullins and Sekerka (1964) for each epitaxy process have been calculated for the GaAs-$Al_xGa_{1-x}As$ material system. It has been shown that MBE is the most suitable crystallization method for monolithic optical integration, MO CVD being a less suitable method. (26 refs.)

100926 **Integrated optics—devices.** J.S.Wilkinson (Dept. of Electronic & Electrical Engng., Univ. Coll., London, England).
Phys. Technol. (GB), vol.14, no.4, p.190-3, 8 (July 1983).
The main advantages of integrated optics devices lie in the inherent simplicity of all-optical systems and high switching speeds (>5 Gbit s^{-1}). The outstanding device problems include the connection of optical fibres to these microcircuits and the integration of many devices on a single chip. The development of integrated optics is limited by the materials technology available but some promising work is being done in this area. (4 refs.)

100927 **Fabrication techniques for integrated optics devices.** R.A.Betts (Dept. of Electrical & Electronic Engng., Univ. Coll. London, London, England).
Phys. Technol. (GB), vol.14, no.4, p.194-8 (July 1983).
Developments in integrated optics are limited by the materials technology available. Progress in optical fibre technology and the development of sophisticated optical chips to generate, modulate and process laser light signals along the fibres are discussed. (5 refs.)

100928 **An investigation of multimodal interference of surface light waves in a microwaveguide interferometer.** A.P.Ostroumenko, V.P.Prudkiy, A.V.Shmal'ko.
Radio Eng. & Electron. Phys. (USA), vol.27, no.10, p.11-15 (Oct. 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.10, p.1869-74 (Oct. 1982).
Results of investigation of multimodal interference between surface light waves in a Mach-Zander microwaveguide interferometer. The interferometer is constructed from planar optical waveguides, loaded by a dielectric strip, i.e. the so-called strip optical waveguides. It is shown that the use of strip waveguide in interferometers of this type results in their effective low-modal and multimodal operation. (13 refs.)

100929 **Integrated optics and its application limits.** J.Schrofel.
Slaboproudy Obz. (Czechoslovakia), vol.44, no.7, p.313-21 (July 1983). In Czech.
Discusses the present state of the art in the field of integrated optics and the possibilities of its application in optical systems for transmitting and processing information. Examples are given of various types of planar component parts for distributing and controlling conducted radiation; there is also an analysis of the physical, material, design and manufacturing factors limiting the characteristics of the optical waveguides and component parts used. (14 refs.)

100930 **Signal transmission in a system of two injection lasers optically coupled with a fiber lightguide.** Vu Van Luk, P.G.Eliseev, M.A.Man'ko, G.T.Mikaelyan.
Sov. Phys.-Lebedev Inst. Rep. (USA), no.10, p.27-30 (1982). Translation of: *Sb. Kratk. Soobshch. Fiz. AN SSSR Fiz. Inst. P.N. Lebedeva*, no.10, p.31-4 (1982).
The authors study the possibility of using the saturation effect in injection lasers in the system of two-sided fiber-lightguide coupling, with stripe-geometry heterolasers based on AlGaAs as the terminal devices. (1 ref.)

100931 **Mode filter characteristics of metal-clad GaAs waveguide and its application to light intensity modulator.** S.Ohke, A.Kusunoki, Y.Cho, Y.Matsuo (Inst. of Sci. & Industrial Res., Osaka Univ., Ibaraki, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part C (Japan), vol.J66C, no.5, p.426-7 (May 1983). In Japanese.
Mode filter characteristics have been studied at 1.15 μm in metal-clad GaAs waveguides with Au, Pt-Pd and Ag. As an application of the mode filter, electro-optic light intensity modulation was investigated in a unified Schottky junction structure of modulator- and analyzer-sections using metal-cladding with (110) crystal axis. (6 refs.)

Integrated-optics photodetector utilizing the external photoelectric effect in a Schottky barrier ....See Entry 99189

Optical waveguiding in (In, Ga)(As, P) inverted rib waveguide lasers at 1.3 μm wavelength ....See Entry 100765

Fabrication technique of fine gratings in two-dimensional diode lasers ....See Entry 100795

Graphical representation of prism coupling into thin films ....See Entry 100884

Passive planar multibranch optical power divider: some design considerations ....See Entry 100885

Integrated optical polariser on $LiNbO_3$:Ti channel waveguides using proton exchange .... See Entry 100886

High resolution etching of GaAs and CdS crystals .... See Entry 100935

Long-range surface plasmons in electrode structures .... See Entry 102275

Investigation of the refractive index profiles of multilayer $Ga_{1-x}Al_xAs$ laser heterostructures .... See Entry 102844

42.85 OPTICAL TESTING AND WORKSHOP TECHNIQUES

100932 Method of characterizing the optical quality of glass. E.M.Vogel (Bell Labs., Murray Hill, NJ, USA).
Appl. Opt. (USA), vol.22, no.15, p.2241-2 (1 Aug. 1983).
Describes a system based on an instrument to measure 90° laser light scattering coupled to a data management section, for characterising the optical quality of glass. (3 refs.)

100933 Modeling the computer-controlled polishing process. R.A.Jones (Perkin-Elmer Corp., Norwalk, CT, USA).
Appl. Opt. (USA), vol.22, no.15, p.2245-6 (1 Aug. 1983).
To optimize the computer-controlled polishing (CCP) operation, its removal process was modeled on a computer. The algorithm large optics fabrication simulation (LOFS) was created to simulate the removal of surface errors by both figuring and smoothing mechanisms. The CCP moves a grinding or polishing tool, considerably smaller than the workpiece, over the workpiece with the path and velocity of the tool (along that path) controlled by a minicomputer. The CCP figuring operation is accomplished by altering the time that the tool polishes any surface region, and smoothing results from greater pad pressure at high surface points due to greater pad compression as the pad attempts to conform to the workpiece surface. Since the high surface points are polished with greater pressure, more material removal is obtained for those areas. The LOFS algorithm was modified to reliably forecast figure results for the CCP. This program uses actual surface data and CCP parameters and provides a simulation of CCP polishing including figuring, smoothing, and edge correction. (2 refs.)

100934 The design of the kinematics of the knife movement in the production of a circular paraboloid. S.Michal, J.Wagner.
Jemna Mech. & Opt. (Czechoslovakia), vol.28, no.7, p.180-2 (July 1983). In Czech.
Deals with the problem of fabricating rotational aspherical surfaces of the second order. After a brief analysis of the available production processes, a more detailed analysis of a method based on the utilisation of plane sections obtained by a knife instrument is presented. The main attention is paid to the kinematic constructional modification of the conventional production equipment by implementing three new elements into the kinematic chain. The modification improves the production effectiveness as well as the quality of the aspherical surfaces. (3 refs.) *E.D.*

100935 High resolution etching of GaAs and CdS crystals. D.V.Podlesnik, H.H.Gilgen, R.M.Osgood (Dept. of Electrical Engng., Columbia Univ., New York, NY, USA), A.Sanchez, V.Daneu.
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.57-63
Submicrometer gratings have been etched in GaAs and CdS crystals which have been immersed in an oxidizing etch and illuminated with interfering laser beams. A resolution of 170 nm was obtained. At high laser intensity and with prolonged etching time the surface properties of the material are degraded. The use of in-situ optical measurements of grating parameters allows ready optimization of the grating fabrication process. (9 refs.)

Ion-etching as a means of blazing and optimizing holographic diffraction gratings .... See Entry 100688

Integrated optical polariser on $LiNbO_3$:Ti channel waveguides using proton exchange .... See Entry 100886

Glass fiber manufacturing: continuous purification of lightguide chemicals .... See Entry 100903

Morphological stability in epitaxy of monolithically integrated optical devices .... See Entry 100925

43.00 ACOUSTICS

(for audition, see 87.34; for speech, see 87.36; for sound effects on living matter, see 87.50C)

43.20 GENERAL LINEAR ACOUSTICS

(see also 03.40K Mathematical problems in waves and wave propagation)

100936 Far field patterns for the impedance boundary value problem in acoustic scattering. D.Colton (Dept. of Math. Sci., Univ. of Delaware, Newark, DE, USA).
Appl. Anal. (GB), vol.16, no.2, p.131-9 (1983).
New and more straightforward proofs are given showing that the class of far field patterns corresponding to the scattering of entire incident fields by a bounded obstacle in the plane having nonzero surface impedance is dense in $L^2[0,2\pi]$ for all values of the wave number. (11 refs.)

100937 Spherical wave decomposition approach to ultrasonic field calculations. C.P.Griffice (Dept. of Radiology-Phys., Sidney-Farber Cancer Inst., Boston, MA, USA), J.A.Seydel.
J. Nondestr. Eval. (USA), vol.2, no.3-4, p.241-7 (Dec. 1981).
A simple, flexible, accurate, and comprehensive numerical method is presented for theoretically analyzing the diffraction field of a continuous wave transducer of arbitrary size, shape, and frequency. Using the extensively studied circular transducer for comparison, numerical results are shown for an unfocused transducer with uniform velocity excitation as well as for a focused transducer with Gaussian velocity excitation. Data concerning the execution time, program size, and convergence of the method are also presented for its implementation as a design tool on a minicomputer system. (33 refs.)

100938 Active cancellation of the acoustic field in the case of sound sources with small frequency shifts. A.Gaudefroy (CNRS, Marseille, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.15, p.1139-42 (25 April 1983). In French.
Starting from equations previously obtained, it is shown that it is possible, up to a certain extent, to increase the number of secondary sources in such a way that small frequency shifts will not affect the control already set, which corresponds to a zero field. (6 refs.)

100939 Energy balance in active sound attenuation. G.Dumery (Univ. de Toulon et du Var, La Garde, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.16, p.1225-7 (2 May 1983). In French.
The energy balance in active sound attenuation of a plane wave by an array of antagonistic sources was estimated. It is shown that an active sound attenuator is not necessarily a sound absorbing device. (2 refs.)

100940 Planning of electroacoustical units. II. W.Salm.
Elektrotechnik (Switzerland), vol.34, no.6, p.69-73 (June 1983). In German.
For pt.I see ibid., no.5, p.61 (1983). Conditions governing sound propagation in rooms when a group of loudspeakers is used are considered, and indications for spacing between the speakers are quoted. This is followed by the outline of amplifiers location for optimizing the effect and for reducing the echo or other interferences affecting the intelligibility of the received sound signals. (9 refs.) *I.G.*

100941 On the Green's function for acoustical diffraction by a strip. A.K.Gautesen (Dept. of Math., Iowa State Univ., Ames, IA, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.600-4 (Aug. 1983).
The author assumes that the solution to the problem of diffraction by a strip with an impedance boundary condition of a plane-wave incident under a fixed angle ϕ is known. He shows how to construct the Green's function and the solution for a plane-wave incident under any angle from this known solution; and he also gives a simple equation which relates the farfield coefficient for plane-wave incidence under any angle to the known farfield coefficient corresponding to the angle of incidence ϕ. (3 refs.)

100942 Observation of the acoustic glory: high-frequency backscattering from an elastic sphere. P.L.Marston, K.L.Williams, J.B.Hanson (Dept. of Phys., Washington State Univ., Pullman, WA, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.605-18 (Aug. 1983).
Measurements of the scattering of 2.10-MHz ultrasonic bursts gave direct evidence of the acoustic glory. Echo amplitudes were measured as a function of the transverse displacement x from the backward axis; they were maximized on the axis and they manifested side lobes. Except near minima, the amplitudes were proportional to $J_0(kbx/z_n)$, where b and z_n are the radius of, and axial distance to, the virtual focal circles from which the echoes appeared to emanate. This dependence on x is direct evidence of axial focusing. (The principal feature of optical glories of drops and bubbles is also axial focusing.) The experiment was performed in water with a fused silica sphere having a radius $a \simeq 51.6$ mm for which $2\pi a/\lambda = ka \simeq 457$. A theory is developed for certain of the echo amplitudes and focal parameters. The theory typically overestimates the amplitudes of the stronger of the echoes by 5%. Appendices describe aspects of the theory not amenable to the experiment, including: (i) a shift of focal parameters which should be significant when $ka \gtrsim 100$, and (ii) a distortion of transients described in part by the half-order derivative operator. (40 refs.)

100943 An extended unitary approach for acoustical scattering from elastic shells immersed in a fluid. M.F.Werby, L.H.Green (Naval Coastal Systems Center, Panama City, FL, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.625-30 (Aug. 1983).
Derives equations using the T-matrix approach for acoustical scattering from elastic shells immersed in a fluid. The equations contain unitary and symmetry constraints and afford a new procedure for the calculation of the T-matrix. The technique, in addition to satisfying symmetry and unitary conditions, proves to be more numerically stable and less time consuming than the conventional method. In addition, the procedure enables one to determine if convergence has been satisfied and in the limit of no convergence, proves to be a better approximation than that of the matrix method. The authors have developed computer codes using the new technique and present comparisons with the conventional procedure. A salient feature of the new technique is that convergence is arrived at with a smaller number of expansion terms than the older method and this is particularly true as the aspect ratio of the target is increased. (16 refs.)

100944 Wave propagation through a slender curved tube. L.Ting, M.J.Miksis (Courant Inst. of Math. Sci., New York Univ., New York, NY, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.631-9 (Aug. 1983).
The transmission of an acoustic wave through a slender three-dimensional tubular region is investigated. The ratio of the reference length a of a cross section of the tube to the reference curvature of the center line of the tube is assumed to be small. The analysis is carried out for wavelengths ranging from the order of the reference curvature of the center line of the tube to wavelengths much smaller than the reference length of the cross-sectional area. It is shown that the leading solution inside the tube is governed by the same equation as for an equivalent straight tube except for the case where the wavelength is much smaller than the reference length a. For the latter the leading solution is governed by a partial differential equation in the cross section of the tube. The radius of curvature of the center line enters only into the amplitude of the leading order solution of the short waves. (9 refs.)

100945 A note on acoustic wave propagation in periodically stratified media. A.Maewal (Dept. of Mech. Engng., Yale Univ., New Haven, CT, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.654-5 (Aug. 1983).
This letter has been motivated by a recent paper [Schoenberg and Sen., ibid., vol.73, p.61 (1983)] on perusal of which it occurred to the author that it should be possible to derive the macroscopic acoustic properties of a medium with periodic microstructure by utilizing the same analytical methods that have been useful for the problem of heat conduction in such media. (4 refs.)

100946 Scattering of short ultrasonic pulses by thin cylindrical shells, generation of guided waves inside the shell. M.Fekih, G.Quentin (Groupe de Phys. des Solides, Univ. Paris 7, Paris, France).
Phys. Lett. A (Netherlands), vol.96A, no.7, p.379-84 (18 July 1983).
The authors have studied the backscattering of short ultrasonic pulses by solid elastic cylindrical shells at high values of ka. When the thickness e of the shell is larger than the mean value of the wavelength λ_L for longitudinally polarized waves, the scattered echoes are well explained by a geometrical theory and their interpretation is trivial. Much more interesting is the case of very thin shells ($e < \lambda_L$) where the authors have observed the generation of two kinds of guided waves reradiating in the outer liquid and also in the inner

liquid when present. For these shells five different sets of echo corresponding to distinct propagation procedures have been identified. (5 refs.)

100947 Caustic formed with the participation of a diffracted ray. O.A.Godin (Physicotech. Inst., Moscow, USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.13-18 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.23-31 (Jan.-Feb. 1983).
An asymptotic expression is derived for the field in the neighborhood of a caustic formed with the participation of a diffracted ray. A procedure is given for determining the field near the caustic in terms of the ray characteristics. An an example, the reflection of a spherical acoustic wave from a layered fluid half-space is analyzed. (13 refs.)

100948 Method for determining the directivity pattern of low-frequency radiators. V.A.Baranov, Yu.V.Khokha (N.N. Andrew Acoustics Inst., Acad. of Sci., USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.68-9 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.117-18 (Jan.-Feb. 1983).
Under conditions such that the influence of one of the boundaries is made negligibly small, it is possible to formulate a comparatively simple method for determining the required characteristics of the source. In the practical implementation of the given method the accuracy of determination of the resultant directivity patterns of an investigated low-frequency radiator can be affected by methodological errors associated with the presence of zeros in the directivity pattern of the system 'source+virtual image'. To avoid large-scale errors and improve the accuracy of the measurements it is recommended to perform the measurements at more than three points. The authors take advantage of the fact that the positions of the zeros of the directivity pattern should be independent of h, but this is not the case for the system 'source+-virtual image'. (2 refs.)

100949 Acoustic wave diffraction in reflective groove structures. A.Opilski, M.Urbanczyk, W.Wajda (Inst. of Phys., Silesian Tech. Univ., Gliwice, Poland).
Ultrasonics (GB), vol.21, no.5, p.215-16 (Sept. 1983).
A reflective groove structure is a component part of an acoustic surface wave resonator. The diffraction effects in this structure are the subject of this paper. Reflective groove structures are characterized by a concentration of acoustic wave energy, and losses due to diffraction are small. (4 refs.)

New aspects of Huygens principle .... See Entry 100653

Green's function continuation for acoustic propagation in range-dependent environments .... See Entry 100954

On the plane-wave reflection coefficient and nonspecular reflection of bounded beams for layered half-spaces underwater .... See Entry 100955

Acoustic wave scattering by elastic cylindrical shells in water .... See Entry 100956

Pressure radiated by an infinite plate driven by distributed loads .... See Entry 100963

Interaction of a scalar wave with a noise field .... See Entry 100968

Active noise control in finite length ducts .... See Entry 100971

The S-matrix and acoustic signal structure in simple and compound waveguides .... See Entry 100976

Numerical modeling of the diffraction problem for an ultrasonic interferometer .... See Entry 100997

Impedance profile inversion via the first transport equation .. See Entry 101114

Scattering of surface acoustic waves by three-dimensional boundary discontinuities .... See Entry 102146

Normalization of ultrasonic scattering measurements to obtain average differential scattering cross sections for tissues .... See Entry 103942

Broadband interference patterns in shallow water .... See Entry 104374

43.25 NONLINEAR ACOUSTICS AND MACROSONICS

(see also 43.60 Acoustic signal processing; 43.88 Transduction; devices for generation and production of sound)

100950 Collapse of acoustic waves in media with positive dispersion. E.A.Kuznetsov, S.L.Musher, A.V.Shafarenko (Inst. of Automatic Systems & Electrometry, Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.5, p.241-5 (5 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.5, p.204-7 (5 March 1983).
It is demonstrated that collapse of acoustic wave occurs in media with positive dispersion. A qualitative description of wave collapse, based on an analysis of the integrals of motion, is proposed. (11 refs.)

100951 Scattering of the second harmonic of an acoustic wave in a liquid containing gas bubbles. A.Yu.Sokolov, A.M.Sutin (Inst. of Appl. Phys., Acad. of Sci., USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.59-61 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.104-7 (Jan.-Feb. 1983).
The generation of a second acosutic harmonic in a liquid containing gas bubbles is analyzed by summing the fields scattered by individual bubbles. The coherent and incoherent parts of the scattered-signal intensity are determined in the single-scattering approximation. (15 refs.)

100952 Acoustic phase conjugation in water containing bubbles. D.V.Vlasov, E.A.Zabolotskaya, Yu.A.Kravtsov (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.69-70 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.118-209 (Jan.-Feb. 1983).
Carriers out an analysis of the acoustic phase-conjugation effect associated with four-phonon interaction in water containing air bubbles, and determines the possibilities for observing the effect experimentally. (6 refs.)

Nature of the instability associated with parametric excitation of acoustic waves by electromagnetic fields .... See Entry 100851

Pressure impulse generated by a sphere expanding at a constant rate .... See Entry 100966

Polymerization resulting from ultrasonic cavitation .... See Entry 103523

43.30 UNDERWATER SOUND

(see also 92.10 Physics of the ocean)

100953 Effect of pressure on sound absorption in synthetic seawater and in aqueous solutions of $MgSO_4$. C.C.Hsu, F.H.Fisher (Univ. of California, San Diego, CA, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.564-9 (Aug. 1983).
Measurements have been made, at 25°C, of the effect of pressure on sound absorption in Lyman and Fleming (LF) synthetic seawater from 30-300 kHz up to 307 atm. Similar measurements were made in 0.02M $MgSO_4$ solution in a 0.02M $MgSO_4$-0.6M NaCl solution. The decrease with pressure of absorption per wavelength $(\alpha\lambda)$ in LF seawater differs substantially from those reported by other investigators. The relaxation frequency, within experimental error, was found to be independent of pressure. For LF seawater, increasing pressure to 307 atm reduced absorption by 26.3%, very nearly the same as was observed previously (28.2%) for 0.5M $MgSO_4$ solutions. The addition of 0.6M NaCl to the 0.02M $MgSO_4$ solution decreased the absorption by a factor of 4 and the effect of pressure was found to be independent of the NaCl concentrations. The Eigen and Tamm multistate dissociation parameters which best describe the pressure dependence of sound absorption and electrical conductance in a 0.02M $MgSO_4$ solution predict a 21.4% decrease in absorption at 307 atm compared with the observed 19.6% decrease. However, these parameters yield an equilibrium constant which differs from the conductance derived value by a factor of 3. (25 refs.)

100954 Green's function continuation for acoustic propagation in range-dependent environments. H.Weinberg (New London Lab., Naval Underwater Systems Center, New London, CT, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.570-5 (Aug. 1983).
The acoustic field in a range-dependent ocean environment is expressed as a surface integral of Green's functions. Then, if one can find Green's functions for small domains, the solution can be continued to large domains. Several simplifying approximations are introduced. If one expresses the known pressure and Green's functions in raylike expansions, and apply stationary phase, the transverse integration can be eliminated. It is suggested that certain forward derivatives are negligible at typical ranges and frequencies of interest. The principal result of this article considers propagation in a vertical plane through the source. Finally, it is shown that the Green's function continuation agrees with ray theory in the high-frequency limit. In general, the approach developed here should be accurate and readily evaluated for many problems of practical interest. (11 refs.)

100955 On the plane-wave reflection coefficient and nonspecular reflection of bounded beams for layered half-spaces underwater. D.B.Bogy, S.M.Gracewski (Dept. of Mech. Engng., Univ. of California, Berkeley, CA, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.591-9 (Aug. 1983).
Studies the recently derived reflection coefficient for plane waves in a liquid that are incident on the liquid-solid interface of a solid half-space, which consists of a single layer of one elastic material bonded to a substrate of a different material. Plots of the magnitude of the reflection coefficient versus the incident angle are presented for many sets of material parameters and values of frequency *f* and layer thickness *d*. The use of the results presented for the study of nonspecular reflection of bounded acoustic beams is of primary interest. The authors therefore seek to identify all the critical incidence angles for nonspecular reflection. They find that nonspecular reflection can occur, not only in connection with surface waves that are purely propagating modes in the absence of the liquid, but also for leaky modes on a layered half-space, provided the leakage is not too great. The authors also investigate, in particular, the surface wave propagation for the case of a stiff layer on a soft half-space, and they find that the purely propagating mode cuts off with increasing *fd* when its speed reaches the shear wave speed of the substrate, as reported in the literature. However, as *fd* increases further, a leaky mode appears that approaches the Rayleigh wave for the layer. This leaky mode is also associated with nonspecular reflection for large enough *fd*. (26 refs.)

100956 Acoustic wave scattering by elastic cylindrical shells in water. T.A.K.Pillai, V.K.Varadan, V.V.Varadan (Wave Propagation Group, Ohio State Univ., Columbus, OH, USA), R.P.Radlinski.
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.619-24 (Aug. 1983).
Frequency dependence of acoustic wave scattering by an infinite cylindrical shell of arbitrary cross section is analyzed using the *T*-matrix approach. Explicit expression for the *T*-matrix of a two-layered cylinder is presented. Numerical results are obtained for plane wave incidence normal to the axis of the shell but arbitrary with respect to the nonciruclar cross section for a range of frequencies. Backscattering cross sections for various angles of incidence are presented for aluminum, steel, and plastic compliant tubes. The results obtained for circular elliptical cross sections are compared with other available theoretical and experimental results. (15 refs.)

100957 Application of time-delay-and-integrate c.c.d.s in sector scanning sonars. M.H.Yassaie, L.H.Ong, P.N.Denbigh (Dept. of Electronic & Electrical Engng., Univ. of Birmingham, Birmingham, England).
Radio & Electron. Eng. (GB), vol.53, no.7-8, p.295-300 (July-Aug. 1983).
Non-uniform time-delay-and-integrate (n.u.t.d.i.) devices have been designed and used for fast beam scanning. The possibility of using such devices for very high angular resolution is examined and it is shown that there must be a trade-off between the number of angular resolution cells and the scanning rate. It is shown however that an improved sector scanning sonar may be realized by combining modulation scanning with the time delay scanning. It is also shown how the n.u.t.d.i. device can be used to advantage for solving the ambitious problem of two dimensional beam scanning. (8 refs.)

100958 Stereoscopic visualization and contour mapping of the sea bed using a bathymetric sidescan sonar (BASS). P.N.Denbigh (Dept. of Electronic & Electrical Engng., Univ. of Birmingham, Birmingham, England).
Radio & Electron. Eng. (GB), vol.53, no.7-8, p.301-7 (July-Aug. 1983).
Besides the backscattered amplitude measurements of a conventional sidescan sonar, the Bathymetric Sidescan Sonar (BASS) makes simultaneous measurements of the depth of the sea bed throughout the sidescanned area. It does this by determining the angle of the returning wavefront at each instant in time and combining the result in an appropriate manner with the range measurement. The depth information can be used to generate contour maps. It can also be used to generate stereoscopic images of the sea bed. A potential cause of major errors in the depth measurement is surface multipath interference, and special features are introduced into the transducer design to avoid this. (8 refs.)

100959 Operation of a horizontal line array in a shallow sea. V.A.Eliseevnin (N.N. Andreev Acoustics Inst., Acad. of Sci., USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.25-8 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.44-9 (Jan.-Feb. 1983).
The directional properties of an extended horizontal line array in a shallow sea are investigated. The latter is represented by a homogeneous water layer,

which has a perfectly compliant surface and is bounded below by a fluid half-space. The response of the array is calculated in the sound field of a tone signal, which is represented by a sum of normal modes. (4 refs.)

100960 Theory of sound propagation in a layered variable-density ocean. V.I.Klyatskin, L.Ya.Lyubavin (Pacific Ocean Oceanological Inst., Acad. of Sci., USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.36-9 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.64-8 (Jan.-Feb. 1983).
The field of a point source in a layered inhomogeneous medium with a variable density is investigated. The method of invariant imbedding is used to reduce the solution of the boundary-value problem for various conditions at the boundary of the medium to the solution of a Riccati equation and the subsequent computation of a series of quadratures. Derivatives of the density are not involved in this approach. (6 refs.)

100961 Excitation of groups of modes in a layered ocean. V.N.Kulakov, N.E.Mal'tsev, S.D.Chuprov (N.N. Andreev Acoustics Inst., Acad. of Sci., USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.41-4 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.74-9 (Jan.-Feb. 1983).
The structure of the field of a point source in a layered ocean is investigated. Expressions are derived in the WKB approximation for the field created by groups of normal modes excited in phase. (3 refs.)

Observation of the acoustic glory: high-frequency backscattering from an elastic sphere .... See Entry 100942

An extended unitary approach for acoustical scattering from elastic shells immersed in a fluid .... See Entry 100943

Method for determining the directivity pattern of low-frequency radiators .... See Entry 100948

Acoustic phase conjugation in water containing bubbles .... See Entry 100952

An experimental evaluation of the Neyman-Pearson detector .... See Entry 100991

Concurrent underwater acoustic wave-front fluctuations at two frequencies .... See Entry 104373

Broadband interference patterns in shallow water .... See Entry 104374

Influence of Rossby waves on the sound-velocity distribution in the ocean .... See Entry 104388

'Linear' source of explosion waves in the ocean .... See Entry 104389

43.35 ULTRASONICS, QUANTUM ACOUSTICS, AND PHYSICAL EFFECTS OF SOUND

(for phonons in crystal lattices, see 63.; for plasma acoustics, see 52.35; for low-temperature acoustics and sound in liquid helium, see 67.; for acoustic properties of liquids, see 62.60; for acoustical properties of solids, see 62.65; for ultrasonic relaxation, see 62.80; for acoustic properties of thin films, see 68.60; for surface waves in solids, see 68.25; for acoustoelectric effects and acoustic wave amplification, see 72.50; for magnetoacoustic effects, oscillations and resonance, see 72.55; for acousto-optical effects and acoustic holography, see 78.20H and 43.63; for sound effects on living matter, see 87.50)

Analysis of ultrasonic field images obtained in air by means of a liquid-crystal film .... See Entry 100995

Polarization of elastic waves in gyrotropic crystals .... See Entry 101854

Polymerization resulting from ultrasonic cavitation .... See Entry 103523

43.40 MECHANICAL VIBRATIONS AND SHOCK

(see also 46.30M Vibrations, aeroelasticity, hydroelasticity, mechanical waves and shocks)

100962 Sound radiation from an impact-excited clamped circular plate in an infinite baffle. A.Akay, M.Latcha (Mech. Engng. Dept., Wayne State Univ., Detroit, MI, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.640-8 (Aug. 1983).
Sound radiation from most mechanical systems results from impact forces of various kinds. In this paper, transient sound radiation from impact-excited circular plates is studied both analytically and experimentally. First, the contact force developed during the inelastic collision of a ball with a flexible plate was obtained. The plate vibrations were then obtained using normal mode analysis. The sound radiation waveforms in the time domain were obtained by numerical integration of the Rayleigh integral. Both analytical and experimental results show the radiation of a sound pulse during the contact which is a result of the forced deformation of the plate. Quantitative relationships are given for the plate vibration response and acoustic radiation. (25 refs.)

100963 Pressure radiated by an infinite plate driven by distributed loads. M.C.Junger (Cambridge Acoustical Associates Inc., Cambridge, MA, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.649-53 (Aug. 1983).
The pressure radiated by an effectively infinite elastic plate is formulated for rectangular and axisymmetric load distributions and for straight and circular line forces. The farfield pressure on the normal to the plate is shown to depend only on the resultant load applied, irrespective of its distribution. For extensive loads, the directivity pattern may display nulls which reduce the mainbeam width below that of the point-excited plate. The location of these nulls is not altered by plate orthotropicity as they are exclusively a function of the load distribution. The load distribution may be adjusted to have a null cancel the coincidence peak at a selected frequency. Power radiated by a point force is greater than for distributed loads or line forces. Finally, the plate acceleration in response to an incident spherical wave is related by the reciprocity principle to the plate's volume acceleration in response to an arbitrary distributed load. (13 refs.)

100964 Response of multiple layered media. G.Maidanik, L.J.Maga, T.J.Eisler (David Taylor Naval Ship Res. & Dev. Center, Bethesda, MD, USA).
J. Sound & Vib. (GB), vol.89, no.1, p.31-57 (8 July 1983).
A recently developed method for estimating the response of multiple coupled one-dimensional dynamic systems can be adapted to deal with the response of multiple layered media. This paper discusses this adaptation. The purpose is to bring this method to bear on this important subject, on the one hand, and to expand the range of applicability of the method on the other. In the method the interactions between the one-dimensional dynamic systems are defined in terms of reflection and transmission coefficients at junctions at which the dynamic systems terminate. In that sense the formalism is cast in terms of standard procedures in the investigations of the response of multiple layered media and, therefore, the adaptation is straightforward. Once the adaptation is instituted, the procedures are extended so that the formalism can treat situations in which steady flows are present in the layers. This extension has previously received only meager analytical attention. It is argued that in certain situations of this kind, the flows may introduce significant modifications in the response. The conditions and the nature of such modifications are defined and examined. (15 refs.)

100965 Influence of anisotropy and contact with a liquid on the vibrations of an infinite plate driven by a point force. V.A.Golovanov, A.L.Popov (Inst. of Problems in Mech., Acad. of Sci., USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.18-21 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.32-7 (Jan.-Feb. 1983).
In the case of steady-state flexural vibrations of an infinite anisotropic plate in a fluid, explicit expressions are derived for the bending mode configuration of the plate and for the surface acoustic-pressure wave. (7 refs.)

100966 Pressure impulse generated by a sphere expanding at a constant rate. Yu.V.Petukhov (Radiophys. Sci.-Res. Inst., USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.51-2 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.88-90 (Jan.-Feb. 1983).
The results of calculations of the pressure impulse in the linear approximation are compared with results obtained using the exact equations for a self-similar shock wave. The results in the Kirkwood-Bethe approximation yield substantially different values for the dependence of the pressure impulse on the rate of expansion of the boundaries of the sphere. (4 refs.)

100967 Impedance of a sphere as part of a system of two closely spaced oscillating spheres. G.V.Udalov.
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.62-4 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.108-12 (Jan.-Feb. 1983).
The impedance of a sphere is determined as part of a system of two spheres separated by a small wave distance and oscillating in arbitrary directions. The solution is analyzed for special cases of spheres of identical radius oscillating in certain directions. (7 refs.)

On the disturbance produced by an impulsive shearing stress on the surface of a semi-infinite poro-elastic medium .... See Entry 101113

43.50 NOISE, ITS EFFECTS AND CONTROL

(see also 86.70J Environmental science)

100968 Interaction of a scalar wave with a noise field. R.Bourret (Inst. of Oceanography, Univ. of Oriente, Cumana, Venezuela).
Acustica (Germany), vol.53, no.3, p.162-5 (July 1983).
Shows that for the case of scalar waves with non-derivative scalar coupling, the background noise field perturbs the propagation exactly like a frozen random background. This in general is not very different from the purely spatial noise autocorrelation with a modified coherence length. In a given problem it should be considered whether some fraction of the intermediate propagators should be of the advanced type. The present analysis may be generalized both for more complicated couplings and, if desired, for waves, both coherent and incoherent (i.e. ϕ and ϵ) obeying other equations of propagation. (5 refs.)

100969 Suppression of noise by a plasma shield. A.P.Saxena, N.S.Suryanarayana (Dept. of Phys., Ravishankar Univ., Raipur, India).
Indian J. Pure & Appl. Phys., vol.21, no.6, p.359-60 (June 1983).
The transmission of sonics through an ionized medium has been numerically evaluated with the help of a computer. The analysis shows that if a source of noise is surrounded by a plasma barrier it can effectively shield most of the noise spectrum. (10 refs.)

100970 Theoretical foundations of urban noise control. R.Makarewicz (Inst. of Acoustics, A. Mickiewicz Univ., Poznan, Poland).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.543-58 (Aug. 1983).
Traffic noise propagating within an urban area of any configuration is considered. A street and a single building being a part of a 'loose urban area' are examined closely. Final results allow one to determine any composite index (based upon equivalent level-L_{eq}) of noise penetrating into a building, i.e., a room. These results are a synthesis of a study of such phenomena as: propagation of noise over a flat surface, specular reflection and scattering by the walls of buildings, and transmission through a barrier, e.g., a window. (46 refs.)

100971 Active noise control in finite length ducts. M.C.J.Trinder (Dept. of Electrical Engng. Sci., Univ. of Essex, Colchester, England), P.A.Nelson.
J. Sound & Vib. (GB), vol.89, no.1, p.95-105 (8 July 1983).
A simple technique for the active control of sound in ducts, initially suggested by Olson and May [1953], is investigated in detail. A simple, 'virtual earth' principle, feedback loop is used to drive the sound pressure to a minimum at a microphone placed close to a loudspeaker in the duct wall. This produces a reflection of downstream travelling plane waves. A detailed investigation of the loudspeaker near field has enabled the optimum position of the microphone to be identified. The system is shown to be especially effective at the frequencies of the longitudinal duct resonances, where the acoustic response of the dust produces a high loop gain. Results are presented which show a reduction of up to 20 dB in the amplitude of low frequency broadband noise at a position downstream of the cancelling source. (10 refs.)

100972 New low-frequency and infrasonic resonant sound absorber. K.A.Velizhanina, V.A.Oborotov (Phys. Faculty, M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.3-6 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.5-10 (Jan.-Feb. 1983).
A new type of resonant sound absorber with a diffraction baffle, designed for the absorption of low audio and infrasonic frequencies, is proposed, analysed, and investigated experimentally. In such an absorber, as a result of diffraction effects, the total mass reactance is increased by an order of magnitude, and the resonance frequency is lowered. (5 refs.)

100973 Simple procedure for calculating noise loudness levels. Yu.A.Indlin (Sci.-Res. Inst. of Photography & Cinematography, USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.28-30 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.50-4 (Jan.-Feb. 1983).
A procedure is proposed for calculating noise loudness levels according to two objectively measured parameters: the noise (intensity) level and the width of the noise spectrum, where the latter parameter is measured for complex noise according to the spectrogram recorded by third-octave filters, at the level of -24 dB relative to the noise level. Calculations by the proposed procedure have provided a more accurate approximation to subjective loudness assessments than the methods of Zwicker and Stevens. (6 refs.)

100974 Fan noise considerations. A.Potter (Torin Corp., Torrington, CT, USA).
Midcon/82 Conference Record, Dallas, TX, USA, 30 Nov.-2 Dec. 1982 (El Segundo, CA, USA: Electron. Conventions 1982), p.12/2/1-8
The reason for a fan's existence and for its use is the movement of air. Usually, in application to electronic equipment, the desired result is a flow of air through a compartment or around certain components to be cooled. This effect may be desired at a point some distance from the fan itself; clearly, the only effect required from the fan at its location is the establishment of a moving stream of air. Any other results are unnecessary, perhaps even detrimental. The author considers noise problems caused by fans. (no refs.)

Robust detector for narrow-band signals in non-Gaussian noise .... See Entry 100992

43.55 ARCHITECTURAL ACOUSTICS

100975 Sound transmission through windows. II. Double and triple glazing. J.D.Quirt (Div. of Building Res., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.534-42 (Aug. 1983).
For pt.I see ibid., vol.72, p.834 (1982). Experimental sound transmission loss data for double-glazed windows have been compared with the predictions of several theoretical models. Simple equations that provide a satisfactory empirical fit to the data were found. The transmission loss of double glazing was compared with that of triple glazing; the results are very similar when the combined interplane spacings of the triple window match the spacing of the double glazing. The triple glazing did, however, exhibit consistently higher transmission loss both at frequencies below the mass-air-mass resonances and in the vicinity of the coincidence dip. (17 refs.)

Planning of electroacoustical units. II .... See Entry 100940

Theoretical foundations of urban noise control .... See Entry 100970

43.60 ACOUSTIC SIGNAL PROCESSING

100976 The S-matrix and acoustic signal structure in simple and compound waveguides. C.H.Wilcox (Dept. of Math., Univ. of Utah, Salt Lake City, UT, USA).
Appl. Anal. (GB), vol.15, no.1-4, p.255-81 (1983).
The author considers the propagation of transient acoustic fields in waveguides consisting of a semi-infinite cylinder coupled to a resonant cavity. The author calculates the signals and analyses how their structure depends on the sources and geometry of the waveguide. Particular attention is given to the cases when the signal sources and/or observation point lie in the cylinder far from the resonator. (12 refs.)

100977 An analogue Hilbert transformer for complex waveform detection. G.F.Manes, D.Gerli, P.Tortoli, C.Atzeni (Istituto di Elettronica, Univ. Degli Studi di Firenze, Firenze, Italy).
Ultrasonics (GB), vol.21, no.5, p.211-14 (Sept. 1983).
An analogue Hilbert transformer capable of performing complex envelope detection of ultrasonic waveforms is described and initial experimental results presented. The unit is based on a SAW programmable microprocessor controlled transversal filter, which accepts data a 3 MHz clock rate and is thus capable of processing the input waveform in real-time. A squaring-summing network performs the required operation for envelope extraction. (9 refs.)

An experimental evaluation of the Neyman-Pearson detector .... See Entry 100991

Robust detector for narrow-band signals in non-Gaussian noise .... See Entry 100992

Discrimination of speech processed by low-pass filtering and pitch-invariant frequency lowering .... See Entry 103869

43.63 ACOUSTIC HOLOGRAPHY

100978 Industrial applications of acoustical holography. B.P.Hildebrand, T.J.Davis, A.J.Boland, R.L.Silta (Spectron Dev. Labs. Inc., Seattle, WA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.353, p.121-30 (1983). (Industrial and Commercial Applications of Holography, San Diego, CA, USA, 24-25 Aug. 1982).
Acoustical holography is rapidly approaching commercial status with applications to nondestructive evaluation, underwater imaging, and underground pipe location being pursued. The authors review the techniques involved, show some experimental results, and describe the latest commercial system. (5 refs.)

100979 An arrangement of transmitter and receiver arrays for synthesizing acoustical holograms. K.Nagai, M.Kimura (Inst. of Appl. Phys., Univ. of Tsukuba, Ibaraki, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part C (Japan), vol.J66C, no.5, p.409-15 (May 1983). In Japanese.
Discusses the reduction of the total number of transducers by compounding transmitter and receiver arrays in acoustic holography. The point spread function of such an imaging system is calculated and two kinds of grating lobes are shown. The arrangement of both arrays is specified so that it eliminates the grating lobes of a narrower period. Holograms are constructed for each transmitter and are combined into a single large hologram. A numerical image can be reconstructed by the conventional method from a synthesized hologram. (4 refs.)

43.70 SPEECH COMMUNICATION

(inc. speech perception, speech intelligibility, and speech synthesis; see also 87.36 Speech)

100980 Stress and vowel duration effects on syllable recognition. C.W.Marshall, P.W.Nye (Haskins Labs., New Haven, CT, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.433-43 (Aug. 1983).
Systems designed to recognize continuous speech must be able to adapt to many types of acoustic variation, including variations in stress. A speaker-dependent recognition study was conducted on a group of stressed and destressed syllables. These syllables, some containing the short vowel /I/ and others the long vowel //, were excised from continuous speech and transformed into arrays of cepstral coefficients at two levels of precision. From these data, four types of template dictionaries varying in size and stress composition were formed by a time-warping procedure. Recognition performance data were gathered from listeners and from a computer recognition algorithm that also employed warping. It was found that for a significant portion of the data base, stressed and destressed versions of the same syllable are sufficiently different from one another as to justify the use of separate dictionary templates. Second, destressed syllables exhibit roughly the same acoustic variance as their stressed counterparts. Third, long vowels tend to be involved in proportionally fewer cross-vowel errors but tend to diminish the warping algorithm's ability to discriminate consonantal information. Finally, the pattern of consonant errors that listeners make as a function of vowel length shows significant differences from that produced by the computer. (21 refs.)

100981 The relationship between the RMS level and the average absolute magnitude of long-time continuous speech. R.J.Niederjohn, D.G.Haworth (Dept. of Electrical Engng. & Computer Sci., Marquette Univ., Milwaukee, WI, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.444-6 (Aug. 1983).
The relationship between the average absolute magnitude and the RMS level of long-time continuous speech is reported in this paper. The ratio of these two measurements (called β) and the standard deviation of this ratio have been experimentally determined as a function of speech utterance lengths from 2.5 s to 10 min. For utterance lengths greater than about 20 s, the average value of β is approximately 0.55 and 0.60 for male and female speakers, respectively. (11 refs.)

100982 Acoustical effects of vertical vibrations of the vocal folds. E.V.Vlasov, V.N.Sorokin (Inst. of Information-Transmission Problems, Acad. of Sci., USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.6-10 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.11-18 (Jan.-Feb. 1983).
Vertical vibrations of the vocal folds produce a highly perceptible effect, altering the timbre, generating turbulent noise, and improving the phonation of synthetic speech. The waveform of the excitation pulse is affected not only by the first, but also by the third time derivative of the volume velocity of the airstream through the glottis. (33 refs.)

100983 Speech processing—an outlook for the coming decade. N.R.Miller (Diebold Group Inc., New York, NY, USA).
Wescon/81 Conference Record, San Francisco, CA, USA, 15-17 Sept. 1981 (El Segundo, CA, USA: Electron. Conventions 1981), p.6/1/1-7
The author presents a forecast of the developments in speech processing technology over the coming decade. Consideration is given to speech synthesis and an applications forecast is presented in table form. Speech recognition is also discussed and a simplified block diagram of a speed recognition system given. Some application examples are cited. It is predicted that a significant development will be the combination of recognition and speed synthesis on the same semiconductor chip. However, the development of algorithms for accurate continuous speech recognition remains the most challenging task. (no refs.)

100984 Automatic speech recognition systems—evaluation and application. D.F.Fink (Intel Corp., Santa Clara, CA, USA).
Wescon/81 Conference Record, San Francisco, CA, USA, 15-17 Sept. 1981 (El Segundo, CA, USA: Electron. Conventions 1981), p.6/2/1-8
The author discusses automatic speech recognition (ASR) systems by firstly classifying them into four groups: speaker dependent systems; speaker independent systems; discrete word recognition; and connected word recognition. ASR performance factors are then considered and since most commercially available systems are discrete word speaker dependent systems, these are discussed in more detail. Finally, application selection criteria are covered with a brief mention of human factors. (no refs.)

Perceptual prominence of harmonic components in vowel-like sounds .... See Entry 103860

Vowel identification and dichotic fusion of time-varying synthetic speech sounds .... See Entry 103861

Discrimination of speech processed by low-pass filtering and pitch-invariant frequency lowering .... See Entry 103869

Physiological evidence for central modulation of voice tremor .... See Entry 103885

Formant frequencies, bandwidths, and *Q*s in helium speech ... See Entry 103886

Speech synthesis for the speech impaired .... See Entry 104127

43.75 MUSIC AND MUSICAL INSTRUMENTS

100985 Acoustic admittance of organ pipe jets. S.Thwaites, N.H.Fletcher (Dept. of Phys., Univ. of New England, Armidale, New South Wales, Australia).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.400-8 (Aug. 1983).
The admittance of a turbulent jet as the generator in organ flue pipes was investigated experimentally with respect to the relevant parameters, that is, the frequency, the jet efflux velocity, the mouth-end-correction, and the jet tip deflection at the edge. First, an experiment was performed using a jet with a pulsating velocity to drive a pipe to isolate and identify the various drive mechanisms occurring in the jet-pipe interaction. The two established drive mechanisms, momentum drive and volume drive, were found to be operating, but the relative proportion of momentum drive was greater than expected. Turning then to a typical flue pipe arrangement, as a preliminary experiment, the jet admittance in the pipe was shown to be independent of the jet tip deflection so long as the deflection was less than about 0.7 jet widths. This constant admittance regime was then used to facilitate measurement of the pipe excitation as a function of the three remaining parameters. The admittance magnitude and phase were used, in conjunction with a knowledge of the jet behavior, to quantify the relative importance of the two drive mechanisms here, revealing once again a greater proportion of momentum drive then expected. To a good approximation, the admittance magnitude multiplied by the efflux velocity, and the admittance phase were each found to lie on a universal curve when plotted against a parameter consisting of the frequency divided by the efflux velocity, provided the cutup was constant. A deviation from expected behavior, as yet to be explained, was found in the jet admittance and phase for very low frequencies and high blowing pressures. (17 refs.)

100986 The production of musical sounds by means of a microprocessor. I. A.Garcia.
Rev. Esp. Electron. (Spain), vol.30, no.343, p.52-4 (June 1983). In Spanish.
A method is described of converting the microprocessor system into a small electronic organ, by taking advantage of the facility with which a microprocessor is capable of generating square-wave signals in order to generate audible sounds. A flow diagram demonstrates the structure of a program capable of producing musical notes. (no refs.) *S.M.H.*

43.85 ACOUSTICAL MEASUREMENTS AND INSTRUMENTATION

(for acoustic noise measurement, see also 43.50; for photoacoustic spectroscopy, see 07.65)

100987 On the diffraction effects in an ultrasonic interferometer. A.S.Khimunin, E.A.Lvova (Inst. of High Frequency Currents, Leningrad, USSR).
Acustica (Germany), vol.53, no.3, p.107-22 (July 1983).
A numerical method is suggested for solving a model problem for an ultrasonic interferometer with a plane circular radiator of finite size and a plane movable reflector. The results are presented and analysed for computing fine structure of extrema in the reaction curve. A substantial difference is established in the diffraction shifts of maxima and minima of the reaction curve in relation to their position in the one-dimensional solution. Additional extrema on the reaction curve whose appearance is often ascribed to diffraction effects (the so-called 'diffraction satellites') have not been found. Numerical values are obtained for corrections to the measured values of ultrasound velocity and absorption coefficient. It is shown that diffraction corrections for the interferometric measurements can be substantially smaller than similar corrections applicable to the travelling wave conditions. The aspects are discussed of the realization in an experiment of the conditions adopted in a model problem which permit high accuracy of absolute measurements to be achieved. (47 refs.)

100988 Typical errors in using finite miniature ultrasonic probes for far field measurements. A.Markiewicz, R.C.Chivers (Dept. of Phys., Univ. of Surrey, Guildford, England).
Acoust. Lett. (GB), vol.6, no.10, p.142-7 (April 1983).
Limited calculations are presented of the effects of using hydrophones of diameters ranging from one to four wavelengths for measuring phase and amplitude distributions in the far field of a disc piston source. In agreement with intuitive ideas, it is shown that the errors may be kept below the usual instrumental uncertainties (1% in amplitude and a few degrees of phase) by using a hydrophone with a diameter of a wavelength or less. Computation of the errors due to misalignment indicate the need for a mechanical precision of positioning and repositioning of a quarter of a wavelength or better. (9 refs.)

100989 Interior imaging using spatial frequency sampling. E.El-Shirbini, D.A.Sinclair, I.R.Smith (Dept. of Electrical Engng., Univ. College, London, England).
J. Nondestr. Eval. (USA), vol.2, no.3-4, p.203-7 (Dec. 1981).
A new acoustic synthetic aperture geometry is demonstrated in which the image field is sampled in the spatial frequency domain. This means the sampled field is recorded in a particularly convenient form for presentation to the back propagation algorithms used to reconstruct the field at the object plane. The method has applications in interior visualization. It is difficult to image the interior of solid objects using lens based imaging systems because a different lens geometry must be used for each distinct object material. The system presented here overcomes such problems since both the angular variation of the transmission coefficient at the object-water interface and the aberrations introduced by the velocity mismatch at the object surface may be readily compensated for in the back propagation routine. Experimental results are presented illustrating the detection of four half wavelength diameter defects, spaced by three wavelengths, at a depth of eight wavelengths below the surface of an aluminum block. (6 refs.)

100990 Extension of an ultrasonic apparatus for measuring of sound velocity to the echo-overlap-method of Papadakis. J.Bernhardt (Tech. Univ. Dresden, Dresden, Germany).
Exp. Tech. Phys. (Germany), vol.31, no.3, p.219-25 (1983). In German.
An ultrasonic apparatus working according to the impulse-echo-method of Mcskimin is changed in such a manner that measurements according to the impulse-overlap-method Papadakis are also possible. The electronic equipment is described and some experimental results are presented. (5 refs.)

100991 An experimental evaluation of the Neyman-Pearson detector. J.Woods, A.J.Estes (Appl. Res. Labs., Univ. of Texas, Austin, TX, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.518-26 (Aug. 1983).
Several aspects of the discrete time Neyman-Pearson detector are investigated using experimental acoustic data. The problem considered is the detection of a known signal in a surface reverberant environment. The Neyman-Pearson detector is formulated with a given noise ensemble, and then employed to detect a known signal in that noise field. The noise background consists of sonar returns obtained by directing the transmitter and receiver array toward the wind driven surface of a freshwater lake. The noise process is assumed Gaussian with a known covariance matrix, which is estimated with an ensemble average over the reverberation events. Data for the known signal consist of a single echo from a Styrofoam sphere recorded with no measurable reverberation present. Signal plus noise returns are created by adding samples of the target return to samples of the reverberation returns at specified signal-to-noise ratios (S/N). The performance of the detector is obtained experimentally and compared to the performance predicted from theoretical considerations based on the Gaussian assumption and the empirical covariance matrix. The performance is investigated as a function of S/N, number of channels, and transmission type. Two types of transmission are employed, a 1.0-ms pulsed continuous wave (CW) signal with a 10-kHz sweep centered at 80 kHz. The degradation of the detector's performance due to simplifying assumptions that have been placed on the noise process is investigated. The Neyman-Pearson detector using the experimental data displays the following improvements in performance over the simple matched filter: 12 dB for the CW data and 9 dB for the LFM data. (16 refs.)

100992 Robust detector for narrow-band signals in non-Gaussian noise. J.G.Shin (Dept. of Electrical Engng. & Computer Sci., Stevens Inst. of Technol., Hoboken, NJ, USA), S.A.Kassam.
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.527-33 (Aug. 1983).
For the detection of a bandpass signal with Rayleigh amplitude and uniform phase, the authors first show the degradation in performance of the square-law detector when the in-phase and quadrature noise components have small degrees of non-Gaussian contamination. A robust detector using limiter-squarers instead of square-law characteristics to limit the influence of occasional, large observations is proposed. Specific numerical results illustrate the considerable advantage of the robust structure when small degrees of deviation occur from the nominal Gaussian assumption. (15 refs.)

100993 Surface acoustic wave measurements using an impulsive converging beam. K.Yamanaka (Mech. Engng. Lab., Ibaraki, Japan).
J. Appl. Phys. (USA), vol.54, no.8, p.4323-9 (Aug. 1983).
A method for velocity and attenuation measurement of leaky surface acoustic wave on small areas of a solid surface was developed. This technique uses an impulsive converging beam generated with an acoustic lens. Reflected waves from a sample consisted of the axial wave and the leaky surface wave separated in time domain. From the time interval between these waves, the velocity of the leaky surface wave is determined using an expression derived along with ray optics. Because time interval measurements do not require any mechanical scanning, they can be done without special attention paid for mechanical precision of the scanning system, enabling rapid and simple measurement. Since the impulsive wave has a broad frequency spectrum, spectroscopic analysis of leaky surface wave is also possible. Frequency dependent attenuation measurement of leaky surface acoustic waves on heat treated steels and velocity dispersion measurement of leaky surface wave on titanium nitride film on tool steel are demonstrated. (14 refs.)

100994 The improvement of axial resolution in ultrasonic testing with controlled signals. H.-A.Crostack, H.Morlo.
Mater. Test. (Germany), vol.25, no.7, p.231-4 (July 1983). In German.
The equipment arrangement for ultrasonic testing comprises the ultrasonic transmitter, test-piece and optimisation unit. A schematic diagram summarises the layout of the components, viz: transmission unit, amplifiers, impedance changer, display unit, transmission receiver and process computer. The spectrum of the received signal is represented by a product of functions, some squared, denoting the spectra of the circuit components. Amplitude/time and amplitude/frequency characteristics of the transmitted and echoed signals are shown. Optimisation is achieved by using a transmission spectrum with signal amplitude augmented for the higher frequencies by introducing a positive exponent of the attenuation coefficient (alpha) given by $K(A).f^1$ plus $K(S).f^n$ where K(A,S) are the absorption and diffusion factors, f is the frequency and n is 2 for stochastic scattering and 4 for Rayleigh scattering. (14 refs.) *G.C.*

100995 Analysis of ultrasonic field images obtained in air by means of a liquid-crystal film. F.F.Legusha, V.A.Murga, A.N.Slavin (Shipbuilding Inst., Leningrad, USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.47-50 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.84-7 (Jan.-Feb. 1983).
The results are given from a theoretical and exerimental study of the ultrasonic field in an air gap between two planes, one of which contains a circular radiating transducer. The field is visualized by means of a cholesteric liquid-crystal film. (8 refs.)

100996 Influence of periodic nonuniformities of the element directivity patterns on the directivity pattern of a planar acoustic array. M.D.Smaryshev.
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.58-9 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.101-3 (Jan.-Feb. 1983).
The influence of a periodic nonuniformity in the directivity patterns of the individual elements of planar acoustic arrays on the directivity patterns of the total arrays is investigated for two cases of array nonuniformities, the period of which is two and three times the spacing period of the elements. (no refs.)

100997 Numerical modeling of the diffraction problem for an ultrasonic interferometer. A.S.Khimunin (V.P. Vologdin All-Union Sci.-Res. Inst. of High-Frequency Currents, USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.65-7 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.113-16 (Jan.-Feb. 1983).
The results of a computer-aided solution of the model problem for an ultrasonic interferometer with a plane circular radiator of finite radius and a plane movable reflector are reported and analyzed. The diffraction structure of the response curve and the diffraction corrections to the measured values of the phase velocity and attenuation of ultrasound are calculated. (14 refs.)

100998 Loudspeaker measurements simplified. P.F.Dobbins.
Wireless World (GB), vol.89, no.1571, p.32-5 (Aug. 1983).
Acoustic measurement techniques designed to avoid the vagaries of personal prejudice and room acoustics normally require a calibrated microphone. Using the principle of reciprocity three transducers can be calibrated with reasonable accuracy and no specialized equipment. (6 refs.)

100999 On the effect of evaluating the time, when measuring sound levels, on the realisation of the equivalent energy principle. G.Fuder (Sektion Informationstech., Tech. Univ. Dresden, Dresden, Germany).
Z. Elektr. Inf.- & Energietech. (Germany), vol.13, no.3, p.259-75 (1983). In German.
The change from analogue methods of processing the measured data on acoustic problems to digital methods, involving highly integrated circuits which facilitate the achievement of a much more extensive range of processing methods, requires, according to the author, the development of algorithms which will provide the acoustic engineer with more exact information than is provided by the usual analogue methods. The behaviour of a sound pressure curve with respect to time is too complex for representation by analytical functions. The sound level is obtained on a logarithmic scale using average values for the squares of the sound pressure amplitudes modified by time and frequency measurements to obtain these average values. Because rapid fluctuations in the instantaneous sound level can occur, purely digital methods of display are not practical. The author also discusses the extent to which the energy equivalence principle can be practically used for the determination of sound levels. The digital methods of processing the measured data, however, enable the energy equivalence principle to be realized with much less restricted boundary conditions. This facilitates the determination of the equivalent sound level, especially when logging pulsed sound pressure functions of time. (10 refs.) *G.W.*

101000 Acoustic lenses - Focusing in on defects. C.A.Kittmer.
Report AECL-7981, Atomic Energy Canada Ltd., Chalk River, Ont. (March 1983), 18 pp.
The following topics were dealt with: acoustic lenses focus ultrasound to produce pencil-like beams with reduced near fields. When fitted to conventional (flat-faced) transducers, such lenses greatly improve the ability to detect and size defects. This paper describes a program developed to design acoustic lenses for use in immersion or contact inspection, using normal or angle beam mode with flat or curved targets. Lens surfaces are circular in geometry to facilitate machining. For normal beam inspection of flat plate, spherical or cylindrical lenses are used. For angle beam or curved surface inspections, a compound lens is required to correct for the extra induced aberration. Such a lens is aspherical with one radius of curvature in the plane of incidence, and a different radius of curvature in the plane perpendicular to the incident plane. The resultant beam profile (i.e. location of the acoustic focus, beam dimater, 6 dB working range) depends on the degree of focusing and the transducer used. The operating frequency and bandwidth can be affected by the instrumentation used. Theoretical and measured beam profiles are in good agreement. Various applications, from zone focusing used for defect sizing in thick plate, to line focusing for pipe weld inspection, are discussed. (4 refs.)

Surface acoustic-wave device for measuring high voltages	See Entry 99132
Total internal reflectance optoacoustic spectroscopy	See Entry 99195
FTIR photoacoustic mapper	See Entry 99207
Trends in Fourier transform infrared spectroscopy	See Entry 99208
On a certain inverse problem in γ-acoustic spectroscopy	See Entry 99245

Making objects visible in non-transparent media—a method employed in breeder reactor technology .... See Entry 99693

Photoacoustic observation of third-order absorption in thallium halides at 1.06 μm .... See Entry 100865

Energy balance in active sound attenuation .... See Entry 100939

Operation of a horizontal line array in a shallow sea .... See Entry 100959

Computerized evaluation of acoustic images utilizing a method of averaging .... See Entry 103409

Non-destructive testing and acoustic microscopy of diffusion bonds .... See Entry 103425

Echo response of crack-like reflectors in focused ultrasound fields. II .... See Entry 103433

Flaw classification by a spectral division of ultrasonic echoes .... See Entry 103436

A Fourier transform technique that measures phase delays between ultrasonic impulses with sufficient accuracy to determine residual stresses in metals .... See Entry 103437

43.88 TRANSDUCTION; DEVICES FOR THE GENERATION AND REPRODUCTION OF SOUND

101001 Particle velocity near-fields of disc radiators with variable drive. D.A.Hutchins (Dept. of Phys., Queen's Univ., Kingston, Ontario, Canada), J.A.Archer-Hall.
Acustica (Germany), vol.53, no.3, p.123-31 (July 1983).
A limited series method has been used to evaluate the particle velocity in the near-field of disc and ring radiators. The use of a simultaneous equation technique to find the coefficient for each term in the series makes it possible to fit boundary conditions defined in terms of either particle velocity or pressure, with the additional advantage that these parameters can be constant or variable. Results given here have all assumed an infinite rigid baffle, and compare favourably with those obtained by surface integral techniques for a constant particle velocity across the radiator's front face. Further studies have shown that resultant diffraction patterns are substantially modified when the particle velocity varies progressively across the front face in a well-defined manner. (15 refs.)

101002 Principle of piezoelectric frequency-tunable transducer. Wang Chenhao, Zhao Zheying (Inst. of Acoustics, Acad. Sinica, Peking, China).
Chin. Phys. (USA), vol.3, no.2, p.493-500 (April-June 1983).
The effect of an electric load on the characteristics of piezoelectric vibration systems was presented in the authors' recent papers. The resonance frequency of such systems can be changed continuously with the electric load. In accordance with this effect, the piezoelectric-tunable transducer has been built. In this paper, the principle of the piezoelectric-tunable transducer is demonstrated, the tuning of the sandwich piezoelectric transducer is analyzed theoretically, and a sandwich transducer of a longitudinal vibrating bar with field parallel to the length is investigated experimentally. The theoretical and experimental results show that such piezoelectric-tuning is available in three second octaves. The tuning is convenient for the piezoelectric-tunable transducers, and can be carried out continuously and instantaneously. (4 refs.)

101003 Estimating the bandwidth of low-frequency cylindrical piezoelectric transducers. B.A.Kasatkin, Yu.V.Matvienko (Dal'standardt Sci.-Industrial Union, USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.34-6 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.60-3 (Jan.-Feb. 1983).
Cylindrical matching layers of variable height are proposed for increasing the bandwidth of low-frequency radial-mode cylindrical piezoelectric transducers. The results of numerical calculations are given. (8 refs.)

101004 Influence of electrical grouping of electroacoustic transducers on the parameters of a radiating line array. O.A.Kudasheva, I.L.Rubanov.
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.39-41 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.69-73 (Jan.-Feb. 1983).
The influence of electrical grouping of resonant electroacoustic transducers on the parameters of a radiating line array is investigated. (6 refs.)

101005 Effect of bevelling on the thickness vibration of high-frequency Pb(ZrTi)O_3 ceramic transducers. H.Hatano, J.Oosumi (Res. Lab. of Precision Machinery & Electronics, Tokyo Inst. of Technol., Yokohama, Japan).
Ultrasonics (GB), vol.21, no.5, p.205-10 (Sept. 1983).
The effects of bevelling on the thickness vibration of Pb(ZrTi)O_3 piezoelectric-ceramic disc transducers for generating high-frequency ultrasonic power were studied by measuring electrical characteristics and displacement distributions. A laser heterodyne system was employed for the contact-free measurement of vibration. It was shown for a wide range of diameter-to-thickness ratios that bevelling circular edges was effective in reducing the coupled radial vibrations and enhancing the uniform thickness vibration. The vibration characteristics required for generating high-frequency ultrasound were substantially improved by slight bevelling. These results were accounted for by energy trapping of thickness vibration and by the consequent decrease in the equivalent mass of the transducers. (10 refs.)

Semiconductor strain gauges .... See Entry 99093

Ultrasound transducers for pulse-echo medical imaging .... See Entry 103995

A comparison of two methods for determining ultrasonic intensity for medical transducers .... See Entry 104000

43.90 OTHER TOPICS IN ACOUSTICS

101006 Measurement of the temperature field in the gas of a photoacoustic cell. F.Lepoutre, J.P.Roger, D.Fournier, A.C.Boccara (Lab. d'Optique Physique, ESPCI, Paris, France).
J. Appl. Phys. (USA), vol.54, no.8, p.4686-8 (Aug. 1983).
This paper presents interferometric measurements of the temperature field in a gas heated periodically by a solid sample. These measurements allow a good verification of photoacoustic theories and a clear understanding of the generation of photoacoustic signals. (8 refs.)

44.00 HEAT FLOW, THERMAL AND THERMODYNAMIC PROCESSES

44.10 HEAT CONDUCTION (MODELS, PHENOMENOLOGICAL DESCRIPTION)

101007 Convergence of statistical finite element solutions of the heat equation with a random initial condition. S.Tasaka (Dept. of Regional Planning, Toyohashi Univ. of Technol., Toyohashi, Japan).
Comput. Methods Appl. Mech. & Eng. (Netherlands), vol.39, no.2, p.131-6 (Aug. 1983).
Previously (see ibid., vol.29, p.109 1981) the author analysed the stability of a finite element scheme for the one-dimensional heat equation with a random initial condition. The author now examines the convergence of statistical finite element solutions to the same problem. The goal of the convergence study is to show that the error of finite element solutions is bounded by some quantities of finite values the magnitude of which may or may not be evaluated, and that the error goes to zero as h and Δt go to zero. In statistical cases, one can define several kinds of solutions to a given problem, i.e. a random function satisfying the governing stochastic equation and some other auxiliary conditions, statistical quantities of the random function, its probability distributions, etc. The author confines the analysis to the first two 'solutions' as already made in the previous paper. Hence, 'finite element solutions' have also these two different meanings. The latter solution, referred to as statistical finite element solutions, may be more important for practical purposes. (5 refs.)

101008 An analytic method for solution of nonlinear inverse problems of heat conduction. A.A.Aleksashenko.
Power Eng. (J. Acad. Sci. USSR) (USA), vol.20, no.3, p.118-26 (1982). Translation of: *Izv. Akad. Nauk SSSR Energ. & Transp.*, vol.20, no.3, p.122-30 (1982).
An analytic method is given for solution of certain nonlinear inverse problems of heat conduction; it utilizes 'model' solutions to evaluate the unknown quantities. Sample calculations are given. (9 refs.)

101009 A discretized-intensity method proposed for two-dimensional systems enclosing radiative and conductive media. T.M.Shih, Y.N.Chen (Dept. of Mech. Engng., Univ. of Maryland, College Park, MD, USA).
Numer. Heat Transfer (USA), vol.6, no.2, p.117-34 (April-June 1983).
A method has been developed for numerically solving two-dimensional radiative and conductive problems. Unlike conventional approaches in which the radiative fluxes are assumed to be one-dimensional, the proposed method bypasses the unnecessary use of the integrodifferential energy transport equation and accounts for the two-dimensionality of the radiative fluxes. Energy conservation is directly taken within a circular control volume. In addition, nodal intensities in four directions are introduced as unknowns. The system of nonlinear algebraic equations is closed with the aid of the equation of transfer in the discretized form. With such a formulation, it is possible to derive, for any grid point j, a set of generalized equations that are readily applicable to other grid points simply by changing the indices; the radiation that arrives at the control volume from remote areas does not explicitly appear in the algebraic equations, but is implicitly accounted for. (20 refs.)

Thermal conductivity of plastic foams .... See Entry 101017

Heat transfer by conduction and radiation in one-dimensional planar media using the differential approximation .... See Entry 101246

Theoretical study of tilted solar still as a regenerator for liquid desiccants .... See Entry 103720

Transient performance of normal/reverse flat plate collector with selective absorber surface .... See Entry 103721

44.25 CONVECTIVE AND CONSTRAINED HEAT TRANSFER

(see also 47.25Q Convection and heat transfer)

101010 Generalised nonstationary temperature fields in a half-space with cylindrically-elliptical plane. N.V.Golets', M.P.Lenyuk.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.6, p.60-4 (1983). In Ukrainian.
The method of fundamental functions is used to solve the problem of the structure of a generalized nonstationary temperature field in a homogeneous isotropic space with a cylindrically elliptic cavity under the assumption that the cavity boundary is maintained under preset heat conditions, and that the half-space boundary allows heat exchange according to the Newton generalized law. (7 refs.)

101011 Thermal instability of two-dimensional stagnation-point boundary layers. K.Chen, M.M.Chen, C.W.Sohn (Dept. of Mech. & Industrial Engng., Univ. of Illinois, Urbana, IL, USA).
J. Fluid Mech. (GB), vol.132, p.49-63 (July 1983).
A study of thermal instability for the two-dimensional stagnation flow for Prandtl numbers ranging from 0.7 to infinity is presented. The analysis represents an exact solution since neither the boundary-layer approximation nor the parallel-flow assumption was invoked. Of particular interest is that the critical Rayleigh number and the critical wavenumber, when defined on the basis of the thermal boundary-layer lengthscale, are found to be relatively insensitive to the Prandtl number for the range of Prandtl numbers studied. (8 refs.)

Pulsed laser beam control by hot spot tracking .... See Entry 100812

Existence conditions for stationary state of a free convection flow in a confined medium .... See Entry 101211

Structure of growing double-diffusive convection cells .... See Entry 101241

Experimental investigation of heat transfer and hydraulic resistance in the channels with alternating cross-section .... See Entry 101337

A simple analysis of an open regeneration system .... See Entry 103658

Transient analysis of forced circulation solar water heating system with collectors in series .... See Entry 103717

Transient analysis of double basin solar still .... See Entry 103718

Year-round performance of an improved collector-cum-storage type solar water heater .... See Entry 103719

Theoretical study of tilted solar still as a regenerator for liquid desiccants .... See Entry 103720

Transient performance of normal/reverse flat plate collector with selective absorber surface .... See Entry 103721

A wind-mixed layer model for solar ponds .... See Entry 103725

44.30 HEAT TRANSFER IN INHOMOGENEOUS MEDIA AND THROUGH INTERFACES

101012 The existence and stability of regions with superheating in the classical two-phase one-dimensional Stefan problem with heat sources. A.A.Lacey, M.Shillor (Math. Inst., Oxford Univ., Oxford, England).
IMA J. Appl. Math. (GB), vol.30, no.2, p.215-30 (March 1983).
It is proved that in one-dimensional two-phase Stefan problem regions with superheating (supercooling) appear when sufficiently strong volume heat sources (sinks) are present. The stability of the problem with superheating is considered. It is proved that when the heat flux, on the free boundary, from the solid is greater than that from the liquid then the free boundary is linearly unstable against three-dimensional perturbations. From these results it follows that the classical model for the melting of a metal under Joule heating has a linearly unstable free boundary. Such models are applicable to the electrical welding of metals. (18 refs.)

101013 Vapour bubble formation during fast transient boiling on a wire. K.Derewnicki (Simon Engng. Labs., Univ. of Manchester, Manchester, England).
Int. J. Heat & Mass Transfer (GB), vol.26, no.9, p.1405-8 (Sept. 1983).
The author investigates the heat transfer mechanisms accompanying rapid heating of a fine platinum wire (0.025 mm in diameter) immersed in subcooled water at a range of pressures up to 14 bar and of rates of increase of the heating surface temperature up to $10^7 K\ s^{-1}$. With such rapid heating, especially at elevated pressures, nucleation occurs in a homogeneous rather than heterogeneous manner. The results presented, were obtained from transient boiling tests with relatively low heating rates, i.e. below $10^6 K\ s^{-1}$ and at atmospheric pressure. Such rates of heating were found to lead to stable nucleate boiling following a brief period of local and highly unstable film boiling. (7 refs.)

101014 Heat-transfer rate on boiling in the presence of scaling. V.I.Tolubinskii, V.A.Antonenko, G.R.Kudritskii, Yu.N.Ostrovskii (Inst. of Tech. Heat Phys., Acad. of Sci., Kiev, Ukrainian SSR).
J. Eng. Phys. (USA), vol.43, no.6, p.1360-2 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.6, p.942-5 (Dec. 1982).
Deactivation of vapor-formation centers is decisive in producing the temperature rise at a heating surface when deposits are formed on it. (4 refs.)

101015 Impact of an evaporating drop on a heated wall. Yu.A.Buevich, V.N.Mankevich (Ural State Univ., Sverdlovsk, USSR).
J. Eng. Phys. (USA), vol.43, no.6, p.1362-9 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.6, p.945-55 (Dec. 1982).
The interaction of a superheated surface with a drop impinging upon it is treated in the quasistationary approximation, neglecting dissipative effects. (21 refs.)

101016 Numerical computation using finite elements for the moving interface in heat transfer problems with phase transformation. J.Yoo, B.Rubinsky (Dept. of Mech. Engng., Univ. of California, Berkeley, CA, USA).
Numer. Heat Transfer (USA), vol.6, no.2, p.209-22 (April-June 1983).
A numerical method involving finite elements is presented for the solution of multidimensional problems of heat transfer with phase transformation. Specific to the method is that both the energy equation in the media and the energy equation on the change of phase interface are regarded as independent governing equations which, when solved through the use of a finite-element formulation, yield the temperature distribution in the media as well as the continuous displacement of the interface. Specific examples illustrate the ability of the method to handle problems with arbitrary boundary conditions which result in irregular two-dimensional shapes of the change of phase interface. (18 refs.)

101017 Thermal conductivity of plastic foams. R.J.J.Williams, C.M.Aldao (Inst. of Materials Sci. & Technol., Univ. of Mar del Plata, Mar del Plata, Argentina).
Polym. Eng. & Sci. (USA), vol.23, no.6, p.293-8 (April 1983).
A simple equation enabling the prediction of the thermal conductivity of plastic foams, without the aid of adjustable parameters, is proposed. The equation is based on a recurrent method, previously developed, that showed reasonable agreement with experimental results. Ways of decreasing the thermal radiation contribution are shown. In particular, the influence of cell size, radiation transmission through solid membranes and low-emissivity boundary surfaces are analyzed. Errors involved in steady techniques of measuring the thermal conductivity associated with radiation are discussed. (3 refs.)

101018 Characteristics of nucleate pool boiling from porous metallic coatings. A.E.Bergles, M.C.Chyu (Dept. of Mech. Engng., Iowa State Univ., Ames, IA, USA).
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.279-85 (May 1982).
A study of pool boiling from a commercial porous metallic matrix surface is reported. The excellent steady boiling characteristics of this type of surface are confirmed; however, high wall superheats are required in most cases to initiate boiling. The resultant boiling curve hysteresis does not appear to have been previously reported in the literature. This effect is indicated in recent pilot plant tests. The present results generally confirm the speculated mechanism of boiling with these surfaces and suggest reasons whereby single-tube performance may be superior to tube bundle performance. (29 refs.)

101019 Effects of pore diameters and system pressure on saturated pool nucleate boiling heat transfer from porous surfaces. W.Nakayama, T.Daikoku, T.Nakajima (Mech. Engng. Res. Lab., Hitachi Ltd., Ibaraki, Japan).
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.286-91 (May 1982).
The porous surface structure was manufactured with precision from the experimental study of nucleate boiling heat transfer in R-11. Boiling curves and the data of bubble formation were obtained with a variety of geometrical and operational parameters; the pore diameters were of 50, 100, 150 μm, there was a combination of pores of different sizes; and the system pressures were of 0.04, 0.1, 0.23 MPa. The boiling curves exhibit certain trends effected by the diameter and population density of pores. A combination of high system pressure and pore sizes of 100 or 150 μm dia enables boiling to persist even when the wall superheat is reduced to an extremely low level of 0.1K. A noteworthy feature of porous surface boiling is than intense bubble formation does not necessarily yield a high heat-transfer performance. Examination of the data indicates that liquid suction and evaporation inside the cavities are a probable mechanism of boiling with small temperature differences. (9 refs.)

101020 Pool boiling heat transfer from enhanced surfaces to dielectric fluids. P.J.Marto, Lt.V.J.Lepere (Dept. of Mech. Engng., Naval Postgraduate School, Monterey, CA, USA).
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.292-9 (May 1982).
Pool boiling heat-transfer measurements were made using a 15.8 mm OD plain copper tube and three copper enhanced surfaces. The dielectric fluids were Freon-113 and Fluorinert FC-72, a perfluorinated organic compound manufactured to cool electronic equipment. Data were taken at atmospheric pressure, and at heat fluxes from 100 W/m^2 to 20000 W/m^2. Prior to operation, each test surface was subjected to one of three aging procedures to observe the effect of surface past history upon boiling incipience. For Freon-113 the enhanced surfaces showed a two to tenfold increase in the heat-transfer coefficient when compared to a plain tube, whereas for FC-72 an increase of two to five was measured. The high flux surface gave the best performance over the range of heat fluxes. The GeWa-T surface did not show as much of an enhancement at low fluxes as the other two surfaces, but at high fluxes its performance improved. In fact, it was the only surface tested which delayed the onset of film boiling with FC-72. The degree of superheat required to active the enhanced surfaces was sensitive to both past history of the surface and to fluid properties. (22 refs.)

Critical heat flux during natural convective boiling in vertical rectangular channels submerged in saturated liquid .... See Entry 101244

Nonlinear nonclassical boundary problem for thermal conductivity of crystalline media .... See Entry 102081

Surface resistance dominated thermal transport in thin specimens .... See Entry 102082

Effects of mass flux, flow quality, thermal and surface properties of materials on rewet of dispersed flow film boiling .... See Entry 102127

Inert-gas energy-accommodation coefficients on tungsten .... See Entry 102161

Mathematical modelling of heat flow in Czochralski crystal pulling .... See Entry 103040

Proportioning composites for efficient thermal storage walls .... See Entry 103657

A simple analysis of an open regeneration system .... See Entry 103658

Transient analysis of forced circulation solar water heating system with collectors in series .... See Entry 103717

Transient analysis of double basin solar still .... See Entry 103718

Year-round performance of an improved collector-cum-storage type solar water heater .... See Entry 103719

Theoretical study of tilted solar still as a regenerator for liquid desiccants .... See Entry 103720

Transient performance of normal/reverse flat plate collector with selective absorber surface .... See Entry 103721

Experimental and analytical performance study of a thermosyphon water heater .... See Entry 103722

A wind-mixed layer model for solar ponds .... See Entry 103725

The thermal trap solar collector .... See Entry 103727

44.40 RADIATIVE HEAT TRANSFER

101021 Model approximations in radiative heat-exchange calculations. V.I.Adrianov.
Power Eng. (J. Acad. Sci. USSR) (USA), vol.20, no.3, p.156-61 (1982). Translation of: *Izv. Akad. Nauk SSSR Energ. & Transp.*, vol.20, no.3, p.159-64 (1982).
The way in which the process of radiative heat exchange is affected by selectivity and anisotropy of the optical properties of materials has been investigated for a system of two parallel, optically smooth surfaces separated by a diathermal medium. Various model approximations are considered that simplify study of the process but distort its actual physical pattern. This problem has been solved both in exact formulation and by computer on the basis of approximations. The results of the exact solution are compared with model approximations; this makes it possible to judge the accuracy of approximate computational schemes and their comparative advantages. (9 refs.)

101022 'Equilibrium' approximations in theory of radiative heat transfer. V.N.Adrianov (Moscow Inst. of Steel & Alloys, Moscow, USSR).
J. Eng. Phys. (USA), vol.43, no.6, p.1398-403 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.6, p.989-95 (Dec. 1982).
Two methods are proposed for approximately taking into account the selectivity and anisotropy of radiation characteristics in calculation of radiative heat transfer. Both methods are shown to be sufficiently reliable and effective. (1 ref.)

101023 Temperature distribution in thin films receiving radiant energy. M.A.Gurbanyazov, I.S.Lisker, M.B.Pevzner (Sci.-Res. Inst. of Agrophys., Leningrad, USSR).
J. Eng. Phys. (USA), vol.43, no.6, p.1403-6 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.6, p.995-9 (Dec. 1982).
An expression is derived for estimating the temperature distribution in thin metal and semiconductor films locally receiving radiant energy. (12 refs.)

101024 The Galerkin method for solving radiation transfer in plane-parallel participating media. M.N.Ozisik (Mech. & Aerospace Engng. Dept., North Carolina State Univ., Raleigh, NC, USA), Y.Yener.
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.351-4 (May 1982).
The Galerkin method is applied to solve radiative heat transfer in an isotropically scattering, absorbing, and emitting plane-parallel medium with diffusely reflecting boundaries. In this approach, the integral form of the equation of radiative transfer is transformed into a set of algebraic equations for the determination of the expansion coefficients associated with the representation of the incident radiation in a power series in the space variable. The method is easy and straightforward to apply and requires relatively little computer time for the computations, since explicit analytical expressions are obtainable for the expansion coefficients. (16 refs.)

101025 View factors in radiation between two parallel oriented cylinders of finite lengths. N.H.Juul (Dept. of Mech. & Aerospace Engng., State Univ. of New York, Amherst, NY, USA).
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.384-8 (May 1982).
A simple double-integral expression for the diffuse radiation view factor, F_{12}, between two parallel cylinders of finite lengths is derived. No closed-form solution appears possible except for the limiting case of infinite long cylinders for which an analytical expression for the view factor ${F_{12}}^{\infty}$ is derived by applying the crossed string method. The accuracies of the line source approximations are evaluated, and the regions for which they are accurate to one percentage or better are identified. The view factor F_{12} between two opposing cylinders of equal length is computed by numerical integration and normal-

ized by F_{12}^{∞}. The results are presented. Analytical expressions, which approximate the view factors between two opposite cylinders of finite length, are derived and their accuracy is evaluated over a useful parameter range. The range of their applications corresponds approximately to that for the line source approximation. This result is expected, because the errors are caused in part by blockage of radiation which is similar. (7 refs.)

A discretized-intensity method proposed for two-dimensional systems enclosing radiative and conductive media ......See Entry 101009

Heat transfer by conduction and radiation in one-dimensional planar media using the differential approximation ......See Entry 101246

Nonlinear nonclassical boundary problem for thermal conductivity of crystalline media ......See Entry 102081

Transient analysis of forced circulation solar water heating system with collectors in series ......See Entry 103717

Transient analysis of double basin solar still ......See Entry 103718

Year-round performance of an improved collector-cum-storage type solar water heater ......See Entry 103719

Theoretical study of tilted solar still as a regenerator for liquid desiccants ......See Entry 103720

Transient performance of normal/reverse flat plate collector with selective absorber surface ......See Entry 103721

44.50 THERMAL PROPERTIES OF MATTER (PHENOMENOLOGY, EXPERIMENTAL TECHNIQUES)

(see also 07.20 Thermal instruments and techniques)

101026 Calculation of the temperature regimes for the fine anneal of quartz discs. E.I.Shyb (State Sci.-Res. Inst. of Vitreous Silica, Leningrad, USSR).
Sov. J. Glass Phys. & Chem. (USA), vol.8, no.4, p.335-40 (July-Aug. 1982). Translation of: *Fiz. & Khim. Stekla (USSR)*, vol.8, no.4, p.484-90 (July-Aug. 1982). [received: May 1983]
On the basis of a diffusion approximation, a method of calculating the heat transfer in large blanks made of vitreous silica of thickness >0.20 m and diameter >1 m has been developed. This method is based on the introduction of a coefficient of radiation thermal conductivity obtained by averaging the length of the radiation free path in relation to the spectrum as is valid for large discs. A calculation was made for the fine anneal of a disc made from KV vitreous silica enclosed in a brick capsule with third-order boundary conditions. From the temperature distributions obtained the thermal stresses were calculated along the radius of the disc since these are much greater than the stresses along the axis. The results of the calculations show that the temperature distribution in the disc is independent of the reflection coefficient of the brick capsule in the case of large blanks of diameter >1 m and thickness >0.2 m. The use of the free convection in the annealing furnace with linear cooling of the gas carrier until the final annealing temperature T_f was established followed by a maintenance of the gas temperature T_s at this value until the critical cooling of the glass had finished and also the maintenance of radiative equilibrium between the furnace walls and the capsule enclosing the disc made it possible to choose those regimes from all those considered which ensure that the glass is annealed in accordance with the established technical requirements: in relation to optical uniformity, up to 5 deg/h; and residual stresses, to 40 deg/h. (9 refs.)

Surface resistance dominated thermal transport in thin specimens ......See Entry 102082

Two-dimensional imaging of hotspots in superconducting bridges by low-temperature scanning electron microscopy ......See Entry 102581

44.60 THERMODYNAMIC PROCESSES (PHENOMENOLOGY, EXPERIMENTAL TECHNIQUES)

(see also 05.70 Thermodynamics, 07.20 Thermal instruments and techniques)

Vapour bubble formation during fast transient boiling on a wire ......See Entry 101013

Numerical computation using finite elements for the moving interface in heat transfer problems with phase transformation ......See Entry 101016

A property of the heat equation which extends to the thermoelastic equations ......See Entry 101049

Influence of buoyancy forces and thermal conductivity on flow field and heat transfer of circular cylinders at small Reynolds number ......See Entry 101220

46.00 MECHANICS, ELASTICITY, RHEOLOGY

46.10 MECHANICS OF DISCRETE SYSTEMS

(see also 03.20 General mathematical aspects)

101027 Stationary singular surfaces in materials with scalar internal variables. E.Matsumoto (Dept. of Aeronaut. Engng., Kyoto Univ., Kyoto, Japan).
Arch. Mech. (Poland), vol.34, no.4, p.477-83 (1982).
There can exist stationary discontinuity surfaces of the second deformation gradient in a three-dimensional material with scalar internal variables. Explicit expressions for the growth and decay of the discontinuities are obtained. For a material with an unknown number of scalar internal variables, a method is proposed to find a lower bound for the number of the scalar internal variables, by observing the variation of such discontinuities. (17 refs.)

101028 Thermodynamic influences on stationary singular surfaces in materials with scalar internal variables. E.Matsumoto (Dept. of Aeronatical Engng., Kyoto Univ., Kyoto, Japan).
Arch. Mech. (Poland), vol.34, no.4, p.485-91 (1982).
Stationary singular surfaces may exist in materials with scalar internal variables. The jump of the second deformation gradient across such a surface behaves, under thermodynamic influences, as if the number of the scalar internal variables were increased by one. In other words, the entropy plays the same role as a scalar internal variable on the variation of the discontinuity. As a result, stationary singular surfaces may also exist in a thermoelastic material. (6 refs.)

101029 Solution of dynamic noncircular cylindrical shell problems in liquids. S.A.Borobiov.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.5, p.28-31 (1983). In Ukrainian.
Presents a boundary form perturbation method for solving problems of noncircular cylindrical shell dynamics in liquids. (8 refs.)

101030 Geometrically nonlinear mechanics in discrete system and application to plane frame-works. M.Ai (Dept. of Civ. Engng., Hosei Univ., Tokyo, Japan), F.Nishino.
J. Fac. Eng. Univ. Tokyo Ser. B (Japan), vol.36, no.4, p.745-75 (Sept. 1982).
A general expansion for the geometrically nonlinear mechanics in discrete structural systems is presented, in which the freedom of elemental position is resolved into the elemental deformation and the elemental rigid displacement, and which is applicable to any large displacements. The general expansion is given the specification for plane frame-works, in which a new solution for the elemental deformation is shown to contain more nonlinearity than that of the beam-column theory. The convergence of the discrete solution towards an infinitesimal subdivision of elements is studied on the geometrical nonlinearity. (23 refs.)

101031 Application of the hybrid method of finite elements to strength analysis of axially symmetric shell-plate structures. Z.Dzygadlo, I.Nowotarski.
J. Tech. Phys. (Poland), vol.23, no.2, p.167-78 (1982).
In the displacement method of finite elements, the displacement functions were assumed to be in the form of polynomials, for which the total number of their coefficients α_n was equal to the number of degrees of freedom of the element under consideration. For the one-dimensional element, having the form of a truncated cone, the total number of degrees of freedom was 6, therefore, the displacement functions u and w could be approximated by first and third degree polynomials. The fact that the displacements inside an element were approximated by low-degree polynomials influenced in a disadvantageous manner the accuracy of computation of the deformations of middle surfaces of the system. These deformations were determined from strain-displacement relations, which require differentiation, so the accuracy of the rigidity matrix thus obtained was reduced. This is a drawback in the case of elasticity problems, since discontinuities of stress occur in some cases across boundaries between elements. To avoid such difficulties an attempt was made to apply the hybrid method of finite elements for the construction of the stiffness matrix of a conical shell element. (11 refs.)

On the variational theory of linear configuration-dependent systems ......See Entry 98748

Regions of possible motion in mechanical systems ......See Entry 98754

Oscillation of a system with hysteretic in energy dissipation under random excitation ......See Entry 101106

46.20 CONTINUUM MECHANICS

(see also 03.40 General mathematical aspects)

101032 Comparison of two slideline methods using ADINA. F.M.Guerra, R.V.Browning (Design Analysis Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
Comput. & Struct. (GB), vol.17, no.5-6, p.819-34 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
Two general methods of treating sliding interface problems were implemented in ADINA. The first method uses constraint equations and is based on the work of Taylor, Hughes et al. (1974). The second method is a penalty function method where finite stiffness are used to simulate the contact forces. This is similar to the method used by Hallquist (1982) in NIKE2D. These may be used as notension sliding interfaces, with or without friction, or as a nonsliding interface to interpolate between different mesh regions. The authors briefly review the theory behind these methods and describe the implementation in ADINA. Several application problems have been run, including metal forming problems. Based on this experience the methods are compared in terms of ease of use, accuracy, reliability, influence on bandwidth, and solution time. Neither method is ideal. The penalty method is generally more efficient but may be inaccurate, whereas the constraint equations are accurate but less efficient. (13 refs.)

101033 Solving the static problem of rotation shells with additional supports. A.T.Vasilenko, Ya.M.Grigorenko, T.I.Polishchuk.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.6, p.4-6 (1983). In Ukrainian.
Presents an approach to the solution of problems of statics for shells of revolution on additional supports, certain displacements coming to zero. A solution is presented for a problem of a toroidal noncircular-section shell on a stiff support. (8 refs.)

101034 Structural model of a medium for complex nonisothermal loading processes. Yu.M.Shevchenko, E.I.Zakon.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.6, p.42-6 (1983). In Ukrainian.
Deals with the structural model of a medium describing nonisothermal complex processes of loading and processes of loading according to two-link trajectories of deformation in particular. (8 refs.)

101035 Elastic property anisotropy dependence of fibre composite material on its structure. G.T.Golovchan, N.I.Nikityuk.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.6, p.68-71 (1983). In Ukrainian.
Composites with double-periodic arrangement of fibres are considered. The effective moduli of elasticity are obtained on the basis of a rigorous solution of a boundary value problem. The dependence of elastic property anisotropy on the structure parameters is also studied. (6 refs.)

101036 A new approach to the dynamic analysis of structures using fixed frequency dynamic stiffness matrices. A.J.Fricker (Central Electricity Res. Labs., Leatherhead, England).
Int. J. Numer. Methods Eng. (GB), vol.19, no.8, p.1111-29 (Aug. 1983).
The dynamic analysis of structures by the standard finite element method introduces additional inaccuracies into the solution which are not present when the method is used for static analyses. These inaccuracies can arise from two sources: (i) the element formulation and (ii) the reduction of the size of the matrices by a static condensation. The errors in both cases are caused be neglecting frequency-dependent terms in the functions relating the displacements at any point in the structure to the displacements at certain fixed points. The author proposes a new method of solution in which the

frequency-dependent terms are retained implicitly by using dynamic stiffness matrices defined at a number of fixed frequencies. The dynamic stiffness matrices may be condensed efficiently to a relatively small number of master degree-of-freedom using a front solution algorithm. The final stage in the solution uses these matrices to synthesize a high-order eigenvalue problem. Numerical examples are given to show the accuracy and efficiency of the proposed method compared with conventional methods of solution. (14 refs.)

101037 Finite element techniques for problems of unbounded domains. F.Medina (John A. Blume & Associates, Berkeley, CA, USA), R.L.Taylor.
Int. J. Numer. Methods Eng. (GB), vol.19, no.8, p.1209-26 (Aug. 1983).
A general approach for using infinite elements within the context of the finite element method is presented. Based upon Gauss-Laguerre quadrature, a scheme for numerically computing the infinite element characteristic matrices is proposed. The general formulation of the element shape functions is outlined, including that for infinite elements that model the far field of hyperbolic systems. The technique is illustrated with a classical example in elasticity: a vertically loaded circular rigid plate. (21 refs.)

101038 A geometrically nonlinear theory of thin-walled beams. M.Ai (Dept. of Civ. Engng., Hosei Univ., Tokyo, Japan), F.Nishino.
J. Fac. Eng. Univ. Tokyo Ser. B (Japan), vol.36, no.4, p.713-43 (Sept. 1982).
The geometrically nonlinear behavior of thin-walled beams is formulated into governing equations within the condition of small strains, but without any restriction to the magnitude of displacements. The relative in-plane displacement within a cross-section is taken into account as well as the warping. By employing a transformed geometrical variation from the direct variation of independent parameters in the kinematic field, the variational calculus is simplified to yield an explicit solution. The kinematic field is considered directly to the geometry of thin-walled beams regardless of whether before or after deformation, rather than to the displacement from the initial configuration, with an assertion to the treatment of geometrically nonlinear problems. (14 refs.)

101039 Analysis of stressed state of laminate-wound cylindrical shell with friction taken into account. L.A.Il'in, N.A.Lobkova (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.11, p.993-1000 (Nov. 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.11, p.49-56 (Nov. 1982).
In an earlier study (see ibid., vol.17, no.6, p.59, 1981) a design scheme was described for a thin elastic laminate-wound infinitely long cylindrical shell under an internal pressure load and, from a qualitative analysis of the mode of layer slippage, the authors derived a principle for setting up equations describing the stress-strain state of the shell. The authors demonstrate there that the mode of slippage and thus the form of these equations depends on the magnitude of the friction coefficient. The friction coefficient is thus regarded as a parameter with a continuous range of values and, on this basis, the authors set up equations describing all possible situations. The authors also present a method for solving the corresponding transcendental equations and show how the slip between layers and the forces in layers depend on the magnitude of the friction coefficient for the case of a shell consisting of five turns. (2 refs.)

101040 Refined theory of plates for finite deflections. A.V.Plekhanov, A.P.Prusakov (Dnepropetrovsk Construction-Engng. Inst., Dnepropetrovsk, USSR).
Sov. Appl. Mech. (USA), vol.18, no.11, p.1010-13 (Nov. 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.11, p.70-4 (Nov. 1982).
Considers an elastic transversally isotropoic plate of constant thickness and obtains equations for the equilibrium, boundary conditions and relations between the forces and the displacement using Reissner's variational equation. (4 refs.)

101041 Axisymmetric reinforcement of holes in orthotropic plates. V.K.Kosenyuk (Novosibirsk Inst. of Railroad Transportation Engnrs., Novosibirsk, USSR).
Sov. Appl. Mech. (USA), vol.18, no.11, p.1014-17 (Nov. 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.11, p.75-9 (Nov. 1982).
The presence of a reinforcing ring in a plate weakened by a hole causes a significant stress redistribution in the plate and lowers the stress concentration factors. Various optimality criteria are used to determine the most efficient form of reinforcement of hole edges. The author examines a two-dimensional problem involving a determination of this form for a reinforcing element of constant thickness. The condition of equal strength is satisfied in the plate on the outer contour of the reinforcement. The problem is solved for an infinite orthotropic plate loaded in its own plane with uniform loads in two directions. The method presented also makes it possible to construct solutions for plates of finite dimensions with other loading conditions. (4 refs.)

Perturbation method in boundary-value problems of the mechanics of deformable bodies .... See Entry 98762

Effective methods of accounting for local variation in stiffness characteristics in the finite-element method .... See Entry 101060

Definition and applications of a behavioural law with hereditary form .... See Entry 101072

46.30 MECHANICS OF SOLIDS AND RHEOLOGY

(see also 62.20 Mechanical properties of solids, as related to microscopic structure)

101042 Prestrained elastic laminates: deformations, stability and vibrations. H.Bufler, H.Kennerknecht (Univ. of Stuttgart, Stuttgart, Germany).
Acta Mech. (Austria), vol.48, no.1-2, p.1-30 (1983).
For a general elastic laminate consisting of different transversely isotropic plane layers an exact (but expensive) method for the calculation of the deformations, stability and eigenvibrations is discussed. The specialization to a laminate composed of alternating stiff reinforcing sheets and soft matrix layers (special discrete model), however, allows a considerable simplification. It is shown how this regular laminate (=inhomogeneous classical continuum) may be approximated by a homogeneous continuum with couple stresses using a suitable limiting process (continuum model). This model corresponds to a restricted Cosserat continuum and enables the derivation of closed formulas for the displacements, critical loads, and eigenfrequencies. Numerical results are worked out on the basis of the discrete and continuum model respectively and compared with each other. (27 refs.)

101043 Thermodynamics and the homogenized thermomechanical behaviour. G.Francfort, Q.S.Nguyen, P.Suquet.
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.14, p.1007-10 (18 April 1983). In French.
The macroscopic thermomechanical behaviour of a heterogeneous medium is investigated through a homogenization method. The study is based upon the knowledge of the microscopic thermomechanical behaviour of this medium. A better understanding of the results obtained is achieved through the notion of accompanying equilibrium state. (4 refs.)

101044 Prognosis of the carrying capacity of structures during strength tests. E.G.Geida, A.G.Makarenkov, V.I.Mossakovs'kii.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.6, p.23-5 (1983). In Ukrainian.
Presents a method for predicting the carrying capacity of structure from the parameters (deformations) measured during tests using the second-order autoregression model and corresponding strength criteria. (3 refs.)

101045 Experimental determination of the stresses in the layers of a multilayered rolled shell. M.I.Burak (Dept. of Central Res. Inst. of Steel Structure Design, Minsk, Belorussian SSR).
Strength Mater. (USA), vol.14, no.6, p.792-6 (June 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.6, p.67-71 (June 1982).
An investigation of the ultimate strength of a multilayered rolled shell. To verify the obtained results, the authors tested a model that was sealed with an elastic packing, pressed against the inner surface of the shell by a rigid cover plate with the aid of an elastic distance rod. After loading the model up to the state of total yield of the wall, they succeeded in recording the strain diagram of the hole circumferentially in the outer and inner layers. As a result equal diagrams were obtained whose processing indicates that the stresses across the wall thickness are uniformly distributed. (13 refs.)

101046 Use of the finite-element method to select the optimum geometric shape of 'T'-connections. V.M.Bogomol'nyi, S.V.Ekhlakov, I.V.Kargapolov.
Strength Mater. (USA), vol.14, no.6, p.804-7 (June 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.6, p.78-80 (June 1982).
A numerical analysis of the stress-strain state of 'T'-connections has been presented (Yulikov and Stasenko 1979). The present authors' aim is to substantiate the method of reducing the concentration of stresses at the point of intersection of cylindrical shells, which arise under loading by internal pressure. The radius of coupling of the cylindrical shells and the shell thickness are assumed to be constant. (9 refs.)

101047 Experimental study of the deformed state of a conical panel. V.I.Kostrov.
Sov. Aeronaut. (USA), vol.25, no.2, p.68-70 (1982). Translation of: *Izv. VUZ Aviats. Tekh. (USSR)*, vol.25, no.2, p.60-2 (1982).
The conical panel under the action of static uniform pressure and dynamic loads was studied in great detail. However, the 'load-deflection' dependence was not obtained in those studies. To establish this relation the author designed and built a test setup which consisted of a housing, curvilinear clamping plank, hydraulic pump, calibrated pressure gauge, hydraulic plumbing and a fixture for mounting the indicators used to record the panel deflection. (2 refs.)

Proceedings of the 4th ADINA Conference .... See Entry 98619

Use of two-dimensional schemes in the finite-element method in calculating the coil system for the toroidal magnetic field in a Tokamak ....See Entry 99728

46.30C Static elasticity

101048 Shock wave in piecewise linear elastic material. Z.Wesolowski (Inst. of Fundamental Technol. Res., Polish Acad. of Sci., Warsaw, Poland).
Arch. Mech. (Poland), vol.34, no.3, p.351-8 (1982).
The six-dimensional deformation space is divided into a number of regions. For each deformation belonging to a fixed region there holds the same linear stress-strain relation. The shock wave propagates in this piecewise-linear elastic material. The general algebraic propagation equations are given and three special cases are discussed. (4 refs.)

101049 A property of the heat equation which extends to the thermoelastic equations. W.A.Day (Oxford Univ., Oxford, England).
Arch. Ration. Mech. & Anal. (Germany), vol.83, no.2, p.99-113 (1983).
The author shows that the heat equation property, deduced from the maximum principle, does extend to the thermoelastic equations. (5 refs.)

101050 A class of biharmonic end-strip problems arising in elasticity and Stokes flow. D.A.Spence (Math. Dept., Imperial Coll. London, London, England).
IMA J. Appl. Math. (GB), vol.30, no.2, p.107-39 (March 1983).
Considers boundary-value problems for the biharmonic equation in the open rectangle $x>0$, $-1<y<1$, with homogeneous boundary conditions on the free edges $y=\pm 1$, and data on the end $x=0$ of a type arising both in elasticity and in Stokes flow of a viscous fluid, in which either two stresses or two displacements are prescribed. For such 'noncanonical' data, coefficients in the eigenfunction expansion can be found only from the solution of infinite sets of linear equations, for which a variety of methods of formulation have been proposed. (22 refs.)

101051 SIMPAT (modular simulator for thermoelastic analyses).
Pixel. Comput. Graphics, CAD/CAM, Image Process. (Italy), vol.4, no.2, p.57-61 (1983). In Italian.
Describes SIMPAT, finite elements package oriented to applications of structural analyses in thermal, static and dynamic fields. The library of elements is explained. A diagram is given of various types of elements and their linear, parabolic and cubic representation. The generation of the mesh is described, with its applications to thermal analyses, static and dynamic analyses. Diagrams of these are given. The final section deals with applications to graphical analyses. *G.V.D.*

101052 A simple and effective pipe elbow element—some nonlinear capabilities. K.-J.Bathe (Dept. of Mech. Engng., MIT, Cambridge, MA, USA), C.A.Almeida, L.W.Ho.
Comput. & Struct. (GB), vol.17, no.5-6, p.659-67 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
The authors have previously presented the formulation of a simple pipe elbow element for linear analysis. This formulation is extended to include some nonlinear effects. Elastic-plastic conditions can be modeled, and some kinematic nonlinearities (due to large displacement beam behaviour) can also be represented. The results of some sample solutions are given to illustrate the use of the element. (9 refs.)

101053 On elastic-plastic analysis of *I*-beams in bending and torsion. K.-J.Bathe, P.M.Wiener (Dept. of Mech. Engng., MIT, Cambridge, MA, USA).
Comput. & Struct. (GB), vol.17, no.5-6, p.711-18 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
The use of various models is studied to represent an *I*-beam for its elastic-plastic bending and torsional response including warping. The rectangular cross-section 2-node Hermitian beam element, the 4-node isoparametric beam element, and the 9-node isoparametric shell element of ADINA with constraint equations are used to establish the models. The linear elastic and elastic-plastic solutions of a cantilevered *I*-beam are given, and it is concluded

that the *I*-beam model constructed with the isoparametric beam element can be used for general analysis. (8 refs.)

101054 Nonlinear static analysis of end-fittings for GFRP-prestressing rods. M.Keuser (Inst. fur Massivbau, TH Darmstadt, Darmstadt, Germany), B.Kepp, G.Mehlhorn, F.Rostasy.
Comput. & Struct. (GB), vol.17, no.5-6, p.719-30 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
Considers research on end-fittings for pretensioned GFRP rods. It is shown that the ADINA-FE-program can be modified by user at reasonable expense for the analysis of structures and materials whose properties cannot be reproduced adequately by the original version of the program. For the analysis of anchorage elements for pretensioned GFRP rods a modified elastic-plastic material model for 2/D-elements and a bond-link-element have been added to the program maintaining completely its modular structure. The modifications are explained and the stiffness matrix for the bond-link-element is derived. With this modified program different types of end-fittings are analyzed with special regard to bond between the GFRP rod and the surrounding synthetic resin material. A comparison of the results of the FE-analysis shows good correspondence to test data. (6 refs.)

101055 On one opportunity of the elimination of volumetric forces in problems of mechanics of the deformable rigid body. L.Kh.Talybly.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.5, p.56-61 (1982). In Russian.
It is shown, that if the operative volumetric forces in the body have a potential, the problem of the mechanics of deformable rigid incompressible body may be reduced to the corresponding problem without volumetric forces. (5 refs.)

101056 Asymptotic investigation of the stressed-deformed condition of the dynamic problem of the theory of the elasticity for the empty cylinder of finite length. M.F.Mekhtiev.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.6, p.28-32 (1982). In Russian.
The axially symmetric dynamic problem of the theory of elasticity for the isotropic empty cylinder is considered. An asymptotic analysis of the stressed-deformed condition of the shell is conducted. Comparison of the asymptotic solution with the solutions obtained by the applied theory is connected. (5 refs.)

101057 On the problem of the analysis of the stress field in a multiply connected round plate depending on the different profile loads. K.A.Aliev.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.6, p.142-7 (1982). In Russian.
Presents the study of a round plate in the stressed state by the method of the theory of the analytical functions of a complex variable. The plate is relaxed by the *N*-quantity of the round holes, when the external profile is influenced by a non-uniformly distributed load and the internal profile is influenced by a uniformly distributed load. The solution of the problem is reduced to an infinite set of linear algebraic equations. Numerical examples are examined and the diagrams of the stresses are plotted. (4 refs.)

101058 Homogenization and linear thermoelasticity. G.A.Francfort (Dept. of Mech. Engng., Stanford Univ., Stanford, CA, USA).
SIAM J. Math. Anal. (USA), vol.14, no.4, p.696-708 (July 1983).
The author studies homogenization of linear dynamic thermoelasticity with rapidly varying coefficients, using a semigroup approach. The resulting homogenized problem exhibits an unusual change in initial temperature. A formal asymptotic analysis predicts fast time oscillations in the temperature field. These oscillations explain the temperature shift, and show that, for this problem, weak convergence in time is the best convergence that one can obtain. (8 refs.)

101059 Application of the potential method to two-dimensional problems of the elastic equilibrium of a region with an irregular boundary. G.N.Karpov, N.V.Kurnosov, V.Z.Parton.
Strength Mater. (USA), vol.14, no.7, p.859-61 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.3-5 (July 1982).
Investigators are currently paying increasing attention to methods of solving elastic equilibrium problems based on the formulation and numerical solution of contour integral equations. The authors noted the exceptional promise of using integral equations to solve elastic equilibrium problems, especially on the basis of the elastic potential method. Results are presented of an experiment having to do with the solution of the second basic problem of elasticity theory for a plane weakened by a narrow cavity connecting two circular holes. (4 refs.)

101060 Effective methods of accounting for local variation in stiffness characteristics in the finite-element method. A.S.Tsybenko (Kiev Polytech. Inst., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.7, p.928-30 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.62-3 (July 1982).
Use of the finite-element method (FEM) in optimization computations of structures and also for investigation of the inelastic stress-strain state using iteration algorithms of methods of variable elasticity parameters is associated with the need to find repetitive solutions that are distinguished by variation in the stiffness parameters of the individual finite elements. The mathematical essence of the problem in question consists in the successive reforming of the matrix containing the coefficients of the initial system of FEM equations and in the solution of the transformed system by direct or iteration methods. Together with this, another approach, which is examined in detail, can be used in varying the stiffness characteristics of a small number of finite elements. It is based on the introduction of variations in the vector on the right side of the system of FEM equations. The advantages of this method are particularly conspicuous for direct methods of solution of systems of linear algebraic equations. (5 refs.)

101061 Moving load applied to a layer on an acoustic half-space. V.I.Pozhuev (Zaporozhe Industrial Inst., Zaporozhe, USSR).
Strength Mater. (USA), vol.14, no.7, p.971-7 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.98-101 (July 1982).
Consideration has been given previously to a series of dynamic problems for plates floating on the surface of an ideal liquid of finite and infinite depth applicable to evaluation of an ice mantle. Movement of the mantle has been described by equations for thin plates and a load moving at a constant speed served as an oscillation generator. In order to describe motion of the layer dynamic equations of elasticity theory have been used. Subsonic and supersonic speeds of load motion in relation to the liquid are considered, and a solution is obtained for subseismic, transseismic, and superseismic regimes of motion relative to speeds of wave propagation in the layer. Numerical calculations were carried out for an exponentially decreasing pressure and for a load uniformly distributed over a section of finite length. (7 refs.)

101062 State of thermal stress in a two-temperature half-space with a periodic surface temperature. L.P.Khoroshun, N.S.Soltanov (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.11, p.977-81 (Nov. 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.11, p.30-4 (Nov. 1982).
On the basis of the equations of two-temperature thermoelasticity the authors investigate the established periodic temperature field as well as the induced stresses in the two-component halfspace. The authors investigate the effect of the difference of the temperatures of the components on the distribution of the thermoelastic stresses in the half-space. (7 refs.)

101063 Solution of the thermoelastic problem for a shell of revolution of arbitrary shape. V.V.Kuz'min.
Sov. Aeronaut. (USA), vol.25, no.2, p.71-5 (1982). Translation of: *Izv. VUZ Aviats. Tekh. (USSR)*, vol.25, no.2, p.62-5 (1982).
The author examines a thin elastic shell with axis of revolution z, subject to a steady-state temperature field. (3 refs.)

101064 Three-dimensional thermoelastic treatment in a spherical region and its application to a solid sphere and a rotating heat source. Y.Tanigawa, Y.Takeuti (Dept. of Architectural Engng., Kinki Univ., Osaka, Japan).
Z. Angew. Math. & Mech. (Germany), vol.63, no.7, p.317-24 (1983).
Discusses the three-dimensional thermoelastic treatment governed by a spherical coordinate system. The first part is devoted to deriving the convenient expressions for the displacements and stress components by introducing two functions obtained from the three-dimensional field equations of motion. It is shown that one of them is harmonic, and the other one is a solution of Poisson's equation. In the latter part, the authors have applied the above treatment to a practical three-dimensional thermoelastic problem. As an illustrative example, they have analyzed the thermal stress problem of a solid sphere due to rotating heat source, and carried out the numerical calculation. (3 refs.)

Near-field thermomechanical response of a waste vault .... See Entry 99619

Thermomechanical calculations related to thermally induced rock loosening in an underground cavity .... See Entry 99620

Elastic property anisotropy dependence of fibre composite material on its structure .... See Entry 101035

Finite element techniques for problems of unbounded domains .... See Entry 101037

On the propagation of a thermo-elastic plane wave in a thin infinite plate with thermal relaxation .... See Entry 101097

High-frequency non-axisymmetric vibrations of elastic discs . See Entry 101105

Comments on 'The fundamental frequency of an elastic system and an improved displacement function' [and reply] .... See Entry 101118

Eigenvalue approach to the longitudinal vibration of a circular cylinder coupled with a thermal field .... See Entry 101121

Thermal stresses in an orthotropic elastic half-plane weakened by a Griffith crack .... See Entry 101141

Infinite row of parallel cracks in an orthotropic strip .... See Entry 101142

About one variational principle in the stress analysis of an elastic solid under irradiation taking into account the geometrical nonlinearity .. See Entry 103192

Stress analysis of a simplified compression plate fixation system for fractured bones .... See Entry 104122

46.30J Viscoelasticity, plasticity, viscoplasticity, creep, and stress relaxation

(inc. rheology of solids)

101065 A remark on the definition of hardening, softening and perfectly plastic behaviour. J.Casey (Univ. of Houston, Houston, TX, USA), P.M.Naghdi.
Acta Mech. (Austria), vol.48, no.1-2, p.91-4 (1983).
Previously, the authors adopted as primary the loading criteria of the strain space formulation of plasticity and derived associated loading conditions in stress space. This led to a definition for three distinct types of material response, namely hardening, softening, and perfectly plastic behaviour. A condition of loading from an elastic-plastic state was presupposed. The purpose of the present work is to provide an alternative definition which removes this restriction. The new definition implies the previous definition during loading from an elastic-plastic state. The main advantage of the new definition is that in regions of hardening behaviour, it enables one to prove that the loading conditions of strain space and stress space imply one another. For regions of softening or perfectly plastic behaviour, no such equivalence can be established. (3 refs.)

101066 A thought-experiment concerning an endochronic-type theory. A.Phillips, W.-Y.Lu (Yale Univ., New Haven, CT, USA).
Acta Mech. (Austria), vol.48, no.1-2, p.103-10 (1983).
The authors consider small uniaxial deformations of a rate-independent material. The strain is denoted by ϵ and the length of the strain path by l so that $dl=|d\epsilon|$. In the undeformed state $l=0$ and the final value of l is denoted by L. The deformation to be considered starts at $\epsilon=0$, increases monotonically to ϵ_1, then decreases monotonically to ϵ_2, then increases monotonically to ϵ_3, and so on, until the final reversal takes place at $\epsilon=\epsilon_\mu$. The final value of ϵ is E. In a one-dimensional endochronic type theory the stress σ can be expressed by the constitutive equation $\sigma=\int_0^L f(L,l)(d\epsilon/dl)dl$. It is shown on the basis of a thought-experiment for a material following a specific σ-ϵ curve that this equation is not always valid. (1 ref.)

101067 On the fading memory. D.Graffi.
Appl. Anal. (GB), vol.15, no.1-4, p.295-311 (1983).
The author applies the principle of fading memory to viscoelastic homogeneous isotropic unidimensional bodies. It is shown that the principle is necessary to avoid physical paradoxes, and further restrictions to the memory functions are derived. (15 refs.)

101068 On the linear theory of thermo-viscoelastic materials with internal state variables. S.Chirita (Univ. of Iasi, Iasi, Rumania).
Arch. Mech. (Poland), vol.34, no.4, p.455-64 (1982).
The author establishes the basic equations for the linear theory of thermo-viscoelastic materials with internal state variables. The author further proves a uniqueness theorem for the solution of initial-boundary value problems formulated in the context of this theory. (13 refs.)

101069 The asymptotic rest property for materials with memory. K.Frischmuth, W.Kosinski (Inst. of Fundamental Technol. Res., Polish Acad. of Sci., Warsaw, Poland).
Arch. Mech. (Poland), vol.34, no.4, p.515-21 (1982).
In order to model viscoplasticity the Coleman-Mizel theory (1968) of materials with memory is modified by rejecting its two assumptions which

introduced the fading character of the memory, namely the separability of the history space and the relaxation property of the norm. Remaining within the framework of the new Noll's theory of materials (1972), the so-called asymptotic rest property (AR) is introduced, which ensures Noll's relaxation axiom. Unfortunately this property imposes the same restrictions as the previous one. From the theorem proved in the paper one infers that absolute memory is always fading and a viscoplastic memory is by no means absolute. (7 refs.)

101070 Application of dynamical system methods to flow processes of dissipative solids. P.Perzyna (Inst. of Fundamental Technol. Res., Polish Acad. of Sci., Warsaw, Poland).
Arch. Mech. (Poland), vol.34, no.4, p.523-39 (1982).
The purpose of the paper is to apply dynamical system methods to the investigation of stability of a flow process of dissipative solids. The material of a body is described within the framework of the modified material structure with internal state variables. The internal imperfections are also taken into consideration. To describe the effects of transport phenomena (kinetics of imperfections) the evolution equations for the internal state variables are postulated in the form of partial differential equations. An isothermal flow process of dissipative solids with internal imperfections is described. The criteria of discontinuous solution and bifurcation are discussed. The problem of stability of an equilibrium intrinsic state is also investigated. The first and second Liapounov methods are used. The particular forms of the Liapounov function are assumed. It has been proved that the criteria of asymptotic stability of an equilibrium intrinsic state are stronger than those required by the thermodynamic inequality. (20 refs.)

101071 Research on rheological models for solid polymers under large impact velocity. Identification problems. J.Pouyet, J.L.Lataillade, C.Signoret (Lab. de Mecanique Phys-ERA, Talence, France).
Cah. Groupe Fr. Rheol. (France), vol.5, no.6, p.293-304 (Feb. 1982). In French. [received: July 1983]
The authors deal with results concerning the rheological behaviour of solid polymers at impact rate loadings, obtained through Hopkinson bar apparatus. The modellization is achieved by two means: the first one is based on the analog method, for which the elementary cell is a Bingham one; the elastoviscoplastic analysis is then made in a graphical way: it allows one to get the elastic, viscous and plastic parameters of the material. The second one is based on a Frechet expansion of Volterra integrals up to the third rank in order to involve nonlinear effects as well as memory ones occurring before the viscoplastic yielding. A numerical method is presented which permits one to compute the Volterra kernels related to the material. (20 refs.)

101072 Definition and applications of a behavioural law with hereditary form. P.Guelin, J.M.Terriez, B.Wack (Inst. de Mecanique de Grenoble, Grenoble, France).
Cah. Groupe Fr. Rheol. (France), vol.5, no.6, p.317-38 (Feb. 1982). In French. [received: July 1983]
A thermomechanical pattern previously defined is briefly recalled. This scheme is of hereditary form and demands the use of the discrete memory concept. In order to illustrate the descriptive possibilities of the pattern, some results are given, which have been obtained with solids exhibiting hysteresis and hardening. (45 refs.)

101073 The use of NONSAP to compare the Von Mises and a modified Von Mises yield criteria. T.R.Rogge (Dept. of Engng. Sci. & Mech., Iowa State Univ., Ames, IA, USA), C.F.Sieck.
Comput. & Struct. (GB), vol.17, no.5-6, p.705-10 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
The NONSAP finite element code was modified to include a modified Von Mises yield criterion. The program was then used to study the differences which exist between a Von Mises and a modified von Mises yield criterion for problems of elastic-plastic deformation. The particular examples used to study this variation were that of a circular hole in a plate under uniaxial tension, a pressurized hemispherical head, and a pressurized open ended cylinder. The results of the finite element analysis are compared to previously published experimental studies. (7 refs.)

101074 Calculation of turbine rotors in secondary creep range. H.A.Ziebarth (Kraftwerk Union AG, Muelheim-Ruhr, Germany).
Comput. & Struct. (GB), vol.17, no.5-6, p.809-18 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
Turbine rotors in power plants are exposed to triaxial stresses by centrifugal forces at high temperatures which induce long time creep effects. The author has implemented an algorithm for centrifugal volume forces in ADINA. He tested the numerical behaviour of the modified Newton-algorithm in ADINA within the long time secondary creep range for simplified examples. Isotropic strain hardening was assumed in most cases of creep calculations. The estimate of creep properties is based on the minimum least square method. The numerical stability in creep calculations is dependent on the magnitude of time step size and on a good fit between creep law properties and the real experimental material data. In the examples of turbine rotor models with rotational symmetry we were able to estimate the state of stress and strain under creep conditions for life time periods up to 2×10^5 hr. (10 refs.)

101075 Large strain solutions of rubber components. B.Haggblad, J.A.Sundberg (ASEA AB, Vasteras, Sweden).
Comput. & Struct. (GB), vol.17, no.5-6, p.835-43 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
A Mooney-Rivlin material model for plane strain and axisymmetric analyses of rubber has been implemented in the ADINA computer code. The code has been used in the practical design of a highly strained rubber diaphragm in a sheet metal forming press. The pressure load was kept perpendicular to deformed surfaces and the growth of contact areas between rubber and metal boundaries during the forming process was simulated by introducing successive constraints in repeated restart runs. (15 refs.)

101076 Operator split methods for the numerical solution of the elastoplastic dynamic problem. M.Ortiz, P.M.Pinsky, R.L.Taylor (Dept. of Civil Engng., Univ. of California, Berkeley, CA, USA).
Comput. Methods Appl. Mech. & Eng. (Netherlands), vol.39, no.2, p.137-57 (Aug. 1983).
The elastoplastic dynamic problem is first formulated in a form that facilitates the application of product formula techniques. The additive decomposition of the dynamic equations into elastic and plastic parts is taken as a basis for the definition of product algorithms that exploit such decomposition. In the context of a finite element discretization, these product algorithms entail, for every time step, the solution of an elastic problem followed by the application of plastic algorithms that operate on the stresses and internal variables at the integration points and bring in the plastic constitutive relations. Suitable plastic algorithms are discussed for the cases of perfect and hardening palsticity and viscoplasticity. The proposed formalism does not depend on any notion of smoothness of the yield surface and is applicable to arbitrary convex elastic regions with or without corners. The stability properties of the product algorithm are identical to those of the elastic algorithm used whereas the computational expense is practically equal to that of an elastic probelm. (26 refs.)

101077 On the dissipation postulate for discrete and continuum plastic systems. V.I.Levitas.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.6, p.25-31 (1983). In Ukrainian.
A new method is proposed for the derivation of controlling ratios for discrete and continuous elastoplastic systems and for systems with dry friction. The method requires that laws of classical mechanics (or thermodynamics) be applied to the system together with the dissipation postulate formulated by the author. A physical interpretation of the dissipation postulate is suggested and advantages of the approach proposed are discussed and compared with known methods. (13 refs.)

101078 A boundary element solution to elasto-plastic torsion of solids of revolution. Chen Zhen Sheng (Zhengzhou Res. Inst. of Mech. Engng., Zhengzhou, China).
Int. J. Numer. Methods Eng. (GB), vol.19, no.8, p.1193-207 (Aug. 1983).
A boundary element method for the solution of problems of elastic and elasto-plastic torsion of solids of revolution is proposed. The displacement and stress field produced by a circumferential ring load in an infinite elastic body are derived and used at the fundamental solution to establish the governing integral equations. For the elasto-plastic case, linear boundary elements and bilinear quadrilateral internal cells are used for discretization of these equations. In order to carry out Gaussian integrations along boundary elements and over internal cells, a method ensuring sufficient accuracy for the calculation of singular integrals is proposed. Numerical results for several problems are given. (9 refs.)

101079 On one case of the reduction of the problem of non-linear thermo-viscous-elasticity to the problem of non-linear viscous-elasticity. L.Kh.Talybly.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.6, p.33-7 (1982). In Russian.
The equations of state of non-linear viscous-elasticity of a medium taking into account the general image of the influence of the temperature on the mechanical properties of materials are changed over the mathematical prime and are more convenient for application to the solutions of problems of relations. It is proved that the theorem is reduced in the case a nonstationary homogeneous temperature field of a problem of non-linear thermo-viscous-elasticity to the problem of non-linear viscous-elasticity without the influence of temperature. (10 refs.)

101080 Elastoplastic analysis of corner region of slit under compressive stress. Z.Jin (Min. of Building Materials Industry of China, China), T.Yokobori, T.Yokobori, H.Nishi, I.Maekawa.
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.356, p.509-15 (May 1983). In Japanese.
Elastoplastic analysis was carried out for the corner region of a slit under compressive stress. From this analysis the ratio of work hardening coefficient H' to elastic modulus E plays an important role in the transition from the elastic stress field to the plastic stress field. The aspect ratio d/a of a slit under the elastoplastic condition affects little the stress concentration at the slit corner. But stress apart from the corner decreases rapidly when the aspect ratio decreases. (22 refs.)

101081 A model of thermo-mechanical behaviour of metals with phase changes. J.Giusti (Inst. de Recherches de la Siderurgie Francaise, Saint-Germain en Laye, France), D.Radenkovic.
Mech. Res. Commun. (GB), vol.10, no.3, p.163-9 (May-June 1983).
Presents a complete model of thermo-mechanical behaviour of metals taking into account temperature dependent elasto-plastic deformation, dilatations due to phase changes and phase transformation plasticity. The model is based on the thermodynamics of irreversible processes, the state being defined by a finite number of external and internal variables. The approach is simplified as far as possible in order to achieve a realistic description and yet to obtain a model fit for engineering analyses. The authors consider, in accordance with physical observations, that only one type of phase change at a time occurs in a given process; successive transformations can be dealt with separately. (14 refs.)

101082 Solution of the dynamical problem of viscoelastic shells. L.P.Lebedev (Sci.-Res. Inst. of Mech. & Appl. Math., State Univ., Rostov-on-Don, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.986-7 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.62-4 (Nov. 1982).
The behavior of viscoelastic shells is usually investigated in the quasistatic formulation (problem Q). The parameter ρ characterizing the inertia of a shell in dimensionless variables is very small for many materials. The dynamic problem (problem D) belongs to the class of problems having a small parameter associated with the leading derivative. Consequently, the inertia cannot always be neglected. The author derives sufficient conditions for asymptotic closeness of the solutions of the dynamic and quasistatic problems in any finite interval of time as $\rho\rightarrow0$. He also clarifies the significance of these conditions. (4 refs.)

101083 Solutions to the equations of one-dimensional viscoelasticity in BV. J.U.Kim (Lefschetz Center for Dynamical Systems, Brown Univ., Providence, RI, USA).
SIAM J. Math. Anal. (USA), vol.14, no.4, p.684-95 (July 1983).
The initial value problem associated with the equations of one-dimensional viscoelasticity of the rate type is studied. The system of equations is linearized and the solutions to the resulting linear system are completely analyzed in the L^1-setting by the method of Fourier transform. This enables one to establish the global existence of solutions to the original nonlinear system with small initial data in $L^1\cap$BV. As a by-product, one also obtains precise results on asymptotic behavior of solutions. (6 refs.)

101084 Subcritical stress state in a half-space with a fastened spherical cavity. S.B.Lobovik (Inst. of Math., Acad. of Sci., Ukrainian, SSR).
Strength Mater. (USA), vol.14, no.7, p.861-4 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.5-7 (July 1982).
It is assumed that a subcritical stress state arises in a half-space with a spherical cavity only under the influence of the force of gravity p. The stress tensor components for the subcritical state in the region about a fastened spherical cavity under the influence of uniform cubic compression are determined from a geometrically linear theory which, with regard to its terminology, corresponds to the second variant of the theory of small subcritical strains. A postulate from rock mechanics is also used. For large depths, the problem of determining the stress-strain state of a half-space with a spherical, symmetrically loaded cavity is equivalent to the problem of determining the stress-strain state of weightless half-space with a spherical cavity under the condition that forces equal to the stresses at a depth h in a body without a cavity are applied at infinity. (5 refs.)

101085 Mazing expanded principle in viscoplasticity theory. Yu.I.Kadashevich, V.S.Kleev (Leningrad Technol. Inst. of Cellulose-Paper Industry, Leningrad, USSR).
Strength Mater. (USA), vol.14, no.7, p.913-14 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.50-1 (July 1982).
It is demonstrated that the Mazing expanded principle formulated by Kul'chikhin et al. (see Probl. Prochn., no.11, p.46-8, 1979) for viscoplastic materials proceeds from the generalized theory of hardening (see Dokl. Akad. Nauk. SSSR, vol.254, no.5, p.1096-8, 1980). (7 refs.)

101086 Stability of plastic tension. G.D.Del', S.S.Oding (Voronezh Polytech. Inst., Voronezh, USSR).
Sov. Appl. Mech. (USA), vol.18, no.11, p.1023-8 (Nov. 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.11, p.86-91 (Nov. 1982).
The authors investigate the plastic tension of a body with a given law for the change in length. The buckling process, which is manifest in the form of neck formation, can be represented in this case as a continuous process of equilibrium mode change. Hence, the critical deformation at which a neck is generated can be determined by the bifurcation method. Since the strain buckling under investigation occurs for developed plastic strains and material unloading does not occur in the initial stage of neck development, the authors neglect elastic strains and take the model of a rigidly plastic material with isotropic hardening. (6 refs.)

101087 Study of high-rate deformation in hole flanging. A.G.Pashkevich, A.V.Orekhov, N.Yu.Karataeva.
Sov. Aeronaut. (USA), vol.25, no.2, p.96-101 (1982). Translation of: *Izv. VUZ Aviats. Tekh. (USSR)*, vol.25, no.2, p.79-84 (1982).
The problem of studying high-rate flanging deformation conditions is posed in connection with attempts to realize the process under superplasticity conditions. Utilization of the superplasticity effect significantly broadens the technological capabilities of the process, permitting the achievement of extremely large degrees of deformation. For example, values of the light flanging factor K_{fl}=0.1-0.06 have been achieved on the MA8 alloy which corresponds to 900% maximal hole edge relative elongation. The problem is solved under certain basic assumptions. (1 ref.)

101088 Study of regularities of viscoelastic behaviour of heat-resistant polymers in creep conditions. R.B.Banyavichyus, A.I.Barauskas, A.V.Ambrazyavichyus, A.A.Askadskii.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.7, p.1436-43 (July 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The viscoelastic behaviour of bulk heat-resistant polymers in isothermal creep conditions has been studied for polybenzoxazol. The position of temperature transitions dividing the region of the glassy state on parts with different rates of relaxational processes was found. The regions of linear and non-linear viscoelastic behaviour were determined. The fields of mechanical serviceability of bulk heat-resistant polymer in conditions of creep and stress relaxation were comparatively analysed. (9 refs.)

101089 A twelfth order theory of transverse bending of transversely isotropic plates. E.Reissner (Univ. of California, San Diego, La Jolla, CA, USA).
Z. Angew. Math. & Mech. (Germany), vol.63, no.7, p.285-9 (1983).
Motivated by the problem of the differences between stress and stress couple concentration factors for transverse bending of plates with small circular holes the author uses a variational method for the derivation of a twelfth order two-dimensional theory of transversely isotropic plates, which includes the known sixth order theory of sheardeformable plates as a special case via constitutive-coefficient specialization. It is further shown that the twelfth order system may be reduced in a nonobvious way to two simultaneous second order and two simultaneous fourth order Laplace operator equations, with this then making it possible to obtain closed form solutions for polar coordinate boundary value problems. (12 refs.)

Experiences in nonlinear shell analysis using ADINA .... See Entry 99618

Analysis of stressed state of laminate-wound cylindrical shell with friction taken into account .... See Entry 101039

Refined theory of plates for finite deflections .... See Entry 101040

A simple and effective pipe elbow element—some nonlinear capabilities .... See Entry 101052

On elastic-plastic analysis of *I*-beams in bending and torsion .... See Entry 101053

ADINA modeling of elastoplastic shear/compression waves in tubes .... See Entry 101104

Propagation of a convergent spherical stress wave in an elastic visco-plastic medium .... See Entry 101120

Fracture mechanics *J*-integral calculations in thermo-elasto-plasticity .... See Entry 101134

Elastic-plastic finite-element analysis of cracked plate under biaxial stress and its application to fatigue crack propagation .... See Entry 101143

Mechanics of composite-material failure under axial compression (plastic failure) .... See Entry 101149

Longevity of an aging viscoelastic body with a crack having a moderate tip zone .... See Entry 101151

Isochrone based mastercurves of viscoelastic functions .... See Entry 103196

Analysis of the puncture of a bisphenol-A polycarbonate disc .... See Entry 103241

Mechanical properties of composite microwires (copper-glass) .... See Entry 103249

46.30L Static buckling and instability

101090 On the analysis of creep stability and rupture. J.Walczak, J.Sieniawski (Dept. of Mech. Engng., Rzeszow Tech. Univ., Rzeszow, Poland), K.-J.Bathe.
Comput. & Struct. (GB), vol.17, no.5-6, p.783-92 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
The analysis of problems involving creep material failure and creep buckling is considered. Creep buckling analyses are presented for some columns. A finite element creep rupture analysis of a rotating disc is performed and the results are compared with other solutions. Calculations are also reported for Ti notched tensile specimens and the numerical results are compared with experimental creep investigations, in which micrographs have been taken to study the rupture mechanisms. All numerical solutions have been carried out using ADINA in which a creep-damage material law and the updated-Lagrangian-Jaumann formulation for the thermo-elastic-plastic and creep material model were implemented. (15 refs.)

101091 Surface instability of layered media at finite deformations. J.M.Chekhov.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.5, p.48-50 (1983). In Ukrainian. (9 refs.)

101092 On the use of hardness tests to estimate the extent of plastic deformation. W.J.M.Steel (Britoil, Glasgow, Scotland), J.Spence.
Strain (GB), vol.19, no.3, p.111-14 (Aug. 1983).
The standard hardness test result is dependent to some extent on the surface condition of the material being assessed. In particular, since the measurement involves permanent deformation of the surface the state of stress or strain in the material will influence the result. Consequently the hardness test may be used as an indicator of prior plastic deformation. The phenomenon of buckle propagation in undersea pipelines was considered and a theoretical model of the collapse process was developed. The model predicted the extent of the developing plastic zones around the cross-section of the collapsing pipe. Hardness measurements on the cross-sections of collapsed pipe have been used to estimate the extent of the plastic zones and comparisons with the theoretical analysis are given. (5 refs.)

101093 Stability of orthotropic multilayer cylindrical shells. K.A.Abdulkhakov, S.B.Cherevatskii.
Sov. Aeronaut. (USA), vol.25, no.2, p.49-51 (1982). Translation of: *Izv. VUZ Aviats. Tekh. (USSR)*, vol.25, no.2, p.45-7 (1982).
The authors obtain the basic system of differential equations of stability of thin circular cylindrical shells in the displacements on the basis of the relations using the hypothesis of plane sections and the assumption that the normal stresses are independent of interlayer shears. The solution of this system is sought in double trigonometric series in a form satisfying the boundary conditions in the hinged-edge-support case. (6 refs.)

101094 Some peculiarities of the buckling of ribbed cylindrical shells. S.N.Kan, Yu.I.Kaplan, V.I.Ostrovitskii.
Sov. Aeronaut. (USA), vol.25, no.2, p.63-7 (1982). Translation of: *Izv. VUZ Aviats. Tekh. (USSR)*, vol.25, no.2, p.56-9 (1982).
The authors propose a simple technique for selecting the approximating functions in the energy method for solving shell stability problems. They take as the approximating expressions a linear combination of the functions corresponding to the solutions for the simpler limiting reinforcement cases. If the components of the approximating expressions satisfy the kinematic and static boundary conditions, and also the differential equation of the problem, the solution is practically exact. If the differential equation is not satisfied but the boundary conditions are satisfied the solution error is not large. To illustrate the proposed method they examine longitudinal compression of a freely supported shell, discretely stiffened by elastic stringers, and compare the calculation results with the known solutions. (8 refs.)

On the automatic solution of nonlinear finite element equations .... See Entry 98769

Operator split methods for the numerical solution of the elastoplastic dynamic problem .... See Entry 101076

Stability of plastic tension .... See Entry 101086

Finite element analysis of 3-ply laminated conical shell for flutter .... See Entry 101107

Mechanics of composite-material failure under axial compression (plastic failure) .... See Entry 101149

46.30M Vibrations, aeroelasticity, hydroelasticity, mechanical waves, and shocks

(see also 43.40 Mechanical vibrations and shock)

101095 Free vibrations of simply supported cylindrical shells of oval cross section. V.K.Koumousis, A.E.Armenakas (Polytech. Inst. of New York, New York, NY, USA).
AIAA J. (USA), vol.21, no.7, p.1017-27 (July 1983).
A Flugge-type theory is employed in studying the dynamic characteristics of simply supported shells of oval cross section. The components of displacement are expressed in a double Fourier series of the axial and circumferential coordinates and substituted into the equations of motion. This leads to four different typical, algebraic, eigenvalue problems from which the frequencies and shapes of four types of harmonic modes are determined. These modes are either symmetric or antisymmetric with respect to the principal axes of the cross section of the shell. A comparison of the dynamic characteristics of oval cylindrical shells obtained on the basis of the Donnell, Love, Sanders, and Flugge theories is presented. It shown that the deviations in the results of these theories increase with increasing noncircularity. (17 refs.)

101096 Transverse vibrations of nonuniform rectangular orthotropic plates. J.S.Tomar, R.K.Sharma (Univ. of Roorkee, Roorkee, India), D.C.Gupta.
AIAA J. (USA), vol.21, no.7, p.1050-3 (July 1983).
Increasing use is being made of nonisotropic and nonuniform elastic plates in the design of modern missiles, space vehicles, aircraft wings, and numerous composite engineering structures. The investigation gives extensive and accurate results to study the transverse vibrations of a rectangular orthotropic plate of parabolically varying thickness. The governing differential equation of motion is obtained and solved by the Frobenius method to find the first three modes of vibration of a nonuniform rectangular orthotropic plate having different combinations of boundary conditions and for the various values of the taper parameters and length-to-breadth ratio. (4 refs.)

101097 On the propagation of a thermo-elastic plane wave in a thin infinite plate with thermal relaxation. S.G.Mondal (AKPC Mahavidyalaya, West Bengal, India), R.N.Jana.
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.4, p.235-43 (1983).
The period equation corresponding to a thermo-elastic plane wave in an infinite thermo-elastic plate with thermal relaxation has been obtained when the stressfree plane faces of the plate have been thermally insulated. This equation can be split up into symmetrical parts which in their turn can be expanded when the plate is very thin. In particular, the phase velocity-dispersion relation is obtained for such a plate in the case of a symmetrical vibration. Moreover, the phase velocity has been shown graphically and also the group velocity has been obtained in a tabular form. (3 refs.)

101098 Wave propagation in nonhomogeneous almost nonlinear thin elastic rods. W.Frydrychowicz (Inst. of Mech., Univ. of Warsaw, Warsaw, Poland), M.C.Singh.
Arch. Mech. (Poland), vol.34, no.4, p.437-54 (1982).
Wave propagation in a thin nonhomogeneous almost nonlinear elastic semi-infinite rod subjected to a time-dependent velocity impact is studied. Similarity transformations are used to transform the equation of motion and the boundary condition at the impacted end and the similarity characteristic relation is applied for locating the wave front, to obtain a similarity representa-

tion in the form of a boundary value problem. A solution of the similarity representation has been obtained in the form of power series. Restrictions on the parameters of the problem and relations among them have been determined. The stress distribution in the rod is evaluated and graphically represented. (9 refs.)

101099 Effects of sinusoidal crack-face perturbations on scattering of elastic waves. R.A.Roberts, R.J.Brind, J.D.Achenbach (Dept. of Civil Engng., Tech. Inst., Northwestern Univ., Evanston, IL, USA).
J. Nondestr. Eval. (USA), vol.2, no.3-4, p.153-9 (Dec. 1981).
The scattering of a plane longitudinal wave from a two-dimensional crack, with a sinusoidal surface perturbation whose amplitude and wavelength are much smaller than the length of the crack, is investigated. The amplitude of the cylindrical body waves in the far field are calculated from a Kirchhoff approximation that utilizes the solution to the reflection from the sinusoidal surface profile of a semiinfinite solid. The results are compared to those for a flat crack, and conditions for significant differences of the amplitude as a function of the angle of observation are discussed. Characteristic changes in the scattered field produced by profiles with different amplitudes and periods are explained. (8 refs.)

101100 Frictionless unilateral constraints and inelastic shocks. J.J.Moreau (Univ. des Sci. & Technol. du Languedoc, Montpellier, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.19, p.1473-6 (30 May 1983). In French.
The concept of a standard inelastic shock is introduced; this leads to a very consistent formulation for the dynamics of a system with frictionless unilateral constraints. (5 refs.)

101101 Dynamic response of stiffened plates to impulsive load. J.Michimoto, T.Hirowatari.
Bull. Fac. Eng. Hiroshima Univ. (Japan), vol.30, no.2, p.93-101 (Nov. 1982). In Japanese.
The vibration of stiffened plates is important for the dynamic strength of local ship structure, therefore many researches have been performed. In the paper, a study on the natural vibration and dynamic response of stiffened plates is carried out, in which analytical results are compared with experimental results. The results obtained from this study are as follows: (1) Complete vibration modes of stiffened plates are expressed as the sum of the vibration components of stiffened plates and panel between the stiffeners. And these analytical results have a good agreement with the experimental results. (2) The mode superposition technique can be applied to obtain the dynamic response of elastic stiffened plates to impulsive load. (3) The deflections in dynamic response are about 20-30% larger than the static deflections in the case than the frequency of impulsive load approaches to the lower natural frequencies of stiffened plates. (8 refs.)

101102 Fluid-structure interaction and ADINA. S.Zilliacus (David W. Taylor Naval Ship Res. & Dev. Center, Bethesda, MD, USA).
Comput. & Struct. (GB), vol.17, no.5-6, p.763-73 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
The theoretical basis of a fluid-structure interaction decoupling approximation for transient analysis of wave excited submerged structures is outlined. The approximation, called the Doubly Asymptotic Approximation (DAA) has been included in ADINA. Program modifications and additions are described. Results for two verification problems are given and discussed. It is concluded that the DAA augmented ADINA program gives satisfactory results. (10 refs.)

101103 An application of ADINA to the solution of fluid-structure interaction problems. J.Sundqvist (VBB AB, Stockholm, Sweden).
Comput. & Struct. (GB), vol.17, no.5-6, p.793-807 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
ADINA is employed to solve the lowest natural frequencies and corresponding mode shapes of a plate and turbine blade when submerged in water. Finite element solution parameters such as integration order of elements, mass matrix, flow around edges, and other modelling considerations are reported. The performance of the solution algorithms and comparisons with experimentally obtained results are also presented. The experience reported can be useful for the analysis of problems involving an elastic structure immersed in an acoustic fluid (exterior problems) and problems involving an acoustic fluid within elastic structures (interior problems). (16 refs.)

101104 ADINA modeling of elastoplastic shear/compression waves in tubes. J.M.Santiago, B.I.Shehata, H.L.Wisniewski (US Army Armament Res. & Dev. Command, Aberdeen Proving Ground, MD, USA).
Comput. & Struct. (GB), vol.17, no.5-6, p.911-21 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
Results are presented of calculations using the ADINA program to model the end-to-end impact of two identical thin-walled cylinders, with one cylinder initially spinning. After impact the ends remain engaged without slipping and nearly symmetric compression and shear waves propagate into each cylinder. Purely elastic response and elastic-plastic response assuming linear isotropic hardening are analyzed. The elastic response is compared with a membrane solution, and predictions of wave speeds and stress profiles for both shear and compression waves are found to generally agree. The plastic response is compared with the Clifton-Ting solution in which the hoop stress is neglected, and the relationship between the shear and compressive components in the plastic wave is found to be fairly well reproduced. The comparisons suggest that a more refined element modeling would reproduce the fine details of the stress waves more accurately. (15 refs.)

101105 High-frequency non-axisymmetric vibrations of elastic discs. V.V.Meleshko.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.5, p.34-8 (1983). In Ukrainian.
An exact solution of a three-dimensional problem of elasticity theory is assumed as a basis for studying a spectrum of natural frequencies of the elastic disc nonaxisymmetrical vibrations within a high frequency range. Specific peculiarities of the edge mode for such vibrations are studied. (7 refs.)

101106 Oscillation of a system with hysteretic in energy dissipation under random excitation. L.M.Rizhkov.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.5, p.41-4 (1983). In Ukrainian.
Hysteretic energy dissipation was studied for its effect on single-mass system oscillations under random excitation. (4 refs.)

101107 Finite element analysis of 3-ply laminated conical shell for flutter. P.J.Sunder, C.V.Ramakrishnan (Dept. of Appl. Mech., Indian Inst. of Technol., New Delhi, India), S.Sengupta.
Int. J. Numer. Methods Eng. (GB), vol.19, no.8, p.1183-92 (Aug. 1983).
The results of the finite element analysis of 3-ply laminated conical shells with light core for linear panel flutter are presented and certain advantages of such shells discussed. (8 refs.)

101108 The dispersion and attenuation of Love type surface waves in a frictionally bonded transversely isotropic elastic medium. P.C.Pal (Dept. of Phys. & Math., Indian School of Mines, Dhanbad, India).
Indian J. Pure & Appl. Math., vol.14, no.6, p.757-66 (June 1983).
By an approximate analytical approach the dispersion and attenuation of Love type surface waves in a transversely isotropic elastic layer bonded by Coulomb friction to a transversely isotropic elastic half-space are considered. It is found from the graphs that the dispersion curves are only slightly affected by a small amount of slip at the interface, but that the level of attenuation in the system increases considerably with the amplitude of motion. Furthermore, the results for the frequency dependence of the specific attenuation factor are in good agreement with the experimental data on the attenuation of Love waves in the Earth. (17 refs.)

101109 Propagation and reflection numerical solution of viscous-nonlinear elastic waves. D.G.Agalarov, V.I.Ismailov.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.4, p.55-7 (1982). In Russian.
The numerical solution of the centered wave propagation and reflection problem is considered under the transverse impulse following the viscous-nonlinearelastic thread of finite length. The variation of thread parameters in the fixing point is represented graphically. (3 refs.)

101110 On a method of solving the transverse vibrations equation of the two-layer beam. F.G.Maksudov, M.F.Mekhtiev, A.N.Ali-zade.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.5, p.3-6 (1982). In Russian.
An analytic solution of the vibrational problem for a two-layer beam hinged on the edges and subjected to cross concentrated impact is obtained. (3 refs.)

101111 The asymptotic analysis of dynamic problems of the theory of the elasticity for a cylinder of finite length. M.F.Mekhtiev.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.5, p.62-7 (1982). In Russian.
The vibration of the empty isotropic cylinder of finite dimensions under the subjected action of axially symmetric loadings is studied. The behaviour of the solutions of the three-dimensional problem of the theory of elasticity is examined. (2 refs.)

101112 The radial vibration of multilayer reinforced tubes. G.G.Aliev, M.R.Ataev.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.6, p.139-41 (1982). In Russian.
Offers a new statement of the problem of the radial vibration of multilayer reinforced tubes taking into account reduction and lateral compression of the beam, as well as the radial forces of inertia-reinforcing beams. For the given problem the condition of the existence of stable solutions is found. (5 refs.)

101113 On the disturbance produced by an impulsive shearing stress on the surface of a semi-infinite poro-elastic medium. P.C.Pal (Dept. of Phys. & Math., Indian School of Mines, Dhanbad, India).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.586-90 (Aug. 1983).
The disturbance produced by an impulsive shearing stress in a semi-infinite poro-elastic medium is studied here. Using the Laplace-Fourier transforms the expressions for the solid displacements in the interior as well as on the surface of the semi-infinite medium are obtained. The inversion of the Laplace and Fourier transforms is carried out following Cagniard's technique modified by Gakenheimer (1969). In the limiting case the results for the classical elastic case are also obtained. Last, the variation with the time of the solid displacements after the arrival of shear wave are exihibited graphically and the results for classical case are included for the sake of comparison. (12 refs.)

101114 Impedance profile inversion via the first transport equation. W.W.Symes (Dept. of Maths., Michigan State Univ., East Lansing, MI, USA).
J. Math. Anal. & Appl. (USA), vol.94, no.2, p.435-53 (July 1983).
The subject of this paper is the inverse reflection problem for a stratified elastic half-space. That is, a linear elastic medium, whose elastic properties depend only on depth from a planar free surface, is stimulated at $t=0$ by a plane wave impulsive source. The motion of a typical surface element is recorded for $0 \leq t \leq 2T$. It is shown that this surface trace determines the acoustic impedance of the medium as a function of travel time, to (travel-time) depth T. Moreover, the author gives a precise characterization of those functions which may appear as surface traces, and show uniqueness, existence, and continuous dependence of the logarithm of the impedance as a function of the surface trace in the Sobolev H^1 topology. (14 refs.)

101115 Vibration of a parallelogram membrane. H.F.Bauer (Fachbereich Luft- und Raumfahrttech., Hochschule der Bundeswehr Munchen, Neubiberg, Germany).
J. Sound & Vib. (GB), vol.89, no.1, p.17-30 (8 July 1983).
The approximate natural frequencies of oblique membranes have been determined for arbitrary skew angles and side ratios. The response of such a membrane to a forcing function is then obtained in a similar fashion. The lower natural frequencies have been presented for various side ratios of the membrane as a function of the skew angle and vice versa. With increasing skew angle they increase rapidly. For large skew angles the lower natural frequencies are mainly made up by those of the index $n=1$. This is especially valid for membranes of large side ratio. (13 refs.)

101116 Free vibration of beams with abrupt changes of cross-section. H.Sato (Dept. of Mech. Engng., Kanazawa Univ., Kanazawa, Japan).
J. Sound & Vib. (GB), vol.89, no.1, p.59-64 (8 July 1983).
Free vibration of a beam with large and abrupt changes of cross-section is studied. Applying the simple beam theory to such a beam results in a noticeable error in certain cases, because of overestimation of the bending stiffness at the discontinuity of the cross-section. For this problem a combined type transfer matrix method in which the finite element method is partially used is presented. As a numerical example the first natural frequencies of free-free square beams with a rectangular groove are calculated. The effects of the groove dimensions on the frequency are discussed and the results are compared with those obtained by the simple beam theory. The experimental results agree very well with the calculated ones. (5 refs.)

101117 A highly accurate analytical solution for free vibration analysis of simply supported right triangular plates. D.J.Gorman (Dept. of Mech. Engng., Univ. of Ottawa, Ottawa, Canada).
J. Sound & Vib. (GB), vol.89, no.1, p.107-18 (8 July 1983).
A new analytical technique is described for the free vibration analysis of simply supported right triangular plates. While it is seen that the basic mathematical approach is applicable to right triangular plates with various types of boundary conditions, the problem of the simply supported right triangular plate is resolved for illustrative purposes and eigenvalues are presented for the first four modes. The method employed is basically that of superposition. The governing differential equation is completely satisfied and by means

of a judicious choice of building blocks the boundary conditions are satisfied to any desired degree of accuracy. (6 refs.)

101118 Comments on 'The fundamental frequency of an elastic system and an improved displacement function' [and reply]. P.A.A.Laura, L.Ercoli, R.O.Grossi (Inst. of Appl. Mech., Puerto Belgrano Naval Base, Puerto Belgrano, Argentina), Chang Shangchow.

J. Sound & Vib. (GB), vol.89, no.1, p.135-40 (8 July 1983).

Laura et al. comment on Chang Shangchow's original paper (see ibid., vol.81, p.299, 1982), congratulating him on his interesting idea. The application of the procedure, which consists of using a sequence of displacement functions, each of which always contains a single amplitude parameter and which correspond to successively improved vibrational modes, should prove valuable in many important vibration problems. Unfortunately, when applying his technique to an axial shear vibrations situation he has not used the right governing partial differential equation. His conclusions regarding his numerical result are, apparently, incorrect. In reply, Chang Shangchow states that the improved displacement function approach appears to be useful in obtaining the special values of, or in deriving general formulae for, the fundamental frequency of elastic systems in situations where the governing differential equations are partial differential equations. The values of ΩR given in the original paper are accurate and consistent with the differential equation given there. However, this equation is not the right equation for the problem of interest. This fact leads to some incorrect comments on the related numerical results. (8 refs.)

101119 Frequencies of transverse vibrations of truncated conical cantilevers [and reply]. L.T.Niblett (Materials & Structures Dept., Royal Aircraft Establ., Farnborough, England).

J. Sound & Vib. (GB), vol.89, no.1, p.141-3 (8 July 1983).

In the development of a computer program for calculating the natural frequencies of cantilever and free-free beams the frequencies of truncated wedge and conical cantilevers were calculated and the results compared with the reference values given by Downs (ibid., vol.61, p.71, 1978). Niblett states that, in by far the majority of cases, frequencies agree to six significant figures, the stated accuracy of the Downs frequencies, excepting the occasional difference of unity in the least significant figure. However the differences are considerably larger for the fundamental frequencies of most of the truncated conical cantilevers and in one case the difference is greater than 1 in 1000. Niblett states that the frequencies given by Downs are in error. In reply, Downs states that the values of fundamental frequencies given by Niblett, which he has obtained by two independent methods achieving six significant figure agreement, most certainly do indicate that the corresponding values given by Downs are not correct to six significant figures. The assertion that the stated accuracy of the λ values was six significant figures, is however, not correct. (4 refs.)

101120 Propagation of a convergent spherical stress wave in an elastic visco-plastic medium. E.Wlodarczyk.

J. Tech. Phys. (Poland), vol.23, no.2, p.141-52 (1982).

To produce high pressure in a solid, use is made of, among other agents, the chemical energy contained in an explosive, the method of concentric spherical waves being the most effective. The pressure of the gaseous products of explosion acting on the surface of a spherical solid produces a stress (pressure) wave which undergoes cumulation in the course of its motion towards the centre. When the latter is reached, the wave is reflected and this gives an additional local increase in stress of the medium studied. The authors obtain a complete closed form solution for a problem involving concentric motion of an elastic-viscoplastic spherical body. (12 refs.)

101121 Eigenvalue approach to the longitudinal vibration of a circular cylinder coupled with a thermal field. N.C.Das, S.K.Bhattacharya, S.N.Das (Dept. of Math., Jadavpur Univ., Calcutta, India).

Mech. Res. Commun. (GB), vol.10, no.3, p.133-42 (May-June 1983).

The equations governing the longitudinal vibration of a circular cylinder coupled with a thermal field are presented in the form of a matrix differential equation and are solved by means of algebraic eigenvalue approach. The results are then compared with those in the literature. (14 refs.)

101122 A numerical method for the forced nonlinear vibration. Ock Hyun Kim, Byung Ho Lee (Dept. of Mech. Engng., Korea Advanced Inst. of Sci. & Technol., Seoul, Korea).

Mech. Res. Commun. (GB), vol.10, no.3, p.151-6 (May-June 1983).

When system dynamics includes nonlinearity and discontinuity, it is difficult to solve the steady state response of the system to excitation. In this case a method of numerical simulation has been normally used. The simulation method, however, suffers from the large amount of numerical computation needed, because the computation should be continued until steady state conditions are reached. Moreover, there is also the difficulty that the exact conditions at the point of discontinuity might be missed in digitization, which may lead to unreliable solutions. For this reason Veluswami used an analogue computer to derive the solutions for the problem of an impact pair (1975). The authors present a numerical method which may overcome the above difficulties. The method is based on the fundamental assumption that the steady-state response of the system is periodic. So that from this assumption a two-point boundary-value problem that the state values at any instant should be equal to those after one period is formulated and then solved by Waner's algorithm, because the algorithm is known to be efficient even for the systems when the governing equations are nonlinear and piecewise continuous. The method is demonstrated using some examples where solutions having the same period of excitation are derived. (5 refs.)

101123 Diffraction of elastic waves by a wedge with free boundaries. M.Papadopoulos (Claremont Graduate School, Claremont, CA, USA).

Proc. R. Soc. London Ser. A (GB), vol.388, no.1795, p.335-52 (8 Aug. 1983).

The scattering of elastic waves set up by a transient body force in the interior of an infinite wedge is investigated by transform methods when the wedge has free surfaces. Exact forms are found for those stress components which are required to vanish at the free surfaces, while the remaining, elastodynamic field components can be found by application of Green's identity. Two distinct forms of solution are found. The solution which applies to the case of diffraction by a convex wedge does not hold in the non-convex case; the correction needed to satisfy the edge condition in the anomalous case is associated with a mode transformation which is not present in the convex wedge. (7 refs.)

101124 High-frequency vibrations of shells. V.L.Berdichevskii, Le Khan' Chau (M.V. Lomonosov State Univ., Moscow, USSR).

Sov. Phys.-Dokl. (USA), vol.27, no.11, p.988-90 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.584-9 (Nov. 1982).

The equations of the theory of elastic shells can be regarded as equations obtained from the equations of the three-dimensional theory of elasticity in the long-wave approximation $h_* = h/l \to 0$, where h is the thickness of the shell and l is a characteristic spatial scale of the variation of the stressed state of the median surface (the 'wavelength'). By their structure the equations of shell theory have physical significance only for $h/l \ll 1$. On the other hand, the formulation of boundary-value problems is associated with the behavior of the corresponding differential operator at short wavelengths ($h/l \to \infty$), so that the formulation of the theory of shells involves not only the derivation of equations in the long-wave range, but also another logically independent step—the extrapolation of those equations to short waves. It is possible to carry out either trivial extrapolations, when the system of equations derived for long waves is considered for short waves without any changes, or nontrivial extrapolations, when terms that are small in the long-wave range but appreciable for short waves are introduced into the system of equations. (11 refs.)

101125 Condition of resonance with vibrations of cyclic symmetrical systems. N.P.Aleshin.

Strength Mater. (USA), vol.14, no.6, p.817-23 (June 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.6, p.88-93 (June 1982).

On the basis of the generalised results of special experiments, the author aims to find the necessary kinematic condition of maintaining the vibrations of elastic cyclic symmetrical systems (CSS) realised in the form of travelling or standing strain waves. (9 refs.)

101126 Factor causing vibrations of cyclically symmetric systems with traveling strain waves. N.P.Aleshin.

Strength Mater. (USA), vol.14, no.7, p.964-7 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.92-4 (July 1982).

The nondisappearing wave form of the circular contact belt, maintained by compressive forces, corrects the motion of elements of the same type in case there is some asymmetry between them, i.e. it controls the sequence of motions of the same type executed by the elements. In this case the elements vibrate with the same mean frequency, whereby some of them vibrate freely while the rest carry out forced vibrations. This explains the scatter of stresses in elements of the same type which (when isolated from the system) have different natural vibration frequencies. Asymmetry of the system leads to some nonuniformity of the motion of the waves along the circumference. However, this does not prevent impulses of an external force with a certain periodicity to be matched with compatible branches of the waves, and thus they can maintain vibrations with traveling strain waves. When the asymmetry of the system increases continuously, the resistance to the forced shift of the elements increases, and therefore at some instant the strain waves of the contact belt assume a fully determinate stable position on the circumference, and the motions of the elements of the same type ceases to be interrelated. (7 refs.)

101127 One approach to numerical analysis of free vibrations of thin-walled structures. Ya.M.Grigorenko, E.I.Bespalova, A.B.Kitaigordskii, A.I.Shinkar (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).

Sov. Appl. Mech. (USA), vol.18, no.11, p.986-93 (Nov. 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.11, p.40-8 (Nov. 1982).

The authors represent a generalized approach to numerical analysis of free vibrations of thin elastic shells having intricate geometrical shapes, for determination of the vibration modes and frequencies. Stratification and nonhomogeneity of the material as well as variability of the inertial properties of a shell are taken into account, as is the possibility of a shell operating over a wide range of variation of its physicomechanical characteristics. (12 refs.)

101128 Numerical analysis of wave processes in a shell-rod system. V.I.Patsyuk, G.A.Rybakova, P.F.Sabodash (Odessa Technol. Inst. of Food Industry, Odessa, USSR).

Sov. Appl. Mech. (USA), vol.18, no.11, p.1000-5 (Nov. 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.11, p.57-64 (Nov. 1982).

Proposes an efficient approach to the construction of explicit difference schemes for determining the unsteady reaction of a combined elastic shell-rod system which has a number of specific features: a stepwise variation of the wall thickness, a system of rod-waveguides parallel to the axis of the system with lumped masses rigidly attached to their ends etc. The mathematical model of the process is the hyperbolic system of Timoshenko equations for a shell, supplemented by wave equations for thin elastic rods. The laws of evolution of spatial profiles of radial displacements of points of the middle surface of the shell are investigated for the application of a continuous load to one end; the time development of the vibration process (accelerations) is studied at characteristic points on the side wall of the shell. (8 refs.)

Influence of anisotropy and contact with a liquid on the vibrations of an infinite plate driven by a point force ....See Entry 100965

Pressure impulse generated by a sphere expanding at a constant rate ....
....See Entry 100966

Shock wave in piecewise linear elastic material ....See Entry 101048

Moving load applied to a layer on an acoustic half-space ......See Entry 101061

Diffraction of SH waves by a moving crack ....See Entry 101130

Propagation of elastic waves in honeycomb panels for application to rapid inspection techniques ....See Entry 103412

46.30N Fracture mechanics, fatigue, and cracks

101129 Photoelastic determination of complex stress intensity factors for slant cracks under biaxial loading with higher-order term effects. P.S.Theocaris, C.P.Spyropoulos (Nat. Tech. Univ. of Athens, Athens, Greece).

Acta Mech. (Austria), vol.48, no.1-2, p.57-70 (1983).

The problem of a thin sheet containing a slant crack and subjected to a biaxial load is examined by giving the expressions for stresses in a series form, which are equally valid near and far ($r<2a$) from the crack tip. The progressive importance of the higher-order terms in the series representation for stresses, which were added to the singular and constant ones was demonstrated by giving the isochromatic fringe patterns near and far the crack-tip area. Based on these expressions, a photoelastic determination of the exact values of the complex stress intensity factor was given without necessitating appropriate correction factors and diagrams. The values of SIFs thus determined are valid independently of the polar angle and distance of measurements from the crack tip. (21 refs.)

101130 Diffraction of SH waves by a moving crack. B.M.Singh, R.S.Dhaliwal (Univ. of Calgary, Calgary, Alberta, Canada), J.Vrbik.

Acta Mech. (Austria), vol.48, no.1-2, p.71-9 (1983).

The problem of diffraction of anti-plane shear waves by a running crack of finite length is investigated analytically. The Fourier transform method is used to solve the mixed boundary value problem which reduces to two pairs of dual integral equations. These dual integral equations are further reduced to a pair of Fredholm integral equations of the second kind. The iterative solution of the integral equations has been obtained for small wave number. The solution is used to calculate the dynamic stress intensity factor at the edge of the crack. (6 refs.)

101131 Determination and simulation of stable crack growth in ADINA. D.Siegele, W.Schmitt (Fraunhofer-Inst. fur Werkstoffmech., Freiburg, Germany).
Comput. & Struct. (GB), vol.17, no.5-6, p.697-703 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
Stable crack growth was simulated by displacing and releasing the crack-tip nodes corresponding to the *J*-resistance curve or a discretionary measured displacement as a function of the crack elongation Δa. For the numerical determination of *J*-integral, use is made both of the line integral and of the method of virtual crack elongation. The computer simulation of fracture mechanics experiments using two-dimensional models produced a satisfactory measure of agreement. (20 refs.)

101132 Three-dimensional *J*-integral calculations of part-through surface crack problems. T.Murakami, T.Sato (Toshiba Corp., Yokohama, Japan).
Comput. & Struct. (GB), vol.17, no.5-6, p.731-6 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
In the field of nonlinear fracture mechanics, the *J*-integral is well known to play a significant role in predicting crack propagation and fracture strength. The authors develop the three-dimensional form of the *J*-integral using Eshelby's energy momentum tensor on any closed surface surrounding a crack front. Twenty-node isoparametric hexahedra elements in ADINA are used to calculate stress and strain distributions and Gaussian surface integration is used to evaluate *J*-integral values. Using the above method, the stress intensity factors are calculated for part-through surface cracks and the accuracy of these results is verified. (9 refs.)

101133 Simplified analysis of plastic and stable crack growth. S.Sakata, T.Shimizu, K.Hasegawa, S.Shida (Mech. Engng. Res. Lab., Hitachi Ltd., Tokyo, Japan).
Comput. & Struct. (GB), vol.17, no.5-6, p.757-62 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
A simplified analysis model for the initiation of stable growth and the propagation of a surface crack is proposed. Surface crack growth behaviour can be analyzed by two-dimensional finite element analysis using the simplified model. This model is applied for the estimation of the penetration load on Type 304 stainless steel plate with a part-through notch. (6 refs.)

101134 Fracture mechanics *J*-integral calculations in thermo-elasto-plasticity. H.M.Zien (Babcock & Wilcox Co., Alliance, OH, USA).
Comput. & Struct. (GB), vol.17, no.5-6, p.775-81 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
A finite element post-processor has been developed to calculate an incremental plasticity-based *J*-integral for fracture mechanics evaluations. The post-processor accounts for elastic-plastic deformations and thermal strains. The ADINA finite element computer program, with minor modifications by Babcock and Wilcox, was used with the Ramberg-Osgood stress-strain law and provides through its 'porthole' files the required results of stresses, strains, displacements, and elastic and plastic strain energies. The numerical results of the post-processor indicate that the thermal *J*-integral, which consists of a line integral for the isothermal case and an additional area integral for the thermal effect, can be considered path-independent even in the presence of plastic and thermal strains. (12 refs.)

101135 ADINA analysis of large deflections and stresses in bending fatigue specimens. J.-O.Nilsson (Steel Div. Res. & Dev. Centre, Sandviken, Sweden), M.Hehenberger.
Comput. & Struct. (GB), vol.17, no.5-6, p.865-70 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
Laboratory tests of flapper valve steel bending fatigue specimens are compared to large deflection ADINA analyses based on the nine-node shell element. Three standard thicknesses, 0.254 mm, 0.381 mm and 0.508 mm, are investigated. Both the longitudinal and the anticlastic curvatures could be brought into good agreement with experiment through proper modelling of the grip section by bakelite brick elements in sandwich form. The calculated stress maxima are observed in the specimen edge region. This result is consistent with observations that fracture initiation usually occurs in that region. (10 refs.)

101136 Analysis of surface cracks in plates and shells using the line-spring model and ADINA. M.D.German, V.Kumar, H.G.deLorenzi (Corporate Res. & Dev., General Electric Co., Schenectady, NY, USA).
Comput. & Struct. (GB), vol.17, no.5-6, p.881-90 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
The line-spring model of Rice and Levy (1972) is used in conjunction with thin shell finite elements to analyze surface cracks in plates and cylindrical shells. Implementation of the approach in the finite element code ADINA is discussed in detail. Both linear and nonlinear cases are considered. The stress intensity factor and the *J*-integral results are obtained for several example problems concerning surface cracked plates and axial and circumferential flaws in cylinders. Comparisons are made with previous work. Sensitivity of the results relative to the mesh size, integration scheme and other relevant parameters is also investigated. (27 refs.)

101137 Application of the finite method in micromechanical analyses of creep fracture problems. C.W.Lau, A.S.Argon, F.A.McClintock (Dept. of Mech. Engng., MIT, Cambridge, MA, USA).
Comput. & Struct. (GB), vol.17, no.5-6, p.923-31 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
The finite element method is applied to determine the generalized stress intensity factors for two problems fundamental in the micromechanical study of intergranular creep fracture. Special techniques to simulate multipoint constraints arising from symmetry and periodicity, and a singularity element have been developed and proved effective. The good agreements of finite element results with local field solutions are discussed. (19 refs.)

101138 Probability distributions for the strength of composite materials. IV. Localized load-sharing with tapering. R.E.Pitt, S.L.Phoenix (Sibley School of Mech. & Aerospace Engng., Cornell Univ., Ithaca, NY, USA).
Int. J. Fract. (Netherlands), vol.22, no.4, p.243-76 (Aug. 1983).
For pt.III see ibid., vol.20, p.291, (1982). Continues the study of the chain-of-bundles model for the statistical strength of composite materials by focusing carefully on the localized load redistribution in two-dimensional composites. A tapered load-sharing rule is considered which distributes the nominal load of a failed fiber among its four nearest neighbors, with the two adjacent fibers taking a greater proportion of the load. The authors consider three distinct probabilistic techniques of analysis and find that the basic probability structure for the distribution for composite strength turns out to be the same as for the idealized local load-sharing in earlier work; however, the median strength of the composite rises moderately due to the milder overloads on the fibers adjacent to breaks, while the presence of small overloads on more distant fibers has almost no effect on strength. Also, the variability in composite strength tends to decrease mildly, due to a slight increase in the critical fracture sequence size leading to catastrophic failure. (17 refs.)

101139 The elasticity problem for a thick-walled cylinder containing a circumferential crack. H.F.Nied, F.Erdogan (Lehigh Univ., Bethlehem, PA, USA).
Int. J. Fract. (Netherlands), vol.22, no.4, p.277-301 (Aug. 1983).
The elasticity problem for a long hollow circular cylinder containing an axisymmetric circumferential crack subjected to general nonaxisymmetric external loads is considered. The problem is formulated in terms of a system of singular integral equations with the Fourier coefficients of the derivative of the crack surface displacement as density functions. The stress intensity factors and the crack opening displacement are calculated for a cylinder under uniform tension, bending by end couples, and self-equilibrating residual stresses. (19 refs.)

101140 Analysis of cracks with multiple branches. W.K.Wilson (Res. & Dev. Center, Westinghouse Electric Corp., Pittsburgh, PA, USA), J.Cherepko.
Int. J. Fract. (Netherlands), vol.22, no.4, p.303-15 (Aug. 1983).
Solutions for crack tip stress intensity factors were determined by the finite element method for a wide range of branch crack configurations. In the analysis it is assumed that the length of each branch is much smaller than the length of the main crack. For a large majority of the cases analyzed, the branch region was subject to a mode I stress state (K_I). In the remaining cases a uniform stress field acting parallel to the main crack was imposed. For conditions where previous solutions were available a comparison was made. (9 refs.)

101141 Thermal stresses in an orthotropic elastic half-plane weakened by a Griffith crack. D.K.Ram (Dept. of Math., DAV Coll., Koraput, India), H.K.Parhi.
J. Math. & Phys. Sci. (India), vol.17, no.1, p.1-19 (Feb. 1983). [received: Aug. 1983]
The thermal stresses and displacements in an orthotropic semi-infinite elastic medium containing a Griffith crack are investigated. The crack is situated parallel to the free boundary at a finite distance. The plane of the crack thus divides the semi-infinite space into two domains, on one side of it is the infinite space and on the other side is a slab of finite thickness. The free edge is assumed to be at zero temperature, free from surface traction and the heat flux is prescribed on the crack surface. Also it has been assumed that the temperature, displacements, and stresses vanish at infinity and thermal conditions on the upper surface of the crack are identical with those on the lower surface. (7 refs.)

101142 Infinite row of parallel cracks in an orthotropic strip. B.Behera, A.K.Das (Dept. of Math., Regional Engng. Coll., Rourkela, Orissa, India).
J. Math. & Phys. Sci. (India), vol.17, no.1, p.51-62 (Feb. 1983). [received: Aug. 1983]
The problem of an infinite row of parallel cracks, situated symmetrically in an orthotropic strip, perpendicular to the edges has been analysed under the assumption of plain strain. Two types of boundary conditions on the side edges of the strip are considered: (1) the edges are confined between two fixed smooth rigid planes; and (2) the edges are free from stresses. The mixed boundary conditions lead to dual integral equations which are reduced to Fredholm integral equations of the second kind and the same is solved by the Fox and Goodwin method. In order to show the effect of orthotropy, a numerical study for the stress intensity factor is carried out taking the values of a fibre-reinforced composite material and some isotropic materials. (10 refs.)

101143 Elastic-plastic finite-element analysis of cracked plate under biaxial stress and its application to fatigue crack propagation. T.Hoshide (Dept. of Engng. Sci., Kyoto Univ., Kyoto, Japan), A.Yamada, K.Tanaka.
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.356, p.528-34 (May 1983). In Japanese.
The elastic-plastic deformation of a square plate with a center crack under biaxial stresses was analysed by the finite element method of plane stress. The loading conditions analysed were equibiaxial, uniaxial and shear. The values of the crack-tip opening displacement and J integral increased as the stress parallel to the crack changed from tension to compression, when compared at the same perpendicular stress. The increment under shear loading was considerably large, while the difference between the equi-biaxial and uniaxial cases was relatively small. The interrelation among the near-tip stress-strain distribution, the crack-tip opening displacement and J integral was confirmed to be characterized by the HRR type singularity field. A simple method to estimate J integral for a center-cracked plate under biaxial stresses was proposed based on the finite element analysis. The fatigue crack growth data obtained with a cruciform specimen under biaxial cyclic stresses were analysed in terms of J integral range by using the proposed method. (22 refs.)

101144 Predicting stress corrosion crack growth rates at high stress levels. II. The general yield situation. E.Smith (Metal. Dept., Univ. of Manchester Inst. of Sci. & Technol., Manchester, England).
Mater. Sci. & Eng. (Switzerland), vol.60, no.2, p.185-8 (Aug. 1983).
For pt.I see ibid., vol.55, p.97 (1982). On the assumption that the functional relationship between the crack tip opening angle (CTOA) and growth rate dc/dt is valid outside the LEFM regime, then by determining the CTOA at high stresses, it is in principle possible to predict the stress corrosion crack growth rate at high stresses. A specific model was analysed: that of an edge crack in a solid subjected to a sustained tensile stress such that yielding was extensive although contained; with this model, J increases as the crack propagates. It was concluded that high stress crack growth predictions based on the usual LEFM procedures will be non-conservative in cases where dJ/dc is positive. The earlier work is extended by examining a case where there is general yield and where *J* remains constant during crack propagation. In this case, crack predictions based on LEFM procedures are conservative. (5 refs.)

101145 One case of closure of a crack in a temperature field. V.D.Belen'kii (Rostov-on-Don Plant Affiliated Higher Tech. School, Rostov, USSR).
Sov. Mater. Sci. (USA), vol.18, no.5, p.418-21 (Sept.-Oct. 1982). Translation of: *Fiz.-Khim. Mekh. Mater. (USSR)*, vol.18, no.5, p.57-61 (Sept.-Oct. 1982).
In tension of an isotropic elastic plane with a straight crack the boundary of the latter changes to an ellipse. The author studies the question of closure of a crack by a temperature field acting in the plane. The problem arising of thermoelasticity is solved with use of a Fourier integral transformation. (7 refs.)

101146 Destruction of a metal ring subjected to pulsed loading. G.V.Stepanov (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.6, p.814-17 (June 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.6, p.85-8 (June 1982).
The proneness of material to multiple fracture depends on the degree of homogeneity of its properties, and similarly to the standard mechanical characteristics of materials, it has to be determined from the results of special tests. The authors investigate the example of the destruction of a ring upon expansion the correlation between destruction and the distribution of limit strain along the circumference of the ring at the instant of destruction.

According to the calculations the distribution is not symmetric, and its experimental determination requires a large number of experiments. (4 refs.)

101147 Dynamic stress intensity factors at the ends of two collinear longitudinal shear cracks. N.M.Borodachev, V.A.Kol'tsov (Kiev Inst. of Civil Aeronautical Engrs., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.7, p.891-5 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.31-4 (July 1982).
The effect is evaluated of frequency and mode of a harmonic load, the elastic characteristics of the material, and the length and location of the cracks on the stress intensity factors at the ends of two collinear longitudinal shear cracks. (5 refs.)

101148 Computer modeling of processes of fracture of notched fiber-reinforced composites. A.S.Ovchinskii, S.A.Savel'eva (A.A. Baikov Inst. of Metall., Acad. of Sci., Moscow, USSR).
Strength Mater. (USA), vol.14, no.7, p.945-51 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.75-80 (July 1982).
It is shown that the processes of fracture of notched composites can be examined without the application of the concepts of linear fracture mechanics. The problem is solved by the computer modeling of the process of fracture of the composite. The method includes the examination of the distribution of stresses in the composite in the area of a notch or crack. An unidirectional fiber-reinforced composite loaded with tensile forces along the fibers and containing an edge notch is examined. The presence of the notch results in the formation of a nonuniform stress field. The distribution of the stresses in the fibers is analyzed using the model, which is uniaxial because it is required to analyze the stress distribution only along one axial coordinate. It is also a volume model since the stress distribution in both intersected fibers and in adjacent fibers is examined. (11 refs.)

101149 Mechanics of composite-material failure under axial compression (plastic failure). A.N.Guz (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.11, p.970-76 (Nov. 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.11, p.21-9 (Nov. 1982).
Considers the failure mechanism of monodirectional composite material with a metallic matrix under compression along the reinforcing elements, when stability loss of the reinforcing elements appears. (7 refs.)

101150 Stress state in a strip with four adjacent circular holes. Zh.S.Erzhanov, N.I.Mironenko, T.Kh.Zhetpisov (Inst. of Seismology, Acad. of Sci., Kazakh SSR).
Sov. Appl. Mech. (USA), vol.18, no.11, p.1006-9 (Nov. 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.11, p.65-9 (Nov. 1982).
Considers a strip with four adjacent, pairwise identical and symmetrically situated circular holes. In order to solve the formulated problem the authors apply a method based on the successive application of Sherman's method and on the Fourier integral transform. The authors also present the numerical analysis of the stress state in the strip for four variants of the quantities characterizing the position and the dimensions of the holes and for three variants regarding its load. (3 refs.)

101151 Longevity of an aging viscoelastic body with a crack having a moderate tip zone. V.M.Pestrikov (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.11, p.1028-34 (Nov. 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.11, p.92-9 (Nov. 1982).
Considers the longevity of an aging viscoelastic body with a crack having a moderate degenerate plastic zone at the edges, which is modeled by the Leonov-Panasyuk-Dugdale model. The author pays special attention to determining the duration of the slow crack growth stages up to the beginning of its dynamic development. (10 refs.)

Analysis of the hexcan of a fast breeder reactor with a through crack .... See Entry 99617

Axisymmetric reinforcement of holes in orthotropic plates .... See Entry 101041

Large strain solutions of rubber components .... See Entry 101075

On the analysis of creep stability and rupture .... See Entry 101090

Determination of dynamic stress-intensity factors by holographic interferometry .... See Entry 101157

Conditions of formation and growth of mechanical twins at the tip of a dynamic crack .... See Entry 101720

The random variation of stress concentration factors in fibrous composites .... See Entry 101850

The influence of the crack tip stress field on the nucleation and growth of voids .... See Entry 101853

Mechanical properties of composite microwires (copper-glass) .... See Entry 103249

Sliding mode crack closure and mode III fatigue crack growth in mild steel .... See Entry 103258

Fracture toughness of composite adherend adhesive joints under mixed mode I and III loading .... See Entry 103275

Influence of precracking load on critical stress intensity factor of mild steel .... See Entry 103276

Fracture mechanics in the presence of electrical fields .... See Entry 103329

Experimental checking of a model for calculating the scale factor in fracture of large samples with cracks .... See Entry 103443

46.30P Friction, wear, adherence, hardness, mechanical contacts

101152 Numerical-analytical method of solving dynamic contact problems. M.D.Borodai.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.5, p.25-8 (1983). In Ukrainian.
Investigates the stress-strained state of elastic domains under unstable actions. The numerical-analytical method is proposed for solution of the contact problems. (5 refs.)

101153 The longitudinal impact on the elastic frustrum of a cone. M.Kh.Ilyasov, A.B.Ibragimov.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.5, p.47-54 (1982). In Russian.
The nonstationary boundary problem of the longitudinal impact along the elastic frustrum of a cone existing in an absolute smooth rigid stirrup is investigated. The face of the cone has a spherical surface. The normal stress, or the axial displacement as a function of time and angle are given on the face. Considering the angle of opening of the cone to be equal to $\pi/2$, the authors derive solutions of corresponding problems for the plastic half-space. The authors also examine the examples, when the dependence of the outer disturbance on time is given in the form of one function of Heavisides and sinusoids and when the time-independent radial velocity is given on the face. (2 refs.)

101154 Application of the method of forces to the solution of problems of contact interaction of nodes in structures. N.S.Galkina, V.I.Grishin, A.I.Surkov.
Strength Mater. (USA), vol.14, no.6, p.800-4 (June 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.6, p.74-7 (June 1982).
Presents an effective method of solving problems of contact interaction of elastic bodies simulating the operation of real structures; the method is based on the method of forces of structural mechanics and the finite element methods in displacements. (7 refs.)

101155 Discrete interaction of a plate with a compressed-tensioned rod. L.S.Rybakov (Moscow Aviation Inst., Moscow, USSR).
Sov. Appl. Mech. (USA), vol.18, no.11, p.1018-22 (Nov. 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.11, p.80-5 (Nov. 1982).
Studies a two-dimensional contact problem of the discrete interaction of an infinite thin plate with an infinite, homogeneous, compressed-tensioned rod through a periodic system of rivets under the condition that one of the rivets, having fractured, no longer performs its functions as a rigid connection betwen the plate and rod. With regard to the axial components (projections on the rod axis) of the reactive forces in the rivets, the problem reduces to an infinite system of linear algebraic equations. An exact solution of this system is constructed in quadratures using the Laurent transform. (6 refs.)

101156 On a generalization of the Zhukovskii-Chaplygin theory of hydrodynamic lubrication. A.A.Volkov.
Sov. Aeronaut. (USA), vol.25, no.2, p.18-21 (1982). Translation of: *Izv. VUZ Aviats. Tekh. (USSR)*, vol.25, no.2, p.18-21 (1982).
The author generalizes the hydrodynamic theory of lubrication for periodic oscillations of a journal in a bearing by solving the equations of fluid dynamics in stream functions in the Stokes approximation. (3 refs.)

Analysis of stressed state of laminate-wound cylindrical shell with friction taken into account .... See Entry 101039

On the dissipation postulate for discrete and continuum plastic systems .... See Entry 101077

Analysis of the puncture of a bisphenol-A polycarbonate disc .... See Entry 103241

46.30R Measurement methods and techniques

(see also 07.10 Mechanical instruments and techniques, 81.70 Materials testing)

101157 Determination of dynamic stress-intensity factors by holographic interferometry. H.P.Rossmanith (Inst. of Mech., Tech. Univ. Vienna, Vienna, Austria).
Opt. & Lasers Eng. (GB), vol.4, no.3, p.129-43 (1983).
A method is derived for the determination of the dynamic stress-intensity factor from isopachic fringe patterns around running crack tips obtained by double-exposure dynamic holographic interferometry. Interference patterns are analytically generated and compared with experimentally recorded isopachic interference patterns. Crack jump and boundary effects on the interference patterns are investigated in detail. (11 refs.)

101158 Characteristics of the failure analysis at quasi-static stress. E.Macherauch, H.Muller (Inst. fur Werkstoffkunde I, Univ. Karlsruhe, Karlsruhe, Germany).
Maschinenschaden (Germany), vol.56, no.3, p.86-98 (1983). In German.
Within the scope of elasticity theory the important engineering stress conditions are characterized by terms material stress/material resistance. The most important methods for determining them are discussed. The practical applicability of failure analysis is explained, taking into account the various failure hypotheses (extension, deformation energy, normal and shearing stress hypotheses), and documented by some experimental results. The influences causing failure and the basic types of failure are presented. In addition, the quantitative failure treatment—for determined and probabilistic cases—is discussed on the basis of safety coefficients. (17 refs.)

101159 Some proposals for the application of liquid crystals to photoelastic instrumentation. E.J.Hearn, B.Gorman (Dept. of Mech. & Production Engng., City of Birmingham Polytech., Birmingham, England).
Strain (GB), vol.19, no.3, p.127-9 (Aug. 1983).
Describes proposals for an application of one particular class of liquid crystal, as an optical element in a photoelastic transmission or reflective polariscope. Early results are promising and if successful they could well produce a revolution in the design of optical equipment with particular attraction to automatic systems incorporating microcomputer control. (2 refs.)

Measurement of bending loads with suspended electric strain guages .... See Entry 99090

Speckle and its application to strain sensing .... See Entry 99166

White light optical processing of speckle interferograms .... See Entry 99168

Speckle-shear interferometry with double Dove prisms .... See Entry 99169

A simple graphical method to determine the action of a system of retarders .... See Entry 100663

Effects of sinusoidal crack-face perturbations on scattering of elastic waves .... See Entry 101099

Photoelastic determination of complex stress intensity factors for slant cracks under biaxial loading with higher-order term effects .... See Entry 101129

Ill-posed and well-posed problems in inverse elastodynamic scattering for nondestructive evaluation .... See Entry 103408

Propagation of elastic waves in honeycomb panels for application to rapid inspection techniques .... See Entry 103412

Load fixture for uniform plastic deformation of single crystals .... See Entry 103440

46.60 RHEOLOGY OF FLUIDS AND PASTES

101160 On the dynamics of films of viscous and elastoviscous liquids. V.M.Entov (Inst. for Mech. Problems, Acad. of Sci., Moscow, USSR).
Arch. Mech. (Poland), vol.34, no.4, p.395-407 (1982).
The isothermal dynamics of thin liquid film is discussed. General dynamical equations are derived. The effects of complicated rheology of the liquid are accounted for. Constitutive equations of elastoviscous liquid of Maxwellian type are discussed. Stationary motions as well as small perturbations of film about its stationary position are considered. Some examples are given including the equations of capillary waves on the plane film of viscous liquid and

the growth of a thin spherical film of the elastic liquid due to internal pressure. (18 refs.)

101161 Rheological behaviour of diluted suspensions of deformable particles in simple flow. Yu.V.Pridatchenko, Z.V.Pasichnik.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.5, p.38-41 (1983). In Ukrainian.
Investigates the rheological behaviour of diluted suspensions of deformable particles. (3 refs.)

101162 Electro-Rheology, the basis of novel activators. W.G.Miller.
Funk-Tech. (Germany), vol.38, no.6, p.249-50 (June 1983). In German.
A brief report on the research and development of efficient rheological materials by J.K. Royle of Sheffield University in cooperation with Laser Engineering Ltd. Rheological liquids contain minute particles, for instance methacrylates suspended in oil, and change their viscosity drastically when high potential gradients (typically 2-4 kV/mm) at low current densities are applied. The main existing and proposed uses are in friction control, fluid clutches and flow valves. (3 refs.) *A.L.*

101163 Shear modification of polymers. A.Rudin (Guelph-Waterloo Centre, Univ. of Waterloo, Waterloo, Ontario, Canada), H.P.Schreiber.
Polym. Eng. & Sci. (USA), vol.23, no.8, p.422-30 (mid-June 1983). (Symposium on the Rheological Properties of Polymers. 65th Chemical Conference of the Chemical Institute of Canada, Toronto, Ont. Canada, 30 May-2 June 1982).
Time dependence of recovery from shear history effects in polymer liquids can be used advantageously to modify the properties of macromolecules. The net result of shearing is a reduction in elasticity and possibly in viscosity of the polymer fluid. The material may be processed subsequently in a transient, less elastic, and less viscous state if the diffusion-related rate of recovery of a more fully entangled equilibrium state is not too rapid. Shear-induced changes in entanglement density are manifested in variations in die swell, die entrance pressure losses, normal stresses, melt strength, flow defects such as melt fracture and sharkskin surfaces, haze of extruded films, application properties of coatings liquids and, other properties. Evidence for shear-modification effects is reviewed. The polymer species that are most amenable to this treatment are identified in general terms; shear modification processes that have been used are summarized. Methods for augmenting the efficiency of mechanical shear modification include addition of plasticizers, fillers, and incompletely miscible polymers. (79 refs.)

101164 Pressure dependence of Newtonian viscosity. L.A.Utracki (Industrial Materials Res. Inst., Nat. Res. Council of Canada, Montreal, Quebec, Canada).
Polym. Eng. & Sci. (USA), vol.23, no.8, p.446-51 (mid-June 1983). (Symposium on the Rheological Properties of Polymers. 65th Chemical Conference of the Chemical Institute of Canada, Toronto, Ont. Canada, 30 May-2 June 1982).
Recently, a new method of generalization of the zero shear viscosity of liquids has been proposed. The method utilizes a modified Doolittle formula and the temperature-dependent volume, as expressed by the corresponding states theory of liquids. Furthermore, the glass-transition temperature has been employed as the scaling parameter. The proposed treatment allowed prediction of the correlation between: (i) viscosity, η, and temperature, T, (ii) η and the molecular weight of polymer, (iii) η and concentration, and (iv) the combined effect of these variables. At present, the method is extended to the pressure, P, effect. Furthermore, by substituting the free volume fraction in the Doolittle formula by the theoretical 'hole fraction', a master-relation is proposed that provides means for predicting $\eta = h(T,P)$ dependence. (40 refs.)

101165 Highly elastic-constant viscosity fluids. L.Choplin (Chem. Engng. Dept., Laval Univ., Quebec, Canada), P.J.Carreau, A.Ait Kadi.
Polym. Eng. & Sci. (USA), vol.23, no.8, p.459-64 (mid-June 1983). (Symposium on the Rheological Properties of Polymers. 65th Chemical Conference of the Chemical Institute of Canada, Toronto, Ont. Canada, 30 May-2 June 1982).
The rheological properties of three types of fluids that exhibit large normal stresses are examined and compared. These fluids have a constant or nearly constant viscosity and can be used as model viscoelastic fluids, covering a range of viscosity from 0.1 to 124 Pa.s. One lubricant, Emkarox FC 31-45000, is shown to have the characteristics of a second-order fluid. Series difficulties encountered in measuring the rheological properties of the Separan-corn syrup solutions (Boger fluids) are reported. The Emkarox and solutions of polyacrylamide (Pusher 700) in mixtures of glycerine and water are proposed as better model fluids. (13 refs.)

101166 Steady-shear rheological behavior of the suspension of spherical particles in a second-order fluid. P.N.Kaloni, V.Stastna (Dept. of Math., Univ. of Windsor, Windsor, Ontario, Canada).
Polym. Eng. & Sci. (USA), vol.23, no.8, p.465-70 (mid-June 1983). (Symposium on the Rheological Properties of Polymers. 65th Chemical Conference of the Chemical Institute of Canada, Toronto, Ont. Canada, 30 May-2 June 1982).
Studies the rheological behavior of a dilute suspension of rigid spherical particles in a second-order fluid. The results of viscous fluids are extended to discuss the expression for the bulk stress tensor of a second-order fluid and also obtain an approximate solution to the shear flow problem of this fluid. By combing these results, the authors write an approximate constitutive equation for the bulk stress tensor for such a suspension and study it in a shear flow. It is found that the new equation predicts no variation in the shear viscosity, but predicts enhancement of the pre-existing non-Newtonian nature of the suspending fluid with regard to the normal stress functions. (9 refs.)

Symposium on the Rheological Properties of Polymers. 65th Chemical Conference of the Chemical Institute of Canada ....See Entry 98641

Influence of the viscoelastic properties of a liquid on the wall turbulence ....See Entry 101206

Fibrillation of the mixtures of crystallizable, amorphous and poorly crystalline polymers ....See Entry 101829

Aspects of dispersion and flow in thermoplastic-elastomer blends ....See Entry 102034

Relationship between polymerization conditions and rheological properties for styrene-acrylonitrile copolymers ....See Entry 103201

An observation on the Han-Villamizer critical pressure concept in thermoplastic foams ....See Entry 103605

47.00 FLUID DYNAMICS

(for fluid dynamics of quantum fluids, see 67.; for geophysical fluid dynamics, see 92.10; for astrophysical gas dynamics, see 95.30; for biological fluid dynamics, see 87.45)

47.10 GENERAL THEORY

(see also 03.40G Mathematical aspects)

101167 Circulation-preserving plane flows of incompressible viscous fluids. Wan-Lee Yin (School of Engng. Sci. & Mech., Georgia Inst. of Technol., Atlanta, GA, USA).
Arch. Ration. Mech. & Anal. (Germany), vol.83, no.2, p.169-84 (1983).
The method of complex variables is used systematically to investigate (generally unsteady) plane solutions of the Navier-Stokes equations. (9 refs.)

101168 The free-boundary problem for gravity-driven unidirectional viscous flows. E.O.Tuck (Appl. Math. Dept., Univ. of Adelaide, Adelaide, Australia), M.Bentwich, J.van der Hoek.
IMA J. Appl. Math. (GB), vol.30, no.2, p.191-208 (March 1983).
If a layer of viscous fluid drains steadily under gravity, while in contact with an upward-moving vertical cylinder of a general cross section with boundary C_B, its velocity $\omega(x,y)$ satisfies a Poisson equation $w_{xx}+w_{yy}=g/\nu=$constant. There are two boundaries, the given curve C_B, on which w takes a prescribed constant value, and a free boundary C_F marking the edge of the layer, whose shape the authors wish to determine. In order to do this, they need two boundary conditions on C_F; one is the zero-stress condition $\partial w/\partial n=0$, and they assume that the other is that w is constant around C_F. The latter condition is shown to be equivalent to a requirement that the volume flux in the layer is maximal. The properties of the resulting free-boundary problem are discussed, and numerical solutions obtained for some special cases. For example, a solution for the case when $_B$ is a 270° corner shows that the layer thickness at the corner is reduced to 76% of the thickness on the flat part of the boundary. The present analysis is relevant to industrial coating problems, such as edge effects in continuous galavanizing of sheet steel. (14 refs.)

101169 Flow of viscous incompressible liquid under the action of surface tension forces. K.A.Chornous.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.5, p.44-7 (1983). In Ukrainian.
Using the theory of hydrodynamic potentials the problem of viscous liquid deformation under the effect of the surface tension forces is reduced to one of solving a boundary nonlinear integro-differential equation relative to the functions which are positions of the liquid body boundary points and their rates. It is essential that the equations obtained contain no curvature and that their integral operator kernals have a comparatively simple structure. (8 refs.)

101170 Low-Reynolds-number flow past a cylindrical body. K.Tamada (Dept. of Mech. Engng., Osaka Industrial Univ., Daito, Japan), H.Miura, T.Miyagi.
J. Fluid Mech. (GB), vol.132, p.445-55 (July 1983).
Two-dimensional flow past a cylindrical body of arbitrary profile at small Reynolds numbers is studied theoretically. The asymptotic flow field at large distances from an immersed body is shown to depend only upon the force acting on the cylinder. This universal field is determined by solving the Navier-Stokes equation numerically. The result enables the authors to evaluate the force acting on the body as a function of the flow Reynolds number. A detailed calculation is made of the drag coefficients of a circular cylinder and a flat plate. Results compare favourably with existing experimental and numerical data. (19 refs.)

101171 Formation of saturated solitons in a nonlinear dispersive system with instability and dissipation. T.Kawahara (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
Phys. Rev. Lett. (USA), vol.51, no.5, p.381-3 (1 Aug. 1983).
A simple one-dimensional nonlinear equation including effects of instability, dissipation, and dispersion is examined numerically. It is observed that for the strongly dispersive case the temporal evolution is characterized by formation of a row of solitary pulses of equal equilibrium amplitudes. The width of each pulse is determined by the relative importance of the growing and the damping effects. The equilibrium amplitude increases as the dispersive effect increases. (6 refs.)

101172 Remarks on the renormalization group in statistical fluid dynamics. J.-D.Fournier, U.Frisch (Obs. de Nice, Nice, France).
Phys. Rev. A (USA), vol.28, no.2, p.1000-2 (Aug. 1983).
A variant of the renormalization group is applied to the problem of randomly forced fluids studied by Forster, Nelson, and Stephen [Phys. Rev. A 16, 732 (1977)] and others. Amplitude factors (thought to be nonuniversal by some authors) are evaluated and shown to have universal values. Comparisons with closures are made. The possibility of a breakdown of self-similarity and/or universality due to intermittency effects is discussed. (18 refs.)

A class of biharmonic end-strip problems arising in elasticity and Stokes flow ....See Entry 101050

Rayleigh-Taylor instability and the use of conformal maps for ideal fluid flow ....See Entry 101182

Mathematical modelling and analysis of the fluid dynamics of upper atmosphere dumbbell satellites ....See Entry 104638

47.15 LAMINAR FLOWS

101173 Oscillatory flow through a sharp-edged sudden contraction of a circular tube. S.Yokota, K.Nakano, T.Yamaguchi (Tokyo Inst. of Technol., Tokyo, Japan).
Bull. Res. Lab. Precis. Mach. & Electron. (Japan), no.51, p.1-9 (March 1983).
Laminar oscillatory flow of an incompressible fluid through a sharp-edge sudden contraction of a circular tube is studied. Elucidation of the dynamic behaviors of the flow is indispensable for improving the characteristics of the hydraulic components. Numerical solutions of the oscillatory flow field are obtained by an implicit finite difference method and the axial velocity profiles of the oscillatory flow superposed on a steady flow are measured by means of a laser Doppler method. The results obtained ascertain that there is good agreement. The numerical results obtained indicate that at a Reynolds number less than 800 no flow separation occurs near the sharp-edged corner of the flow field. It is also concluded that the oscillatory velocity profiles near the entrance are not dependent on the Reynolds number and frequency, but only on the axial position. (7 refs.)

101174 Stability of Couette flow between rotating cylinders lined with porous material. I. M.N.Channabasappa, G.Ranganna, B.Rajappa (Dept. of Math., Karnataka Regional Engng. Coll., Srinivasnagar, India).
Indian J. Pure & Appl. Math., vol.14, no.6, p.741-56 (June 1983).
Deals with the linear stability analysis of laminar flow between two long concentric circular rotating cylinders with nonerodable porous lining on the outer wall of the inner cylinder. Appropriate boundary conditions have been derived taking into account the nonvanishing of the disturbance velocity components at the porous boundary. The resulting sixth order boundary value eigenvalue problem has been solved numerically for the small-gap case, assuming that the marginal state is stationary. The influence of the permeability and the thickness of the porous lining as well as the radii ratio on the critical Taylor number has been established. (10 refs.)

101175 The laminar unsteady flow of a viscous fluid away from a plane stagnation point. M.J.Hommel (Dept. of Mech. Engng., Stanford Univ., Stanford, CA, USA).
J. Fluid Mech. (GB), vol.132, p.407-16 (July 1983).
The development with time of the impulsively started laminar flow of a viscous fluid away from a stagnation point is investigated. A series expansion in time is formulated for the shear stress and displacement thickness. This series expansion is obtained from a numerical solution of the full Navier-Stokes equations, and 44 terms are computed for the shear-stress series. The series is analysed and series-improvement techniques are employed to improve its convergence properties. The final series that results converges even for infinite time, and acceptable agreement with the Proudman and Johnson calculations (1962) of shear stress for steady-state flow at a stagnation point is obtained. Only 17 terms in the displacement-thickness series are reported, owing to numerical difficulties which are considerably more of an obstacle than in the shear-stress calculation. (11 refs.)

Heat transfer from partially insulated hexagonal ducts ....See Entry 101226

A boundary integral method for some laminar forced convection problems ....See Entry 101235

Finite difference representations of vorticity transport ....See Entry 101248

Numerical model for dynamic and thermal developments of a pulsed laminar ducted flow ....See Entry 101339

Hall effects on an oscillatory MHD flow in the Stokes problem past an infinite vertical porous plate. I ....See Entry 101342

Transient freezing of a liquid in a convectively cooled tube ...See Entry 101923

The meniscus on a needle—a lesson in matching ....See Entry 102122

A theoretical study of ignition in the laminar mixing layer ...See Entry 103528

47.15C Laminar boundary layers

101176 Single-and-multiple-crater induced nosetip transition. A.Todisco, B.Reeves, D.Siegelman, R.Mascola (AVCO Systems Div., Wilmington, MA, USA).
AIAA J. (USA), vol.21, no.7, p.939-40 (July 1983).
Experiments were conducted at a Mach number of 5 to assess the effect of simulated weather impact craters on nosetip boundary-layer transition. The program treated single craters and patterns of multiple elliptical craters of various depth, ellipticity, and azimuth angle. Test results confirm predictions that craters of the order of from 0.05 to 0.64 mm (2 to 25 mil) depth induce nosetip boundary-layer transition. Results obtained from backface thermocouple measurements show the influence of crater parameters on local transition Reynolds numbers, Re_k and Re_θ transition criteria for craters are compared to criteria for protuberance roughness. (3 refs.)

101177 Laminar free convection on a vertical nonisothermal plate with vigorous blowing. V.M.Eroshenko, L.I.Zaichik, V.A.Pershukov (G.M. Krzhizhanovskii Sci.-Res. Energy Inst., USSR).
J. Eng. Phys. (USA), vol.43, no.6, p.1331-4 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.6, p.909-13 (Dec. 1982).
Asymptotic solutions are obtained for the equations of a dynamically similar boundary layer in the case of natural convection on a vertical nonisothermal plate with vigorous blowing. (6 refs.)

101178 Note on derivation of the boundary layer equations with account for blowing. V.G.Pavlov.
Sov. Aeronaut. (USA), vol.25, no.2, p.22-5 (1982). Translation of: *Izv. VUZ Aviats. Tekh. (USSR)*, vol.25, no.2, p.21-5 (1982).
The authors discuss the influence of 'weak' and 'strong' blowing on a viscous incompressible fluid flow model. (1 ref.)

101179 Numerical solution of stationary problems of viscous incompressible fluid flow. V.A.Prusov.
Sov. Aeronaut. (USA), vol.25, no.2, p.26-31 (1982). Translation of: *Izv. VUZ Aviats. Tekh. (USSR)*, vol.25, no.2, p.25-30 (1982).
The author examines the question of reducing the class of boundary-value problems with one dominant direction of viscous incompressible fluid flow to an evolutionary initial-boundary value problem. He introduces functions which reduce the order of the Navier-Stokes (Reynolds) differential equations and transform the elliptic-type equations to quasihyperbolic. (6 refs.)

101180 The influence of a laminar boundary layer and laminar injection on film cooling performance. R.J.Goldstein (Dept. of Mech. Engng., Univ. of Minnesota, Minneapolis, MN, USA), T.Yoshida.
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.355-62 (May 1982).
Measurements are reported of the film cooling effectiveness and heat transfer following injection of air into a mainstream of air. A single row of circular injection holes inclined at an angle of 35 deg is used with a lateral spacing between the holes of 3 dia. Low Reynolds number mainstream and injection flow permit studying the influence of a laminar approaching boundary layer and laminar film coolant flow. Measurements of the surface heat transfer taken with no injection indicate that the hole openings can effectively trip the laminar boundary layer into a turbulent flow. The type of the approaching boundary layer has relatively little influence on either the adiabatic effectiveness or the heat transfer with film cooling. The importance of the nature of the injected flow on film cooling performance can at least be qualitatively explained by the differences in the transport mechanisms and in the penetration of the injected air into the mainstream. (25 refs.)

Stability of preseparation boundary layer on the leading edge of a thin airfoil ....See Entry 101200

An algorithmic approach to the linear stability of the Ekman layer ....See Entry 101203

The boundary layer regime in a porous layer with uniform heat flux from the side ....See Entry 101221

Forced convective heat transfer in the entrance region of a parallel plate channel ....See Entry 101225

Effect of variable thermophysical properties of a viscous liquid on flow around and heat transfer from a cylinder in turbulent cross flow ......See Entry 101234

Practical use of Hamilton's principle ....See Entry 101250

Similar solutions of the compressible boundary layer on a spinning cylinder in axial flow ....See Entry 101272

Unicity of the polynomial representation of the integral quantities of a compressible boundary layer on a spinning cylinder in axial flow ....See Entry 101273

Laminar entry length problem for power law fluids ....See Entry 101289

Flow of a non-Newtonian fluid in a convergent channel in a transverse magnetic field ....See Entry 101290

Influence of acoustics and the flow regime in the boundary layer on nozzle walls on the mixing layer of an immersed jet ....See Entry 101301

Plane channel flows with surface mass transfer and velocity slip on moving walls ....See Entry 101333

47.15F Stability of laminar flows

101181 Further experiments on shock tube wall boundary-layer transition. M.J.Chaney, W.J.Cook (Iowa State Univ., Ames, IA, USA).
AIAA J. (USA), vol.21, no.7, p.1046-8 (July 1983).
There have been numerous reports supporting the concept that environmental disturbances cause laminar-to-turbulent transition in unsteady shock-tube wall boundary layers in a Reynolds number regime where the laminar boundary layers is theoretically stable. Experimental data is presented of the effects on transition of environmental disturbance which originate during the shock-tube driving process. (6 refs.)

Single-and-multiple-crater induced nosetip transition ....See Entry 101176

47.20 HYDRODYNAMIC STABILITY

101182 Rayleigh-Taylor instability and the use of conformal maps for ideal fluid flow. R.Menikoff, C.Zemach (Theoretical Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
J. Comput. Phys. (USA), vol.51, no.1, p.28-64 (July 1983).
Potential theory permits ideal fluid dynamics to be formulated in terms of boundary motion. In two dimensions, the flow can then be found using conformal mapping. The evolution of some Rayleigh-Taylor instabilities is calculated well into the large amplitude nonlinear regime. The Rayleigh-Taylor calculation for Atwood ratio unity is used as a prototype for a system of theoretical and numerical techniques exploiting complex variable-theory and high-order quadrature methods. (15 refs.)

101183 A note on the stability of low-Prandtl-number Hadley circulations. J.Hart (Dept. of Astrogeophys., Univ. of Colorado, Boulder, CO, USA).
J. Fluid Mech. (GB), vol.132, p.271-81 (July 1983).
Discusses the stability of the flow of a low-Prandtl-number liquid contained in a shallow slot with differentially heated vertical endwalls. The effect of thermally insulating boundaries at the top and bottom of the container on wavelength selection is emphasized. Stability calculations indicate that, for Prandtl number Pr in the range $0.015<Pr<0.27$, the first perturbations to grow are overstable (oscillatory) longitudinal rolls with axes perpendicular to the endwalls, and with very large cross-stream wavelengths of about 9 to 15 layer depths. Previous studies using thermally conducting boundaries predict critical wavelengths of about three layer depths. The new results are in substantial agreement with an experiment using a differentially heated layer of mercury with aspect ratio (depth/length) 0.047 in both horizontal directions. The implications of the long-wavelength instability for the interpretation of thermal oscillations observed in other smaller-aspect-ratio configurations is discussed. (7 refs.)

101184 A spanwise structure in the plane shear layer. J.Jimenez (IBM Sci. Center, Madrid, Spain).
J. Fluid Mech. (GB), vol.132, p.319-36 (July 1983).
The author studies experimentally the spanwise structure of the mean flow field of a plane shear layer. The field is dominated by a lateral undulation that persists downstream to form long longitudinal structures. Both the amplitude and spacing of these structures vary in such a way as to suggest that they are due to a secondary instability of the flow field. Some models for this instability are discussed and compared with the experimental results. (23 refs.)

101185 Stability of a film flowing down along an oscillating surface. V.I.Baikov, A.T.Listrov, Z.A.Shabunina (A.V. Lykov Inst. of Heat & Mass Transfer, Acad. of Sci., Minsk, Belorussian SSR).
J. Eng. Phys. (USA), vol.43, no.6, p.1413-18 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.6, p.1006-12 (Dec. 1982).
The linear approximation for a harmonically oscillating surface is used to obtain the condition of flow stability for a liquid film. (4 refs.)

101186 Generation of a countable set of homoclinic flows through bifurcation. P.Gaspard (Faculte des Sci., Univ. Libre de Bruxelles, Brussels, Belgium).
Phys. Lett. A (Netherlands), vol.97A, no.1-2, p.1-4 (8 Aug. 1983).
A class of three-variable nonlinear differential equations possessing a homoclinic orbit is considered. It is shown that a countable set of perturbed flows, each containing a homoclinic orbit which crosses twice any surface transverse to the original homoclinic orbit, is generated through bifurcation. (9 refs.)

Stability of Couette flow between rotating cylinders lined with porous material. I ....See Entry 101174

Effect of a change of the turbulent structure of a flow on unsteady heat exchange upon heating of gases and liquids in pipes ....See Entry 101197

An algorithmic approach to the linear stability of the Ekman layer ....See Entry 101203

Growth of fluctuations near the Benard-Marangoni convective instability ....See Entry 101210

Instabilities of dynamic thermocapillary liquid layers. I. Convective instabilities ....See Entry 101231

Effects of slowly varying depth and current on the evolution of a Stokes wavepacket ....See Entry 101262

Calculation of three-dimensional transonic gas flow through a stage of an axial turbine ....See Entry 101278

A self-similar flow behind a spherical shock wave with thermal radiation. I ....See Entry 101282

Instabilities in the slit-jet flow field ....See Entry 101303

Hydrodynamics of a subsonic vapor jet in subcooled liquid ...See Entry 101308

An unsteady Faxen's relation for the force including interaction effects (two-phase flow) ....See Entry 101311

On the motion of gas bubbles in a perfect fluid ....See Entry 101312

Steady and unsteady regimes of flow of a multicomponent sorbable mixture through porous media ....See Entry 101326

Features of two-phase flow in long channels ....See Entry 101335

Temperature-gradient-driven electrohydrodynamic instability with unipolar injection in air ....See Entry 101346

Critical fluctuations in a thermo-chemical instability ....See Entry 101356

Principal electro-hydrodynamic instability types in nematic liquid crystals ....See Entry 101544

47.25 TURBULENT FLOWS, CONVECTION, AND HEAT TRANSFER

101187 Viscous flow in corner regions with a moving wall and leakage of fluid. J.Riedler (Gebruder Sulzer AG, Winterthur, Switzerland), W.Schneider.
Acta Mech. (Austria), vol.48, no.1-2, p.95-102 (1983).
The present work concerns the slow motion of a viscous fluid near a corner of plane rigid walls. The flow is mainly caused by the in-plane motion of one of the walls, but it can also be effected by a mass source or sink due to leakage at the wall intersection. Such flows are of considerable practical interest as they locally appear at the edge of a blade used to scrape up liquid from a surface, in a cylinder with a moving piston, or in a screw extruder. (10 refs.)

101188 A theory for flow separation. W.S.Vorus (Dept. of Naval Architecture & Marine Engng., Univ. of Michigan, Ann Arbor, MI, USA).
J. Fluid Mech. (GB), vol.132, p.163-83 (July 1983).
The author proposes a high-Reynolds-number theory for the approximate analysis of timewise steady viscous flows. Its distinguishing feature is linearity. But it differs fundamentally from Oseen's (1910) well-known linear theory. The theory is developed for a 2-dimensional body moving through an infinite incompressible fluid. The velocity-vorticity formulation is employed. A boundary integral expressing the body contour velocity is written in terms of Green functions of the approximate governing differential equations. The boundary integral contains three unknown boundary distributions. These are a velocity source density, the boundary vorticity, and the normal gradient of the boundary vorticity. The unknown distributions are determined as the solutions to a boundary-integral equation formed from the velocity integral by the prescription of zero relative fluid velocity on the body boundary. (5 refs.)

101189 Resistance and stability of a line of particles moving near a wall. S.L.Goren (Dept. of Chem. Engng., Univ. of California, Berkeley, CA, USA).
J. Fluid Mech. (GB), vol.132, p.185-96 (July 1983).
Corrections to Stokes' law are determined to first order in a/b and a/h for a sphere of radius a in a one-dimensional array of identical spheres having centre-to-centre-spacing b and translating a distance h from a no-slip wall. When h/b is small the drag is greater than that given by Stokes's law; as h/b increases, the drag generally decreases and becomes less than that given by Stokes' law. Stability of the array is examined. Motion along the line of centres is found to be stable, but the other two motions are unstable. The wall is a stabilizing influence when motion is toward the wall and a destabilizing influence when motion is away from the wall. For motion parallel to the wall, the presence of the wall shifts the region of maximum stability to smaller wavelengths. Crowley's (1977) results, which neglect any influence of the wall, are approached for h/b greater than about 5. (10 refs.)

101190 Transition of Taylor-Gortler vortex flow in spherical Couette flow. K.Nakabayashi (Dept. of Mech. Engng., Nagoya Inst. of Technol., Nagoya, Japan).
J. Fluid Mech. (GB), vol.132, p.209-30 (July 1983).
The critical Taylor number, phenomena accompanying the transition to turbulence, and the cellular structure of Taylor-Gortler vortex in the flow between two concentric spheres, of which the inner one is rotating and the outer is stationary, are investigated using three kinds of flow-visualization technique. The critical Taylor number generally increases with the ratio β of clearance to inner-sphere radius. For $\beta \leq 0.08$, the critical Taylor number in spherical Couette flow is smaller than in circular Couette flow, but vice versa for $\beta > 0.08$. A pair of toroidal Taylor-Gortler vortices occurs first around the equator at the critical Reynolds number R_{ec} (or critical Taylor number T_c). More Taylor-Gortler vortices are added with increasing Reynolds number R_e. After reaching the maximum number of vortex cells, as R_e is increased, the number of vortex cells decreases along with the various transition phenomena of Taylor-Gortler vortex flow, and the vortex finally disappears for very large R_e, where the turbulent basic flow is developed. The instability mode of Taylor-Gortler vortex flow depends on both β and R_e. The vortex flows encountered as R_e is increased are toroidal, spiral, wavy, oscillating (quasiperiodic), chaotic and turbulent Taylor-Gortler vortex flows. (15 refs.)

101191 On the prediction of pipe freeze-shut in turbulent flow. M.Epstein (Fauske & Associates Inc., Willowbrook, IL, USA).
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.381-4 (May 1982).
Solidification in steady, turbulent pipe flow with a constant, uniform wall temperature has been analyzed as an entrance region problem both by Shibani and Ozisik (1977) and by Thomason, et al. (1978). By ignoring the thermal entrance region, known to be short for highly turbulent flow and Prandtl numbers above ~0.5, the authors obtain a simple, asymptotic closed-form solution for the problem and use it to predict the conditions for the onset of freeze-shut in a pipe containing turbulent water flow. The observations of Gilpin (1979) of the development of ice waves in internal solidification are used to fix the limitations of the authors results. (7 refs.)

The Taylor-Green vortex: fully developed turbulence and transition to spatial chaos ....See Entry 101256

Energy characteristics of cylindrical induction pumps at large R_m numbers ....See Entry 101351

47.25C Isotropic turbulence

101192 Turbulence modeling for computational aerodynamics. J.G.Marvin (NASA Ames Res. Center, Moffett Field, CA, USA).
AIAA J. (USA), vol.21, no.7, p.941-55 (July 1983).
During the last decade advances in computational aerodynamics have increased the ability to compute more complex flows and the burden of establishing limits of applicability for turbulence modeling has increased proportionately. For those unfamiliar with the progress and direction of the modeling of external flows, the paper provides a perspective from which to view further developments certain to come in the next decade. For those entering the field of computational aerodynamics and who are interested in using various models in their computations, it provides a basis of reference and, it is hoped, help them avoid unnecessary difficulties. For those active in the field, it should simply reinforce what they already know about the problems of modeling, although it may also suggest some new ways to view combined computational and experimental investigations. (110 refs.)

101193 Constraints on the invariant functions of axisymmetric turbulence. E.J.Kerschen (General Electric Co., Schenectady, NY, USA).
AIAA J. (USA), vol.21, no.7, p.978-85 (July 1983).
Constraints are derived for the two invariant functions Q_1 and Q_2 that occur in Chandrasekhar's development of the axisymmetric turbulence theory. These constraints must be satisfied for the correlation tensor derived from Q_1 and Q_2 to be that of a stationary random process, i.e. for the turbulence to be realizable. The equivalent results in spectrum space are also developed. Applications of the constraints in aerodynamic noise modeling are discussed. It is shown that significant errors in prediction can be introduced by the use of turbulence models which violate the constraints. (24 refs.)

101194 Numerical investigation of 'lateral' interaction with an obstacle of an axisymmetric jet exhausting into vacuum. N.S.Mironchuk, N.E.Khramov.
Fluid Dyn. (USA), vol.17, no.6, p.855-9 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza,* vol.17, no.6, p.49-54 (Nov.-Dec. 1982).
The problem of the interaction of a strongly underexpanded axisymmetric jet with an obstacle for which the normal to the surface makes an angle near $\pi/2$ with the jet axis is rather laborious for numerical solution due to the high disequilibrium of the gas-dynamic parameters in the peripheral part of the jet and the three-dimensional nature of the flow in the interaction region. The authors study the case when a jet exhausts into vacuum and in front of the obstacle there is a detached shock wave, behind which there is mixed subsonic and supersonic three-dimensional flow. (10 refs.)

101195 Tests of subgrid models in the near-wall region using represented velocity fields. Y.Kaneda, D.C.Leslie (Dept. of Nuclear Engng., Queen Mary Coll., London, England).
J. Fluid Mech. (GB), vol.132, p.349-73 (July 1983).
The 2.5-dimensional model of the turbulent field near a wall, proposed by Hatziavramidis and Hanratty (1979) and modified by Chapman and Kuhn (1981), has been used to test the subgrid models of Schumann (1973, 1975) and Moin and Kim (1982). The results are disquieting, both trends and orders of magnitude sometimes being seriously in error. It also appears that the contribution of the subgrid energy to the pseudopressure calculated in large-eddy simulations can be large, although this contribution is usually neglected. On the positive side, Leonard's model for the Leonard stress is extremely good, and Schumann's synthetic boundary condition is also found to be reliable. (19 refs.)

101196 Time-dependent density profiles in a filling box. M.G.Worster, H.E.Huppert (Dept. of Appl. Maths. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
J. Fluid Mech. (GB), vol.132, p.457-66 (July 1983).
An approximate analytic expression for the time-dependent density profile formed by a turbulent buoyant plume in a confined region is presented. The analysis is based on the approximation that the density of the fluid behind the first front changes at a rate which is virtually independent of position. The approximate expression is shown to be in excellent agreement with a full numerical integration of the governing equations. (8 refs.)

101197 Effect of a change of the turbulent structure of a flow on unsteady heat exchange upon heating of gases and liquids in pipes. G.A.Dreitser (Sergo Ordzhonikidze Moscow Aviation Inst., Moscow, USSR).
J. Eng. Phys. (USA), vol.43, no.6, p.1320-6 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR),* vol.43, no.6, p.898-905 (Dec. 1982).
Presents the results of experimental investigations of the unsteady heat exchange upon heating of gases and liquids and of the change in heat liberation from the pipe walls, as well as of the generalization of the experimental data which confirm the model of the effect of a change in the turbulent structure of the flow on the heat exchange. (8 refs.)

101198 Turbulent flow in an axially rotating pipe (effect of inlet swirl). M.Murakami, K.Kikuyama, K.Nishibori (Dept. of Mech. Engng., Nagoya Univ., Nagoya, Japan), O.Kito.
Mem. Fac. Eng. Nagoya Univ. (Japan), vol.34, no.2, p.284-92 (Nov. 1982).
The effect of the inlet swirl on the flow in an axially rotating pipe was investigated experimentally. The tangential component of velocities given by a honeycomb located at the pipe inlet shows a forced vortex type profile and the axial velocity component is approximately in a fully developed turbulent flow pattern. The tangential velocity profile, which exhibits a forced-vortex one, is deformed into a concave type, and the axial velocity profile becomes more convex as the flow goes downstream. The velocity profiles in this rotating pipe are also compared with those obtained without the inlet honeycomb. By use of a visualizing method the stabilizing effect of the pipe rotation on the flow is confirmed to be more remarkable in the pipe without the inlet honeycomb. (3 refs.)

Spectral analysis of the thermal field in an axisymmetric turbulent plume ....See Entry 101207

Investigation of heat transfer behind an oscillating grid ....See Entry 101222

Comments on 'The effect of subchannel shape on heat transfer in rod bundles with axial flow' ....See Entry 101228

Turbulent flow with polymer additives ....See Entry 101291

Experimental study of velocity and scalar fields in grid-generated turbulence with dilute polymer solutions ....See Entry 101292

Discharge of a turbulent jet in a monodisperse fluidized bed ....See Entry 101304

Simulation of two-dimensional turbulence in a planar channel ....See Entry 101336

Influence of turbulence on the formation of high nonequilibrium concentrations of atoms and free radicals in diffusion flames ....See Entry 103526

A resonant test-field model of gravity waves ....See Entry 104376

47.25F Boundary layer and shear turbulence

101199 Two-scale semiempirical theory of turbulent boundary layers and jets. N.I.Akatnov.
Fluid Dyn. (USA), vol.17, no.6, p.827-34 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza,* vol.17, no.6, p.17-25 (Nov.-Dec. 1982).
To characterize the turbulence of boundary layers in the energy-bearing interval of wave numbers several turbulence scales are sometimes used. It is shown that the introduction of a second scale makes it possible to take into account the interaction of shear layers in flows with two shear layers (for example, a channel or jet), and also to take into account the influence of turbulence of

an external flow on a boundary layer. The interaction of shear layers is taken into account in theories containing a transport equation for the turbulent frictional stress τ_t, in which the essence of the interaction reduces to diffusion of τ_t from layer to layer. A predominant volume interaction effect is assumed which takes the form of a difference between the interaction of large-scale vortices with a shear deformation motion in flows with one and two shear layers, and also in the presence of turbulence in an external flow. (29 refs.)

101200 Stability of preseparation boundary layer on the leading edge of a thin airfoil. A.I.Ruban.
Fluid Dyn. (USA), vol.17, no.6, p.860-7 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.6, p.55-63 (Nov.-Dec. 1982).
The author studies the stability of the boundary layer on the leading edge of a thin airfoil in a flow of incompressible fluid. The case when the angle of attack of the airfoil relative to the oncoming flow differs little from the critical value is considered. (24 refs.)

101201 Mass transfer across a sheared, wavy air-water interface. Y.Cohen (Dept. of Chem. Engng., Univ. of California, Los Angeles, CA, USA).
Int. J. Heat & Mass Transfer (GB), vol.26, no.9, p.1289-97 (Sept. 1983).
The influence of surface motion on liquid phase controlled mass transfer is reviewed. The influence of surface waves and water drift current on air-water exchange was explored theoretically and experimentally, in a laboratory wind-wave facility. The results were analyzed by a surface renewal model. It was found that capillary waves contributed significantly to the enhancement of mass transfer rates at low water friction velocities (for $U_w^* \lesssim 1.5$ cm s^{-1}). At higher friction velocities, the rather spectacular increase in mass transfer was associated primarily with the turbulent water drift current. A convenient correlation is proposed for the liquid phase mass transfer coefficient with the water side friction velocity as the only hydrodynamic parameter. (46 refs.)

101202 Scaling of the bursting frequency in turbulent boundary layers. R.F.Blackwelder, J.H.Haritonidis (Dept. of Aerospace Engng., Univ. of Southern California, Los Angeles, CA, USA).
J. Fluid Mech. (GB), vol.132, p.87-103 (July 1983).
The bursting frequency in turbulent boundary layers has been measured over the Reynolds-number range $10^3 < U_\infty\theta/\nu < 10^4$. When scaled with the variables appropriate for the wall region, the non-dimensional frequency was constant independent of Reynolds number. A strong effect of the sensor size was noted on the measured bursting frequency. Only sensors having a spatial scale less than twenty viscous lengthscales were free from spatial-averaging effects and yielded consistent results. The spatial-resolution problem was apparently the reason for erroneous results reported in the past. (31 refs.)

101203 An algorithmic approach to the linear stability of the Ekman layer. M.V.Melander (Inst. for Numerical Analysis, Tech. Univ. of Denmark, Lyngby, Denmark).
J. Fluid Mech. (GB), vol.132, p.283-93 (July 1983).
The linear stability of the stationary Ekman-layer flow near a plane boundary is considered. Analytical formulas for the eigenfunctions are derived by a spectral analysis. Standard optimization algorithms are used to calculate critical points, maximum growth rates and neutral-stability curves. The new approach provides a better basis for both a linear and a nonlinear stability analysis than the well-known methods have done. The method may also be applied to other boundary-layer problems. (7 refs.)

101204 Numerical calculations of a convective-dispersion equation in shear flow by method of shifting particles. K.Momii, K.Jinno (Dept. of Civil Engng. Hydraulics & Soil Mech., Kyushu Univ., Fukuoka, Japan).
Mem. Fac. Eng. Kyushu Univ. (Japan), vol.43, no.1, p.55-68 (March 1983).
The method of shifting particles is applied to the computations of a convective-dispersion equation in a shear flow. The effectiveness of this method is confirmed by the comparisons of numerical results with analytical solutions to the idealized model for turbulent shear flow. Since this method can consider the local variation of velocity in a flow field in the numerical computation, it is concluded that this method can accurately estimate not only the temporal variation of the longitudinal dispersion coefficient but also the spatial distribution of concentration. In addition to the above analysis, the authors also calculate the dispersion process in an actual turbulent shear flow. The effects of the viscous sublayer are discussed through these analytical and numerical results. It is concluded that the viscous sublayer offers the principal resistance to diffusion in a turbulent shear flow and the contribution of the viscous sublayer to the longitudinal dispersion coefficient increases with the increase in resistance to diffusion of the viscous sublayer. (10 refs.)

101205 Similarity solutions of free shear flows with mean Reynolds stress turbulence models. P.E.Wood, L.G.Leal (California Inst. of Chem. Engng., Pasadena, CA, USA).
Numer. Heat Transfer (USA), vol.6, no.2, p.235-44 (April-June 1983).
The authors present a numerical method for the calculation of free shear flows, using the governing mean Reynolds stress equations in their similarity form. Because the governing equations are nonlinear diffusion equations, and the diffusion coefficient is zero at the edge of the flow, the solutions are not analytic everywhere. Hence the solutions are confined to a finite region of the similarity variable space and it is necessary to calculate the width of this region as an eigenvalue as part of the solution. The calculation scheme is illustrated by using the plane turbulent jet. The authors also calculated the plane wake with a variety of models. Perhaps the most important feature of the present calculation scheme is that whole families of solutions for each flow can be determined for various values of the model parameters by using analytic continuation. Thus the sensitivity of the solution to changes in the parameters can be determined quickly, easily, and at a great savings in computation time. This makes the present approach ideally suited for model testing. (17 refs.)

101206 Influence of the viscoelastic properties of a liquid on the wall turbulence. V.N.Pilipenko, G.V.Kireiko (Sci.-Res. Inst. of Mech., M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.911-13 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.578-83 (Nov. 1982).
The authors use the monoharmonic model of the wall turbulence, which takes into account the three-dimensional character of the motion of the liquid, to examine the effect of the viscoelastic properties on the fluctuational and averaged characteristics of the flow. Calculations are done for the flow of liquids having Maxwellian or Oldroyd equations of state and different types of time derivatives. They discuss the questions of how the elasticity of the liquid and the behavioral features in a flow with longitudinal extension influence the reduction of the turbulent drag. (7 refs.)

Single-and-multiple-crater induced nosetip transition ....See Entry 101176

Note on derivation of the boundary layer equations with account for blowing ....See Entry 101178

Numerical solution of stationary problems of viscous incompressible fluid flow ....See Entry 101179

The boundary layer regime in a porous layer with uniform heat flux from the side ....See Entry 101221

Effect of variable thermophysical properties of a viscous liquid on flow around and heat transfer from a cylinder in turbulent cross flow ......See Entry 101234

Natural convection from a horizontal cylinder—turbulent regime ....See Entry 101239

Practical use of Hamilton's principle ....See Entry 101250

Analysis of viscous-inviscid interaction in transonic internal flows ....See Entry 101276

Investigation of two plane parallel jets ....See Entry 101297

Influence of acoustics and the flow regime in the boundary layer on nozzle walls on the mixing layer of an immersed jet ....See Entry 101301

Heat and mass transfer by condensation in an incompressible turbulent boundary layer on a flat plate with low level exchange ....See Entry 101313

47.25J Turbulent diffusion

101207 Spectral analysis of the thermal field in an axisymmetric turbulent plume. J.-M.Agator, Doan-Kim-Son (Lab. de Thermique, ENSMA, Poitiers, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.15, p.1119-22 (25 April 1983). In French.
Temperature fluctuation spectra are determined on the axis of an axisymmetric turbulent thermal plume. The high frequencies region of the spectrum is found to be associated with the n^{-3} spectral law, introduced by Lumley, where n is the temperature fluctuation frequency. However, this law was observed in a restricted part of the flow. (15 refs.)

Heat and mass transfer by condensation in an incompressible turbulent boundary layer on a flat plate with low level exchange ....See Entry 101313

Dispersal by randomly varying currents ....See Entry 104400

47.25M Noise (turbulence generated)

101208 Derivation of the fundamental equation of sound generated by moving aerodynamic surfaces. H.R.Aggarwal (Univ. of Santa Clara, Santa Clara, CA, USA).
AIAA J. (USA), vol.21, no.7, p.1048-50 (July 1983).
The author generalizes Lowson's (1965) concept of moving point singularities to moving surface singularities and gives a new derivation of the fundamental equation. The present derivation is based on topological considerations of the underlying space, the fluid medium, and the integral properties of the Dirac delta function. It is simple, direct, physical, and instructive. (6 refs.)

101209 Problems in flow acoustics. W.Mohring, E.-A.Muller, F.Obermeier (Univ. Gottingen, Gottingen, Germany).
Rev. Mod. Phys. (USA), vol.55, no.3, p.707-24 (July 1983).
The research field 'flow acoustics' is defined, and problems of current interest are discussed. The physical interpretation of fluid-mechanical sound sources for an acoustic medium, both at rest and in motion, is addressed. In the first case, it has been possible to relate the sound pressure field for low Mach numbers to sound sources that depend linearly on velocity; progress has been achieved by means of the causality correlation method with application of laser-Dopper velocity measurements. In the theory of the acoustic medium in motion, it has been found that vortices downstream from a nozzle discharge can function as sound sinks; for a unidirectional mean flow, conditions for the sound sources are developed on the basis of the causality principle and the boundedness of the flow quantities. Experimental and theoretical results for flowfield oscillations in a high-velocity duct flow with sudden duct enlargement are discussed. Finally, some points concerning the influence of shear flow on sound propagation are described. (234 refs.)

Acoustic admittance of organ pipe jets ....See Entry 100985

Constraints on the invariant functions of axisymmetric turbulence ....See Entry 101193

47.25Q Convection and heat transfer

(see also 44.25 Convective and constrained heat transfer)

101210 Growth of fluctuations near the Benard-Marangoni convective instability. G.Lebon, A.Cloot (Liege Univ., Liege, Belgium).
Acta Mech. (Austria), vol.48, no.1-2, p.43-55 (1983).
The effects of temperature dependent surface-tensions on the growth rate of fluctuations near Benard-Marangoni's instability are examined. This is achieved by defining a new parameter ϵ measuring the deviation from the marginal state. The present analysis amplifies recent papers wherein surface effects were not considered. The behaviour of the growth rate in terms of the non-dimensional Rayleigh, Maragnoni, Biot, and Prandtl numbers is discussed. Landau's picture is finally used to study the approach of disturbances towards equilibrium. (17 refs.)

101211 Existence conditions for stationary state of a free convection flow in a confined medium. J.-F.Pignatel, J.Marcillat (Inst. de Mecanique des Fluids, Marseille, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.14, p.1023-6 (18 April 1983). In French.
Transition from stationary to unsteady state of a free convection flow in an inclined air layer heated from below, is studied experimentally for tilt angles $0<\alpha<90°$, Rayleigh numbers $2\times10^3<\mathrm{Ra}<10^6$ and shape factors $2<1<18$. The transition criterion is based upon the time dependence of the response of a thermocouple junction placed along the upslope axis of the cavity. The results are reported in form of the evolution of critical Rayleigh number with the shape factor and the tilt angle. (10 refs.)

101212 Heat transfer in the desublimation of phthalic anhydride. J.Bilik (Design Office, Metalchem, Gliwice, Poland), R.Krupiczka.
Chem. Eng. J. (Switzerland), vol.26, no.3, p.169-80 (June 1983).
The heat transfer in the desublimation of phthalic anhydride has been investigated experimentally for the purpose of modelling and developing the design calculation procedure. Experiments were performed on a pilot installation connected to the industrial plant. On the basis of the experimental data, new correlations for the equivalent local heat transfer resistance and the mean equivalent density of the condensate were obtained. The formula for the equivalent heat transfer coefficient in the gaseous phase and the diagram for determination of the efficiency of the process are also given. The validity of the proposed formulae was verified by comparison of the calculated temperature profiles along the condenser with the measured values. (14 refs.)

101213 Heat transfer in temperature-dependent flow. K.Wichterle (Inst. of Chem. Process Fundamentals, Czechoslovak Acad. Sci., Prague, Czechoslovakia).
Chem. Eng. J. (Switzerland), vol.26, no.3, p.217-22 (June 1983).
Solutions of temperature and velocity fields near a constant-temperature wall are presented. For liquids with temperature-dependent Newtonian or non-Newtonian viscosity, the mathematical model of the system is represented by coupled partial differential equations. A similarity variable for the thermal entrance region has been introduced, which allows the partial differential equations to be transformed into ordinary ones. The procedure reduces to the well-known Leveque solution for temperature-independent flow. Exact solutions to the nonisothermal problem have been obtained, results of which can be expressed using the classical Leveque-Lighthill formula (for isothermal flow) supplemented by a simple correction term expressing the effects of variable viscosity. The correlation has been adapted to express explicitly the Nusselt number and pressure drop in the thermal entrance region of a circular tube. (8 refs.)

101214 Finite-amplitude convection in mixtures with heat sources proportional to the concentration of one of the components. A.K.Kolesnikov, V.I.Yakushin.
Fluid Dyn. (USA), vol.17, no.6, p.821-6 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.6, p.10-16 (Nov.-Dec. 1982).
A numerical investigation has been made into the equilibrium stability with respect to finite perturbations of a mixture with heat sources proportional to the concentration of an active component. The convective motions that develop after the loss of stability were also studied. The equations of thermoconcentration convection were solved by the grid method for a planar region of rectangular shape simulating a convective cell in the horizontal layer. Neutral curves for finite-amplitude perturbations are constructed, the regions of existence of subcritical motions are found, and a comparison with the results of linear theory is made. (12 refs.)

101215 Oscillatory and steady convection in a nematic liquid crystal. K.Otnes, T.Riste (Inst. for Energy Technol., Kjeller, Norway).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.837-46 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Demonstrates that a nematic liquid crystal in a vertical magnetic field is a convenient physical system for studying these phenomena, and that neutron scattering provides an ideal experimental tool. In the experiments that the authors report they used a setup that allowed them to study a wider range of temperature gradients and magnetic fields, thereby making it possible to disentangle most of the intricate phase diagram. The information that was obtained on the time behaviour of the order parameters and of the attractors in phase space is however still incomplete. (11 refs.)

101216 Hydrodynamics and heat transfer in sphere assemblages—cylindrical cell models. R.Tal, D.N.Lee, W.A.Sirignano (Carnegie-Mellon Univ., Pittsburgh, PA, USA).
Int. J. Heat & Mass Transfer (GB), vol.26, no.9, p.1265-73 (Sept. 1983).
In order to evaluate interactions between vaporizing fuel droplets, a cylindrical cell model based on a single sphere has been suggested by the authors in previous works as a replacement for the existing spherical cell model. Since wake effects are important, a multisphere cylindrical cell model has been developed in the present work. The Navier-Stokes and energy equations have been solved numerically within the representative cells for intermediate Reynolds numbers. Using a nonuniform mesh suited for the problem, several spheres in tandem are considered and the importance of wake effects in considerably reducing the drag and Nusselt number in the bulk is discussed. The quasiperiodic features of the results are indicated and compared favorably with a model assuming periodicity a priori. (28 refs.)

101217 Local mass transfer for cross flow through tube banks of square in-line layout at intermediate Reynolds numbers. I.A.Nieva, U.Bohm (Dept. de Industrias, Univ. de Buenos Aires, Buenos Aires, Argentina).
Int. J. Heat & Mass Transfer (GB), vol.26, no.9, p.1283-8 (Sept. 1983).
Local mass transfer rates around a circular tube placed in a tube bank of square in-line layout are measured by the electrochemical technique. Four different pitches are investigated and the results are compared with theoretical values and simpler geometries. (12 refs.)

101218 Domain dependence of critical Rayleigh numbers. J.S.Vrentas, C.M.Vrentas (Dept. of Chem. Engng., Pennsylvania State Univ., University Park, PA, USA), R.Narayanan.
Int. J. Heat & Mass Transfer (GB), vol.26, no.9, p.1299-305 (Sept. 1983).
The dependence of critical Rayleigh numbers for buoyancy-driven convection on the size of the domain is investigated. The method of parameter differentiation is used to establish monotonicity conditions for the Rayleigh number-geometry dependence for axisymmetric convection in a cylindrical container and for three-dimensional convection in a rectangular box. The dependence of the critical Rayleigh number on the Nusselt number is also studied. (10 refs.)

101219 Heat transfer in large particle fluidized beds. N.Decker, L.R.Glicksman (Dept. of Mech. Engng., MIT, Cambridge, MA, USA).
Int. J. Heat & Mass Transfer (GB), vol.26, no.9, p.1307-20 (Sept. 1983).
A physically based model is proposed for heat transfer to immersed surfaces in large particle fluidized beds. 'Large' particles are distinguished as those with thermal time constants substantially greater than their residence time at a heat transfer surface. At typical fluidized bed combustor operating conditions, particles 1 mm or larger are 'large'. Conduction through the gas near points of solid contact and convection by the interstitial gas flow both contribute to heat transfer during emulsion (or dense phase) contact. As particle size increases the heat transfer by gas convection provides a greater share of the heat transfer. It is shown that the gas convective component in fluidized bed heat transfer is not simply related to overall gas convection in a packed or quiescently fluidized bed. The model is shown to provide good agreement with data from several sources. (20 refs.)

101220 Influence of buoyancy forces and thermal conductivity on flow field and heat transfer of circular cylinders at small Reynolds number. B.Sunden (Dept. of Appl. Thermo & Fluid Dynamics, Chalmers Univ. of Technol., Goteborg, Sweden).
Int. J. Heat & Mass Transfer (GB), vol.26, no.9, p.1329-38 (Sept. 1983).
A numerical investigation of the influence of buoyancy forces and thermal conductivity ratio (k_s/k_f) on the flow field and heat transfer around circular cylinders is presented. The flow field and energy equations are solved under the conditions of continuity in temperature and heat flux at the fluid-solid interface. The buoyancy forces are taken into account by applying Boussinesq's approximation. Numerical results are given for Reynolds numbers in the range of $5 \leq Re \leq 40$, buoyancy parameters in the range of $-1 \leq Gr/Re^2 \leq 2$ and thermal conductivity ratios in the range of $0 \leq k_s/k_f \leq \infty$. (39 refs.)

101221 The boundary layer regime in a porous layer with uniform heat flux from the side. A.Bejan (Dept. of Mech. Engng., Univ. of Colorado, Boulder, CO, USA).
Int. J. Heat & Mass Transfer (GB), vol.26, no.9, p.1339-46 (Sept. 1983).
Reports an analytical solution and a numerical study of natural convection in a rectangular porous layer heated and cooled with uniform heat flux along the vertical side walls. It is shown analytically that in the boundary layer regime the vertical boundary layer thickness is constant (independent of altitude) and the core region is motionless. The vertical temperature gradient is the same constant everywhere in the porous layer. Numerical results are reported in the range $100 < Ra < 5000$, $1 \leq H/L \leq 10$, where $Ra = Kg\beta H^2 q''/(\alpha\nu k)$. The boundary layer analytical solution is shown to agree well with the numerical results. (20 refs.)

101222 Investigation of heat transfer behind an oscillating grid. W.Kuhn (Inst. fur Mech., Akad. der Wissenschaften, Berlin, Germany).
Int. J. Heat & Mass Transfer (GB), vol.26, no.9, p.1347-55 (Sept. 1983).
Measurements of heat transfer behind a harmonically oscillating grid yielded rates of heat spread which were higher than those in usual turbulent flows produced by stationary grids. The mean temperature profiles showed an unexpected shape with two maxima and a minimum between them. This was caused by large-scale velocity fluctuations which produce heat fluxes independent of the local mean temperature gradient. A simple heat transfer model is proposed which takes into account both the large-scale velocity fluctuations produced by the oscillating grid and the 'usual' turbulence. The calculated mean temperature profiles show a good agreement with the measured ones. (5 refs.)

101223 A refutation of King's rule for multi-dimensional external natural convection. E.M.Sparrow, M.A.Ansari (Dept. of Mech. Engng., Univ. of Minnesota, Minneapolis, MN, USA).
Int. J. Heat & Mass Transfer (GB), vol.26, no.9, p.1357-64 (Sept. 1983).
Experiments have been carried out to test the validity of King's widely quoted rule for evaluating a characteristic length for problems of multi-dimensional external natural convection. A more recent rule set forth by Lienhard (1981) was also tested. Both rules are intended to enable standard textbook-type correlations to be employed to predict natural convection heat transfer from complex bodies. The experiments were performed using a heated vertical cylinder of equal height and diameter, with heat being transferred to the ambient air from all three faces of the body (top, side, and bottom). The use of King's rule led to 40-50% overpredictions of the experimental data, so that its continued citation in textbooks appears inappropriate. Although Lienhard's rule yielded predictions that were somewhat closer to the data than those of King, the level of agreement does not appear to warrant its adoption as the link between multi-dimensional natural convection and the established literature correlations. (15 refs.)

101224 Heat transfer in vertical upwards gas-liquid slug flow. D.Barnea, N.Yacoub (School of Engng., Tel-Aviv Univ., Tel-Aviv, Israel).
Int. J. Heat & Mass Transfer (GB), vol.26, no.9, p.1365-76 (Sept. 1983).
An analytical solution for the transient behaviour of heat transfer in vertical upward gas-liquid slug flow is presented. The results allow the prediction of the temperature variation with time and location and the wall temperature fluctuations, as well as the average heat transfer coefficients. (10 refs.)

101225 Forced convective heat transfer in the entrance region of a parallel plate channel. R.Das, A.K.Mohanty (Dept. of Mech. Engng., Indian Inst. of Technol., Kharagpur, India).
Int. J. Heat & Mass Transfer (GB), vol.26, no.9, p.1403-5 (Sept. 1983).
Laminar convective transport in the channel entrance region has received considerable attention because in several internal flow situations the length to diameter ratio is not adequate to ensure fully developed conditions. Leading edge effects result in high transport rates. Immediately downstream of the entry, the flow is laminar, irrespective of the diameter based Reynolds number, thereby allowing theoretical evaluations to be made. The simultaneous development in the entrance of a parallel plate channel is analyzed incorporating the two-zone hydrodynamic model and the centre-line temperature variation. Both isothermal wall ($T_w = C$) and uniform heat flux ($Q_w = C$) conditions are considered. (7 refs.)

101226 Heat transfer from partially insulated hexagonal ducts. R.M.Abdel-Wahed, A.E.Attia (Dept. of Mech. Engng., Univ. of Alexandria, Alexandria, Egypt).
Int. J. Heat & Mass Transfer (GB), vol.26, no.9, p.1408-12 (Sept. 1983).
The authors generate theoretical Nusselt values for the fully developed laminar flow inside partially insulated hexagonal ducts receiving constant axial heating. In view of the thermal condition around the duct periphery at a given axial location, the thermal situation on the solid exposed boundary can be further classified. Two such subcategories are considered, namely, the isothermal and the uniform heat flux peripheries. (12 refs.)

101227 Magnetohydrodynamic natural convection heat transfer from horizontal cylinders. P.F.Dunn (Engng. Div., Argonne Nat. Lab., Argonne, IL, USA).
Int. J. Heat & Mass Transfer (GB), vol.26, no.9, p.1413-16 (Sept. 1983).
Presents an approximate 2-dimensional solution of magnetohydrodynamic (MHD) natural convection heat transfer from a finite cylinder at various orientations with respect to an applied magnetic field. The work is an extension of that of Lykoudis and Dunn (1973) in which they measured and successfully predicted the MHD natural convection heat transfer from hot-film probes aligned axially with a horizontal magnetic field. (19 refs.)

101228 Comments on 'The effect of subchannel shape on heat transfer in rod bundles with axial flow'. J.T.Rogers (Dept. of Mech. & Aeronautical Engng., Carleton Univ., Ottawa, Ontario, Canada).
Int. J. Heat & Mass Transfer (GB), vol.26, no.9, p.1417-18 (Sept. 1983).
For original paper see W.J. Seale, ibid., vol.24, no.4, p.768 (1981). Seale's paper provides a useful addition to the knowledge of inter-subchannel heat exchange in rod bundles such as those used in nuclear power reactor fuel assemblies. He makes certain comparisons of his theoretical predictions for heat flow by turbulent interchange between two subchannels simulating a section of a rod array with predictions obtained by Rogers and Rosehart (1972). Rogers comments on the conclusions drawn by Seale. (4 refs.)

101229 Heat exchange under viscid fluid rotation between two concentric spheres. F.M.Ibragimov.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.4, p.123-7 (1982). In Russian.
Some problems concerned with heat exchange in a viscid fluid under rotation between two concentric spheres are studied. The stationary problem is solved when the viscidity is $\mu = \text{const.}$ and then temperature dependent in accordance with the hyperbolical law. (5 refs.)

101230 Critical heat flux in free convective flow through a uniformly heated vertical tube held in a large pool of saturated liquid. Y.Katto, S.Kawamura (Dept. of Marine Engng., Univ. of Tokyo, Tokyo, Japan).
J. Fac. Eng. Univ. Tokyo Ser. B (Japan), vol.36, no.4, p.647-59 (Sept. 1982).
Experiments are made on free convection boiling in uniformly heated tubes held vertically in a large pool of saturated liquid. The length l and diameter d of test tube ranges from 100 to 800 mm and from 4.0 to 10 mm respectively. Under stable conditions where no flow oscillations are detected, critical heat flux (CHF) q_{co} is measured for water at 1.0-8.8 bar and R-12 at 7.5-32 bar. Based on the experimental data of CHF thus obtained together with the existing data of helium I at atmospheric pressure, an attempt is made to derive a simple generalized correlation of CHF in terms of two dimensionless groups $(q_{co}/\rho_v H_{fg})/[\sigma g(\rho_l-\rho_v)/\rho_v^2]^{1/4}$ and l/d. The generalized correlation of water data is found to agree with that of helium data in spite of a large difference of physical properties, whereas R-12 shows a somewhat different trend and also greater dispersion of data. Finally, related discussion is made, in which the CHF mechanism encountered in this study is suggested to differ from that in a heated vertical tube forming part of a natural circulation loop having a noticeable flow resistance due to throttle valves and the like. (17 refs.)

101231 Instabilities of dynamic thermocapillary liquid layers. I. Convective instabilities. M.K.Smith, S.H.Davis (Dept. of Engng. Sci. & Appl. Maths., Technol. Inst., Northwestern Univ., Evanston, IL, USA).
J. Fluid Mech. (GB), vol.132, p.119-44 (July 1983).
A planar liquid layer is bounded below by a rigid plate and above by an interface with a passive gas. A steady shear flow is set up by imposing a temperature gradient along the layer and driving the motion by thermocapillarity. This dynamic state is susceptible to two types of thermal-convective instabilities: (i) stationary longitudinal rolls, which involve the classical Marangoni instability studied by Pearson (1958); and (ii) unsteady hydrothermal waves, which involve a new mechanism of instability deriving its energy from the horizontal temperature gradients. Thermal stability characteristics for liquid layers with and without return-flow profiles are presented as functions of the Prandtl number of the liquid and the Biot number of the interface. Comparisons are made with available experimental observations. (25 refs.)

101232 Unidirectional nonstationary flow of instantaneously heated gas from a cylinder for different positions of the heated zone. E.T.Bruk-Levinson, O.G.Martynenko, E.A.Romashko (A.V. Lykov Inst. of Heat & Mass Transfer, Acad. of Sci., Minsk, Belorussian SSR).
J. Eng. Phys. (USA), vol.43, no.6, p.1425-31 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.6, p.1020-7 (Dec. 1982).
The finite-difference method and one-dimensional approximation are used to consider the processes of decay of an initial pressure discontinuity for the individual cases of its position in a bounded region. (6 refs.)

101233 Heat transfer between three media in triple countercurrent pipe flow. E.E.Shpil'rain, K.A.Yakimovich.
J. Eng. Phys. (USA), vol.43, no.6, p.1431-6 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.6, p.1028-33 (Dec. 1982).
A method is discussed for calculating the thermodynamic characteristics associated with the interaction of three fluid flows in pipes. Analytical relations are derived for the case of triple concentric countercurrent flow. (no refs.)

101234 Effect of variable thermophysical properties of a viscous liquid on flow around and heat transfer from a cylinder in turbulent cross flow. P.P.Vaitekunas, A.Yu.Butola, A.A.Zhukauskas.
Liet. TSR Mokslu Akad. Darbai B Ser.(USSR), no.134, p.55-9 (1983). In Russian.
Palankar and Spalding's finite difference method is used to solve the heat transfer equations for the laminar boundary layer for turbulent cross flow past a cylinder. Numerical results are presented for shear stress and local heat transfer rates as a function of the direction of flow. The dimensionless data show the effects of thermal and physical properties on these parameters. The tube crown heat transfer coefficient is also calculated. The data cover ranges of Reynolds and Prandtl numbers from 10^3 to 10^5 and from 0.71 to 242 respectively. (no refs.) *C.J.S.*

101235 A boundary integral method for some laminar forced convection problems. A.Mir-Mohamad-Sadegh (Dept. of Mech. Engng., City Coll., City Univ. of New York, New York, NY, USA), K.R.Rajagopal.
Mech. Res. Commun. (GB), vol.10, no.3, p.181-6 (May-June 1983).
Forced convection problems involving laminar fully developed steady state flow in channels have been the object of detailed scrutiny for several years. A complex variable approach to solving a class of these forced convection problems analytically, has been developed by Tao (1960). The differential equations for the velocity and temperature fields essentially reduce to solving a single biharmonic equation in the domain of interest. While one can obtain closed form solutions for channels of simple cross-sections, one has to resort to a numerical solutions in the case of arbitrary cross-sections. The authors present a boundary integral method which is ideally suited for this class of problem. (5 refs.)

101236 Numerical study of high Rayleigh number convection in a vertical porous enclosure. G.S.Shiralkar, M.Haajizadeh, C.L.Tien (Dept. of Mech. Engng., Univ. of California, Berkeley, CA, USA).
Numer. Heat Transfer (USA), vol.6, no.2, p.223-34 (April-June 1983).
The results of a numerical simulation of natural convection in a vertical rectangular porous enclosure subjected to a horizontal temperature differential are presented. By use of the stable exponential differencing computation scheme, values of the Darcy-Rayleigh number R have been obtained which are substantially larger than those in previous numerical studies. The present results proved a clear physical picture of the development process as R is increased toward asymptotically high values ($R \rightarrow \infty$). Correlations for the heat transfer rate are presented for four different aspect ratios and are compared with earlier experimental and theoretical results. (11 refs.)

101237 Regimes of free thermally concentrated convection over a point heat source. Yu.D.Chashechkin, V.S.Belyaev (All-Union Sci.-Res. Inst. of Physicotech. & Radio Engng. Measurements, Mendeleevo, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.923-5 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.574-7 (Nov. 1982).
The regimes of free thermally concentrated convection over a point heat source are studied using a tank filled with NaCl solution with a constant density gradient. The flow pattern was recorded using a motion picture method. The regimes described are the diffusion regime; the laminar stratified regime; the finger stratified regime and the intrusional regime. (12 refs.)

101238 Buoyancy-induced flow due to isolated thermal sources on a vertical surface. Y.Jaluria.
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.223-7 (May 1982).
The natural convection flow due to multiple isolated heated elements located on a vertical adiabatic surface has been studied analytically. The problem, which is of particular relevance to electronic circuitry cooling and to the question of locating sources in manufacturing systems, is considered for a Prandtl number of 0.7, which applies for air. Of particular interest were the temperature and velocity fields that arise and the dependence of these on the heat input and on the distance between the heated elements. The flow is treated as a boundary layer problem and the governing equations are solved numerically. The results obtained indicate the general nature of the flow and the dependence of the heat-transfer coefficient for an element, located in the wake of another, on the energy input and location. The downstream variation of the surface temperature, the velocity level, and the resulting velocity and temperature profiles are studied in detail. The results obtained are also compared with those for a single source, bringing out several interesting features. (13 refs.)

101239 Natural convection from a horizontal cylinder—turbulent regime. B.Farouk (Mech. Engng. & Mech. Dept., Drexel Univ., Philadelphia, PA, USA), S.I.Guceri.
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.228-35 (May 1982).
A two-equation model has been adopted in obtaining numerical solutions of turbulent natural convection from an isothermal horizontal circular cylinder. The k-ϵ model employed in this study characterizes turbulence through the kinetic energy and its volumetric rate of dissipation. The transport equations for these two variables, along with those for time-averaged stream function, vorticity, and temperature, form a closed set of five coupled partial differential equations. These equations are solved for the entire flow domain, without boundary layer approximations. Buoyancy effects on the turbulence structure are also accounted for. Results are presented for a Rayleigh number range of 5×10^7 to 10^{10} and the average Nusselt numbers are compared with existing correlations and limited available experimental data. (23 refs.)

101240 Natural convection in an attic-shaped space filled with porous material. A.Bejan, D.Poulikakos (Dept. of Mech. Engng., Univ. of Colorado, Boulder, CO, USA).
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.241-7 (May 1982).
Reports on analytical study of natural convection in a wedge-shaped horizontal space filled with a fluid-saturated porous medium. The study focuses on the detrimental effect of natural convection on the insulation value of an attic-shaped porous layer in 'winter' conditions (cold roof, warm ceilings). The study reveals the most basic features of the temperature field and flow pattern established in the porous layer. The study addresses two distinct flow regimes: (a) the shallow attic limit ($H/L \rightarrow 0$, Ra_H=finite, but fixed) and (b) the boundary layer regime which consists of a boundary layer driven by the sloped (roof) wall plus a core flow moving slowly along the horizontal (ceiling) wall. Heat-transfer results are developed for both flow regimes. (11 refs.)

101241 Structure of growing double-diffusive convection cells. Y.Suzukawa, U.Narusawa (Tech. Res. Center, Nippon Kokan KK, Kawasaki, Japan).
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.248-54 (May 1982).
When a fluid with a vertical route gradient is heated from a sidewall, layers of convection cells form along the wall. For an acqueous solution of common salt (i.e. fixed values of Pr and τ), the convection cells will form along the vertical heated wall for values of $\pi(=\alpha(q/k)/\beta(-dS/dz))$ greater than ~ 0.28. This paper reports the experimental investigation of the structure of the growing convection cells when a uniform heat flux is applied at the vertical wall. A series of tests was conducted using a small tank (23 cm high × 16 cm deep × 20 cm wide). Measurements of the vertical temperature distribution in the fluid at five different locations were taken continuously along with shadowgraph pictures to monitor the growth of the convection cells. Based on the set of data thus obtained, the following characteristics of a growing convection cell were found: (a) A convection cell with a vertical height, K, grows laterally into the quiescent fluid at a constant speed, U, and the Reynolds number of a moving front, defined as UH/ν, changes linearly with π on a log-log scale for our experimental range of $\pi=0.3-10$. (b) The vertical averaged temperature inside a growing cell is a linear function of the distance from the heated wall over a major portion of the cell. (c) The lateral temperature gradient inside a cell decreases with time, and is proportional to the inverse of the elapsed time. (22 refs.)

101242 An application of the optical correlation computer to the detection of the Malkus transitions in free convection. E.F.C.Somerscales (Rensselaer Polytech. Inst., Troy, NY, USA), H.B.Parsapour.
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.255-63 (May 1982).
Presents the results of an investigation concerned with measurements of the scale-size of the flow patterns near the so-called Malkus transitions. The flow patterns in a heated fluid layer were photographed at various Rayleigh numbers and these photographs subjected to quantitative analysis using an optical correlation computer. The results showed that the method provides a very sensitive technique for locating the transitions. Transition reported by other investigators have been confirmed for Rayleigh numbers between 5.0×10^3 and 1.0×10^6, and an additional, previously unobserved, transition has been detected. Heat-transfer measurments were also made. This data demonstrated the limitations, compared to the optical method, of this approach to the detection of transitions. (35 refs.)

101243 Volumetric heat-transfer coefficients for direct-contact evaporation. R.C.Smith, W.M.Rohsenow, M.S.Kazimi (Dept. of Nuclear Engng., MIT, Cambridge, MA, USA).
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.264-70 (May 1982).
An analytical model has been developed for calculating volumetric heat-transfer coefficients for direct-contact evaporation. Heat transfer is modeled using single droplet correlations for the Nusselt number, while the fluid dynamics are described by a drift-flux model. The analysis is divided into a preagglomerative and a postagglomerative stage on the basis of an assumed maximum value for the dispersed phase volume fraction. The analytical results showed good agreement with data obtained from an experimental direct-contact evaporator using cyclopentane and water. (9 refs.)

101244 Critical heat flux during natural convective boiling in vertical rectangular channels submerged in saturated liquid. M.Monde, H.Kusuda, H.Uehara (Dept. of Mech. Engng., Saga Univ., Saga, Japan).
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.300-3 (May 1982).
An experimental study of the critical heat flux has been carried out for natural convective boiling at atmospheric pressure in vertical rectangular channels. Experiments in four kinds of test liquids (water, ethanol, freon 113, and benzene) have been made for the ratio l/s less than 120, in which l is the length of the heated surface and s is the width of the channels. A generalized correlation for the critical heat-flux data in the four test liquids is evolved. (19 refs.)

101245 Effect of laminarization and retransition on heat transfer for low Reynolds number flow through a converging to constant area duct. H.Tanaka (Dept. of Mech. Engng., Univ. of Tokyo, Tokyo, Japan), H.Kawamura, A.Tateno, S.Hatamiya.
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.363-71 (May 1982).
A fully developed turbulent air flow between two parallel plates with the spacing of 15 mm was accelerated through a linearly converging passage of 200 mm in length, from which it flowed into a parallel-plate channel again. A foil heater was fastened on one wall surface over the entire channel, and local heat-transfer coefficient distribution was measured over the channel Reynolds number range of 5000 to 14000 and also the slope of the accelerating section between 2/200 mm/mm and 10/200 mm/mm. (The acceleration parameter K ranged between 1.4×10^{-6} and 2×10^{-5}). The Nusselt number at the outlet of the accelerating section was considerably lower than in the initial fully turbulent state, suggesting laminarization of the flow. The measured Nusselt number continued to decrease in the first part of the downstream parallel-plate section to a minimum and then began to increase sharply, suggesting reversion to turbulent flow. Heat transfer along the parallel-converging-parallel plate system was reproduced fairly satisfactorily by applying a k-kL model of turbulence. (21 refs.)

101246 Heat transfer by conduction and radiation in one-dimensional planar media using the differential approximation. A.C.Ratzel (Sandia Nat. Labs., Albuquerque, NM, USA), J.R.Howell.
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.388-91 (May 1982).
The combined conduction and radiation heat-transfer problem for a gray planar medium is considered using the differential approximation. Two governing energy equations which include isotropic scattering are developed incorporating the P-1 and P-3 approximations for the intensity distribution. The method of solution for the resulting nonlinear ordinary differential equations is summarized along with representative results. (10 refs.)

Flow induced vibration in a heat exchanger with seal strips ....See Entry 99099

Thermal instability of two-dimensional stagnation-point boundary layers ....See Entry 101011

Effects of pore diameters and system pressure on saturated pool nucleate boiling heat transfer from porous surfaces .... See Entry 101019

Pool boiling heat transfer from enhanced surfaces to dielectric fluids ....See Entry 101020

Laminar free convection on a vertical nonisothermal plate with vigorous blowing .... See Entry 101177

The influence of a laminar boundary layer and laminar injection on film cooling performance ....See Entry 101180

Effect of a change of the turbulent structure of a flow on unsteady heat exchange upon heating of gases and liquids in pipes ....See Entry 101197

Numerical calculations of a convective-dispersion equation in shear flow by method of shifting particles ....See Entry 101204

Spectral analysis of the thermal field in an axisymmetric turbulent plume ....See Entry 101207

Some problems of the hydrodynamics of a horizontal cylinder with natural convection ....See Entry 101251

Amplification of azimuthal rotation in a meridional electric vortex flow in a hemisphere .... See Entry 101253

A critical layer dominated by non-parallel effects in a rotating barotropic flow ....See Entry 101254

Instabilities in the slit-jet flow field .... See Entry 101303

Interaction of a system of jets impinging on a plane barrier ....See Entry 101306

Heat and mass transfer by condensation in an incompressible turbulent boundary layer on a flat plate with low level exchange ....See Entry 101313

Generalized boundary conditions for the axial dispersion model ....See Entry 101315

A calculation procedure for two phase flow distribution in manifolds with and without heat transfer ....See Entry 101317

Interfacial area and nucleation site density in boiling systems ....See Entry 101318

Moment method for the evaluations of heat transfer coefficients in a packed bed .... See Entry 101327

Seepage and heat flow in soil freezing .... See Entry 101330

Features of two-phase flow in long channels ....See Entry 101335

Post-burnout heat transfer to Freon flowing in a vertical tube at high subcritical pressures ....See Entry 101338

Numerical model for dynamic and thermal developments of a pulsed laminar ducted flow ....See Entry 101339

Hall effects on an oscillatory MHD flow in the Stokes problem past an infinite vertical porous plate. I ....See Entry 101342

Hall effects on MHD free-convection flow in the Stokes problem for a vertical porous plate ....See Entry 101343

Existence and unicity of the Cauchy problem for a relativistic heat conducting fluid ....See Entry 101357

Inward melting in a vertical tube which allows free expansion of the phase-change medium .... See Entry 101922

Transient freezing of a liquid in a convectively cooled tube ...See Entry 101923

Estimating the intensity of heat transfer to supercritical helium when the specific variation of the thermophysical properties is taken into account ....See Entry 102089

Effects of mass flux, flow quality, thermal and surface properties of materials on rewet of dispersed flow film boiling ....See Entry 102127

A simple analysis of an open regeneration system .... See Entry 103658

Transient analysis of forced circulation solar water heating system with collectors in series ....See Entry 103717

Transient analysis of double basin solar still ....See Entry 103718

Year-round performance of an improved collector-cum-storage type solar water heater ....See Entry 103719

Theoretical study of tilted solar still as a regenerator for liquid desiccants ....See Entry 103720

Transient performance of normal/reverse flat plate collector with selective absorber surface ....See Entry 103721

A wind-mixed layer model for solar ponds ....See Entry 103725

An axisymmetric model for the charging of a liquid-dominated geothermal reservoir ....See Entry 104414

Magnetic-flux transport by a convecting layer—topological, geometrical and compressible phenomena ....See Entry 104826

47.25R Wakes

Similarity solutions of free shear flows with mean Reynolds stress turbulence models ....See Entry 101205

Hydrodynamics and heat transfer in sphere assemblages—cylindrical cell models ....See Entry 101216

47.30 ROTATIONAL FLOW AND VORTICITY

101247 Explicit theory of the median layer associated with a vortex sheet. M.Mudry (Univ. d'Orleans, Orleans, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.15, p.1109-12 (25 April 1983). In French.
It is shown that a vortex sheet can be characterized by a nonunique couple of functions, the properties of which are specified. In the case of an incompressible inviscid fluid, the knowledge of the flow is always reducible to an integro-differential evolution problem regarding the sheet itself. (5 refs.)

101248 Finite difference representations of vorticity transport. M.Joseph.
Comput. Methods Appl. Mech. & Eng. (Netherlands), vol.39, no.2, p.107-16 (Aug. 1983).
Explicit finite difference representations of the steady two-dimensional laminar vorticity transport equation of fluid dynamics are summarized and discussed. The approximations known as 'upwind differencing', 'locally exact' after Allen and Southwell (1955), Briggs (1975) or Dennis and Hudson (1978) are all shown to be the central difference approximation with the addition of numerical diffusion of the order of the error term in cell Reynolds number, R_c, which makes the associated matrix diagonally dominant. The local truncation error of this type of approximation can be minimized thus: (i) for $|r_c|\leq2$, the central difference approximation, (ii) for $|R_c|>2$, upwind differencing applied to the inviscid equations, and therefore can be considered as a boundary layer approximation. This is the scheme introduced by Spalding (1972); successfully tested by Runchal (1972). The local truncation error of the boundary condition, after Woods (1954) for the vorticity is minimized in such a way that the formula is third-order accurate in grid size, in rectangular Cartesian coordinates. (39 refs.)

101249 Limiting amplitudes for forced oscillations in a rotating compressible fluid. P.K.Pal (Dept. of Differential Equations & Functional Analysis, Patrice Lumumba Friendship of Nations Univ., Moscow, USSR).
Indian J. Pure & Appl. Math., vol.14, no.6, p.671-9 (June 1983).
On the basis of the linearised equations of motion, it is shown that for the motion generated in an infinite mass of rotating compressible fluid, by a distribution of periodic forces and sources satisfying certain conditions, the ultimate state of motion is periodic. The limiting amplitude for the motion is obtained. (8 refs.)

101250 Practical use of Hamilton's principle. R.Salmon (Scripps Instn. of Oceanography, La Jolla, CA, USA).
J. Fluid Mech. (GB), vol.132, p.431-44 (July 1983).
Hamilton's principle of mechanics has special advantages as the beginning point for approximations. First, it is extremely succinct. Secondly, it easily accommodates moving disconnecting fluid boundaries. Thirdly, approximations—however strong—that maintain the symmetries of the Hamiltonian will automatically preserve the corresponding conservation laws. For example, Hamilton's principle allows useful analytical and numerical approximations to the equations governing the motion of a homogeneous rotating fluid with free boundaries. (15 refs.)

101251 Some problems of the hydrodynamics of a horizontal cylinder with natural convection. V.A.Belyakov, P.M.Brdlik, V.S.Kuptsova, V.G.Malinin (Moscow Forestry Inst., Moscow, USSR).
J. Eng. Phys. (USA), vol.43, no.6, p.1327-30 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.6, p.905-9 (Dec. 1982).
Examines the special features of vortex flow in the vicinity of the upper critical point, and approximating dependences are obtained for the point of detachment from the data of numerical solution and experiments. (2 refs.)

101252 Shear viscosity in diatomic fluids. M.Whittle, J.H.R.Clarke (Dept. of Chem., Univ. of Manchester Inst. of Sci. & Technol., Manchester, England).
Mol. Phys. (GB), vol.49, no.5, p.1199-208 (10 Aug. 1983).
The centre of mass interaction force between a pair of homonuclear diatomic molecules is expanded as a Taylor series in the bond vectors. This leads to terms in an expression for the off-diagonal stress tensor components which explicitly involve the molecular orientations. Stress correlation functions and steady state shear viscosities obtained using the expansion to only second order compare favourably with exact molecular dynamics results for moderately anisotropic molecules such as nitrogen over a range of liquid densities. (13 refs.)

101253 Amplification of azimuthal rotation in a meridional electric vortex flow in a hemisphere. V.Boyarevich, R.Millere.
Magnetohydrodynamics (USA), vol.18, no.4, p.373-8 (Oct.-Dec. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.4, p.51-6 (Oct.-Dec. 1982).
An axisymmetric meridional flow which converges to the symmetry axis, possesses a striking property of swirling. Even a small priming azimuthal motion results in the formation of a rapidly rotating vortex on the symmetry axis. Such vortices are usually explained by stretching of vortex tubes in the axial region or, in other words, by convection of angular momentum towards the axis, where under the condition of conservation of the momentum Ω the azimuthal velocity $v\sim\Omega/r \sin\theta$ and the angular velocity $\omega\sim\Omega/r^2 \sin^2\theta$ increase strongly as the distance $r \sin\theta$ from the axis decreases. However, the observed quasisteady state of the vortices even upon a change of Ω far from the axis is an indication of a significant effect of viscosity of maintenance of the vortex. The process of interaction of convection and viscous effects in a rotating vortex has not been studied extensively; one can cite only an idealized model which describes maintenance of the rotation of a vortex filament by a potential flow at the rear critical point. A numerical analysis is proposed in this paper of the mechanism which generates a rotating vortex in a meridional flow in a hemisphere, created by an electromagnetic force. This flow is a model of the motion of a fluid medium in electrotechnical processes. (8 refs.)

101254 A critical layer dominated by non-parallel effects in a rotating barotropic flow. L.Merkine (Div. of Engng., Brown Univ., Providence, RI, USA).
Proc. R. Soc. London Ser. A (GB), vol.388, no.1795, p.293-310 (8 Aug. 1983).
The critical layer of perturbations to slowly modulating strong rectified currents induced by vorticity sources in a quasi-geostrophic barotropic flow is investigated. For $r \gg Re^{-3/2}$ and $r \gg \delta^2$ which corresponds to realistic geophysical conditions, the critical layer is dominated by the advection of the perturbation's vorticity by the weak transverse velocity of the basic state and not by the traditional viscous or nonlinear balance. The Ekman, Rossby and Reynolds numbers of the flow are E, Ro and Re respectively and $r = E^{1/2}/Ro$, while δ is the parameter of nonlinearity. The width of the critical layer is $O(r^{1/6})$ which can be quite thick for relevant flow conditions. This suggests that non-parallel effects play an important role in the dynamics of large scale geophysical flows. (22 refs.)

101255 Study of wing vortex schemes. V.I.Men'shikov, M.M.Ovcharov.
Sov. Aeronaut. (USA), vol.25, no.2, p.93-5 (1982). Translation of: *Izv. VUZ Aviats. Tekh. (USSR)*, vol.25, no.2, p.78-9 (1982).
The problem of studying separation-free ideal incompressible fluid flow around a wing of finite aspect ratio reduces to the solution of a singular integral equation. In practice wide use has been made of an approximate method for the solution of this equation, in which the integrals are replaced by sums, which is equivalent to replacement of the vortex surface (replacing the wing) by discrete horseshoe vortexes. Calculations have shown that if one replaces a vortex surface by a comparatively small number of discrete vortexes using this scheme their intensity and the magnitudes of the coefficients c_y and m_z differ significantly from their exact values. The authors attempt to locate the discrete vortices so that the accuracy of determination of the coefficients c_y and m_z of the wing will be sufficiently high even with a small number of vortices. (2 refs.)

101256 The Taylor-Green vortex: fully developed turbulence and transition to spatial chaos. U.Frisch (Obs. de Nice, CNRS, Nice, France).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.257-9
A brief introduction to fully developed turbulence is given. The author then reports results obtained from numerical simulations of the Taylor-Green three dimensional vortex flow. This flow is perhaps the simplest system in which one can study the generation of small scales by three-dimensional vortex stretching and the resulting turbulence. The problem is studied by both direct spectral numerical solution of the Navier-Stokes equations (with up to 256 modes) and by power series analysis in time. (5 refs.)

Stability of Couette flow between rotating cylinders lined with porous material. I .... See Entry 101174

A theory for flow separation .... See Entry 101188

Transition of Taylor-Gortler vortex flow in spherical Couette flow .... See Entry 101190

Turbulent flow in an axially rotating pipe (effect of inlet swirl) .... See Entry 101198

Two-scale semiempirical theory of turbulent boundary layers and jets .... See Entry 101199

Problems in flow acoustics .... See Entry 101209

Finite-amplitude convection in mixtures with heat sources proportional to the concentration of one of the components .... See Entry 101214

Heat exchange under viscid fluid rotation between two concentric spheres .... See Entry 101229

Some observations on boundary conditions for the shallow-water equations in two space dimensions .... See Entry 101258

Similar solutions of the compressible boundary layer on a spinning cylinder in axial flow .... See Entry 101272

Unicity of the polynomial representation of the integral quantities of a compressible boundary layer on a spinning cylinder in axial flow .... See Entry 101273

Three-dimensional flow studies on a slotted transonic wind tunnel wall .... See Entry 101277

Cylindrical Couette problem of rarefied binary mixture .... See Entry 101288

Flow of a second-order fluid under torsionally oscillating disc .... See Entry 101294

Geometrical approach for the study of non-Newtonian fluid flows .... See Entry 101296

Interaction of a system of jets impinging on a plane barrier .... See Entry 101306

Spin-up in Couette flow .... See Entry 101332

Rotating supersonic flow about scoop inlet using an unsteady implicit technique .... See Entry 101334

Three-dimensional effects generated in a finite-length container under the action of a rotating magnetic field .... See Entry 101350

Textures and spin waves in rotating superfluid ^{3}He-B .... See Entry 102099

Vortices and NMR in rotating ^{3}He-B .... See Entry 102100

47.35 WAVES

101257 Principal waves in elastic subfluids. H.Cohen, C.-C.Wang (Dept. of Civil Engng., Univ. of Manitoba, Winnipeg, Manitoba, Canada).
Arch. Ration. Mech. & Anal. (Germany), vol.83, no.2, p.139-68 (1983).
Acceleration waves in various types of elastic subfluids were studied in a recent paper by Tokuoka and Kusunoki (1982). They obtained the general forms of the propagation conditions for waves in elastic subfluids and the speeds of the principal waves. Their results led them to their remark that elastic subfluids possess both solid-like and fluid-like qualities. They neither considered amplitude equations for the principal waves nor put their conclusions into contact with similar results for waves in other types of elastic materials. The present authors close that gap by showing that results obtained by Tokuoka and Kusunoki (1982) may be derived from a general class, including both propagation conditions and amplitude equations, for waves in orthotropic materials. (5 refs.)

101258 Some observations on boundary conditions for the shallow-water equations in two space dimensions. N.A.Edwards, C.P.Please, R.W.Preston (Central Electricity Res. Labs., Leatherhead, England).
IMA J. Appl. Math. (GB), vol.30, no.2, p.161-72 (March 1983).
Discusses the specification of suitable boundary conditions to ensure the well-posedness of the linearized shallow water equations in a semi-infinite region. The authors apply Kreiss's (1970) theory which enables results to be obtained for the case of variable coefficients in a general geometry once the half-plane problem has been analysed. The entire set of possible boundary conditions consisting of linear relations between the flow variables is considered and the effects of the boundary conditions on the well-posedness of the initial-boundary-value problem are discussed. The results indicate a fundamental similarity between the cases of outflow and inflow. They also emphasize the very special nature of the case of no normal flow across the boundary. The results are compared with those which the Classical Energy Method provides for uniqueness. This comparison shows that there may be a relationship between the two methods and further illustrates the similarity between outflow and inflow. (16 refs.)

101259 Study of internal waves in the case of rapid horizontal motion of cylinders and spheres. V.A.Gorodtsov, E.V.Teodorovich.
Fluid Dyn. (USA), vol.17, no.6, p.893-8 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.6, p.94-100 (Nov.-Dec. 1982).
A sphere and a cylinder are simulated by mass sources distributed over their surfaces, and expressions are obtained for the wave resistance of such sources moving horizontally in an exponentially stratified fluid. It is shown that then, in contrast to the case of simulation of such bodies by point dipoles, the paradox of an infinite wave resistance does not arise. Different variants of the method of equivalent sources are discussed. (15 refs.)

101260 Waves in a nonhomogeneous tube of variable circular section with running liquid. R.Yu.Amenzade, V.G.Nasibov.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.5, p.144-50 (1982). In Russian.
Formulation and solution of one-dimensional equations, which describe the extension of stationary waves in a long and nonfixed and nonhomogeneous elastic tube of variable circular section containing liquid, are represented. In addition, the liquid is assumed as inviscid and uncompressed. For the wave, extended in one direction, the solution of the corresponding singular boundary problem of Sturm-Liouville is reduced to the solution of the integral equation of Walter type. (10 refs.)

101261 Theoretical study of wave stream effect on flow around obstructions. A.M.Ibragimov.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.6, p.125-31 (1982). In Russian.
Describes theoretical estimations of loads induced by wave stream on randomly oriented passed obstructions. The problem was solved by applying expressions for the velocity and acceleration from the conception of the potential theory of second approach waves. Unlike previously known solutions, the author during the integration took into account the effect of wave top height by introduction into underintegrated expressions the true ordinates of points of the disturbed liquid surface z instead of ordinates of points in calm z_0, due to which more strict expressions permitting one to determine functional relationships between resultants of wave load with all process parameters are obtained. The derived expressions can be used for the calculation of wave loads on oil and gas field hydrotechnical structures, consisting of tubular stems. (8 refs.)

101262 Effects of slowly varying depth and current on the evolution of a Stokes wavepacket. F.-M.Turpin, C.Benmoussa, C.C.Mei (Dept. of Civil Engng., MIT, Cambridge, MA, USA).
J. Fluid Mech. (GB), vol.132, p.1-23 (July 1983).
The authors consider the effects of slowly varying depth and current on the evolution of a packet of Stokes waves. The lengthscale of one-dimensional depth variation is assumed to be much greater than that of the wave envelope, and the direction of the current is perpendicular to the depth contours. By the method of multiple scales, the wave envelope is found to satisfy a cubic Schrodinger equation with slowly varying coefficients. The criterion of spatial instability to small sidebands is extended. Numerical integration shows that the nonlinear evolution of a wavepacket is directly related to the instability parameter, which depends strongly on the current and depth variation. The heuristic hypothesis of Djordjevic and Redekopp (1978) on the soliton evolution over a slope in the absence of current is assessed. (16 refs.)

101263 Trapping of water waves above a round sill. Y.Renardy (Maths. Res. Center, Univ. of Wisconsin, Madison, WI, USA).
J. Fluid Mech. (GB), vol.132, p.105-18 (July 1983).
The three-dimensional problem of wave trapping above a submerged round sill was first analysed by Longuet-Higgins (1967) on the basis of a linear shallow-water theory. The large responses predicted by the theory were, however, not well borne out by the experiments of Barnard et al. (1983) and this has motivated a more detailed study of the problem. A full linear theory for both inviscid and weakly viscous fluid, without any shallow-water assumptions, is presented here. It reveals important limitations on the use of shallow-water theory and the reasons for them. In particular, while the qualitative features of wave trapping are similar to those of shallow-water theory, the nearly resonant frequencies differ significantly, and, since the resonances are narrow, the observed amplitudes at a given frequency differ greatly. The geometry is strongly indicative of long waves, and the dispersion relation appears quite consistent with that, but the part of the motion at wavenumbers that are not small has, despite the small amplitude, a substantial effect on the response to excitation. (16 refs.)

101264 Instabilities of dynamic thermocapillary liquid layers. II. Surface-wave instabilities. M.K.Smith, S.H.Davis (Dept. of Engng. Sci. & Appl. Maths., Technol. Inst., Northwestern Univ., Evanston, IL, USA).
J. Fluid Mech. (GB), vol.132, p.145-62 (July 1983).
For pt.I see ibid., vol.132, p.119-44 (1983). A planar liquid layer is bounded below by a rigid plate and above by an interface with a passive gas. A steady shear flow is set up by imposing a temperature gradient along the layer and driving the motion by thermocapillarity. This dynamic state is susceptible to surface-wave instabilities that couple the interfacial deflection to the underlying shear flow. These instabilities are found to be directly related to the two-dimensional waves on an isothermal layer subject to wind shear as described by Miles (1960) and by Smith and Davis (1983). Hence the surface-tension gradients are important only in that they drive the basic shear flow. The surface-wave stability characteristics for liquid layers with and without return-flow profiles are presented, and special attention is paid to long-wave instabilities. Comparisons are made with available experimental observations. (9 refs.)

101265 Large-scale modulations of edge waves. T.R.Akylas (Dept. of Mech. Engng., MIT, Cambridge, MA, USA).
J. Fluid Mech. (GB), vol.132, p.197-208 (July 1983).
The temporal and spatial evolution of large-scale modulations of weakly nonlinear edge waves on a uniformly sloping beach is studied using the full water-wave formulation for beach angles $\alpha = \pi/2N$. Equations governing the evolution of envelopes of edge waves, excited by resonant interactions with incident wavetrains, are derived. It is deduced that a uniform train of free periodic edge waves is always unstable to large-scale variations, so that enve-

lope solitons will develop; the resulting three-dimensional solitons are described in detail. In addition, it is shown that steady-state standing subharmonic edge waves, excited by incident wavetrains on long, mildly sloping beach, can be unstable to large-scale modulations. The possible physical significance of these findings is discussed. (18 refs.)

101266 A porous-wavemaker theory. A.T.Chwang (Inst. of Hydraulic Res., Univ. of Iowa, Iowa City, IA, USA).
J. Fluid Mech. (GB), vol.132, p.395-406 (July 1983).
A porous-wavemaker theory is developed to analyse small-amplitude surface waves on water of finite depth, produced by horizontal oscillations of a porous vertical plate. Analytical solutions in closed forms are obtained for the surface-wave profile, the hydrodynamic-pressure distribution and the total force on the wavemaker. The influence of the wave-effect parameter C and the porous-effect parameter G, both being dimensionless, on the surface waves and on the hydrodynamic pressures is discussed in detail. (12 refs.)

101267 Single waves in underground hydromechanics problems. A.Kh.Mirzadzhanzade, Z.P.Shul'man, A.O.Bogopol'skii (M. Azizbekov, Inst. of Oil & Chem., Baku, Azerbaidzhan SSR).
J. Eng. Phys. (USA), vol.43, no.6, p.1407-13 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.6, p.999-1006 (Dec. 1982).
Models of single filtration waves, which can be used in problems of intensification of the development and investigation of oil-gas strata, are considered. (3 refs.)

101268 Excitation of finite-amplitude waves on the surface of a perfectly conducting liquid by a varying magnetic field. A.V.Nesterov.
Magnetohydrodynamics (USA), vol.18, no.4, p.384-8 (Oct.-Dec. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.4, p.64-8 (Oct.-Dec. 1982).
The author considers the interaction of a varying magnetic field with surface waves in an ideal perfectly conducting liquid. A parametric resonance effect, with the amplitude of surface waves increasing exponentially with time, is possible for certain relations between the wave and field frequencies in the system. Account of nonlinear effects makes it possible to find the amplitude of stationary standing waves. (7 refs.)

101269 Bifurcating instability of the free surface of a ferrofluid. E.E.Twombly (NHC Wind Engng., Kent, WA, USA), J.W.Thomas.
SIAM J. Math. Anal. (USA), vol.14, no.4, p.736-66 (July 1983).
Considers a slab of ferrofluid bounded below by a fixed boundary and above by a vacuum. If the fluid is subjected to a vertically directed magnetic field of sufficient strength, surface waves appear. The equations which describe this phenomenon are derived. In the physical space no natural Banach space structure is available due to the free surface. In order to use the available bifurcation theory, a transformation of coordinates is made, mapping the surface flat. In the new coordinate system the equations define an operator between Banach spaces. The minimum eigenvalue of the linearized operator is the critial magnetic field strength where the planar surface loses stability. Using a generalized inverse of the Frechet derivative of the operator and the implicit function theorem, the existence of a nontrivial branch of solutions is proved. A local stability criterion is also obtained and applied to three periodic structures: rolls, squares and hexagons. (22 refs.)

A note on the stability of low-Prandtl-number Hadley circulations .... See Entry 101183

Mass transfer across a sheared, wavy air-water interface ..... See Entry 101201

The KdV equation in stratified fluid flow .... See Entry 101309

Wave motion of a liquid in an inhomogeneous tube .... See Entry 101340

Nonlinear periodic wave and fission of a solitary wave in a slowly varying channel with arbitrary cross-section .... See Entry 101341

Existence and unicity of the Cauchy problem for a relativistic heat conducting fluid .... See Entry 101357

A simplified method for calculating the highest wave on deep water .... See Entry 104365

A resonant test-field model of gravity waves .... See Entry 104376

47.40 COMPRESSIBLE FLOWS; SHOCK AND DETONATION PHENOMENA

(see also 28.70 Nuclear explosions, 52.35T Plasma shock waves)

101270 A variation of MacCormack's method for axisymmetric viscous compressible flows. J.F.Stalnaker (Lockheed-Huntsville Res. & Engng. Center, Huntsville, AL, USA).
AIAA J. (USA), vol.21, no.7, p.1043-4 (July 1983).
Recent advances in computational fluid dynamics and computer technology have made possible the solution of complicated three-dimensional flowfields. Still, if the symmetry of the problem permits, the use of the axisymmetric approximation provides considerable computational economy and greater resolution. If the flowfield in the vicinity of the axis is to be calculated, great care must be taken in choosing a finite difference scheme which properly models the axisymmetric form of the governing equations. The author presents such a finite difference scheme which maintains all the desirable characteristics of MacCormack's highly successful explicit technique. (4 refs.)

The initial boundary value problem for the flow of a barotropic viscous fluid, global in time .... See Entry 98773

Further experiments on shock tube wall boundary-layer transition .... See Entry 101181

Turbulence modeling for computational aerodynamics .... See Entry 101192

Derivation of the fundamental equation of sound generated by moving aerodynamic surfaces .... See Entry 101208

Seven-hole cone probes for high angle flow measurement: theory and calibration .... See Entry 101358

Mathematical modelling and analysis of the fluid dynamics of upper atmosphere dumbbell satellites .... See Entry 104638

47.40D General subsonic flows

101271 Edge tones in high-speed flows and their application to multiple-jet mixing. A.Krothapalli, K.Karamcheti, Y.Hsia, D.Baganoff (Joint Inst. for Aeronautics & Acoustics, Stanford Univ., Stanford, CA, USA).
AIAA J. (USA), vol.21, no.7, p.937-8 (July 1983).
Reports the results of an experimental investigation on edge tones generated with a high-speed subsonic air jet issuing from a rectangular nozzle and impinging on a wedge shaped edge. Experiments were also made to determine the influence of these tones on the mixing of multiple rectangular jets. For exit Mach numbers ranging from 0.2 to 1.0, the minimum breadth required for a tone to be generated increases linearly with Mach number. At distances of the wedge beyond the minimum breadth, the narrow-band spectrum of the near field pressure signals indicate the simultaneous existence of several discrete frequencies, and the amplitude dominant frequencies show different stages. Improved mixing of the multiple jets has been observed when a wedge is placed in one of them. (3 refs.)

101272 Similar solutions of the compressible boundary layer on a spinning cylinder in axial flow. R.Leblanc (Lab. d'Aerodynamique, ENSMA, Poitiers, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.15, p.1113-18 (25 April 1983). In French.
Falkner-Skan type equations are established for the compressible boundary layer on a spinning cylinder in axial flow. The ω-first-order development of the f and g functions lead to the perturbation velocity profiles. The major effects of the rotation is firstly to delay the separation and secondly to generate an over speed for the longitudinal accelerated profiles. (4 refs.)

101273 Unicity of the polynomial representation of the integral quantities of a compressible boundary layer on a spinning cylinder in axial flow. R.Leblanc (Lab. d'Aerodynamique, ENSMA, Poitiers, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.16, p.1207-12 (2 May 1983). In French.
The similar velocity profiles of the compressible boundary layer on a spinning cylinder in axial flow are used to establish the polynomials of the integral quantities. It is shown that the linear relation between the pressure gradient parameter β and the spinning velocity ω for $\beta \simeq 0$, which lead to the same velocity profile, can be generalized. The unicity of the polynomials is then established. (3 refs.)

101274 Configuration of subsonic regions formed by supersonic flow past a cylinder with spherical nose at large angles of attack. V.B.Minostsev, K.G.Savinov.
Fluid Dyn. (USA), vol.17, no.6, p.959-61 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.6, p.174-6 (Nov.-Dec. 1982).
As has been shown by investigations of supersonic flow at large angles of attack past a cylinder with spherical nose, one can distinguish five types of flow in the shock layer on the basis of the configuration of the subsonic regions. In a large range of angles of attack, beginning with zero angle of attack, there is a flow for which the subsonic region is situated only near the nose; this is the first flow type. As the angle of attack is increased, a restricted local subsonic region attached to the surface of the cylinder appears; this is the second flow type. The third flow type is observed at even larger angles of attack, when the subsonic region on the cylinder extends to infinity. With further increase in the angle of attack, the subsonic region attached to the cylinder is joined to the main subsonic region at the nose, which gives the fourth flow type. Finally, at angles of attack near 90°, the flow on the windward side is subsonic everywhere in the shock layer. The authors have calculated the flow on the windward side in the presence of local or extended subsonic regions on the side surface. (3 refs.)

101275 Approximate solution of the problem of sonic flow around a flat-bottom profile. S.K.Aslanov.
Sov. Aeronaut. (USA), vol.25, no.2, p.6-11 (1982). Translation of: *Izv. VUZ Aviats. Tekh. (USSR)*, vol.25, no.2, p.8-12 (1982).
The author constructs the approximate field of sonic flow around a flat-bottom profile at small angle of attack. The solution of the singular problem has simple algebraic form, regular nature of the singularity and branching, satisfies exactly the conditions of flow over the lower part of the wing, agrees very well with the known exact solution in both the near and far zones of the profile, and leads to a closed formula for the pressure distribution on the profile. (4 refs.)

Influence of nozzle profile on the characteristics of a gas-dynamic laser .... See Entry 100789

Numerical investigation of 'lateral' interaction with an obstacle of an axisymmetric jet exhausting into vacuum .... See Entry 101194

47.40H Transonic flows

101276 Analysis of viscous-inviscid interaction in transonic internal flows. Meng-Sing Liou (McDonnell Douglas Corp., St. Louis, MO, USA).
AIAA J. (USA), vol.21, no.7, p.962-9 (July 1983).
A method is presented to compute steady transonic flows in two-dimensional and annular diffusers, including the effects of shock/turbulent boundary-layer interaction and mass transfer through permeable walls. The analysis is based on the technique of matched asymptotic expansions and results in a system of coupled equations that describes the inviscid and turbulent boundary-layer flows. The derivation allows for the possibility of shock-induced separation in case of sufficiently strong shocks, assuming the separation bubble size is comparable to the boundary-layer thickness. The numerical procedure required to solve the system of equations is simple, and the computation times are sufficiently short to be useful in engineering design. Results are illustrated for two-dimensional and axisymmetric cases, the former showing good agreement with available experimental data. (21 refs.)

101277 Three-dimensional flow studies on a slotted transonic wind tunnel wall. J.M.Wu, F.G.Collins, M.K.Bhat (Univ. of Tennessee Space Inst., Tullahoma, TN, USA).
AIAA J. (USA), vol.21, no.7, p.999-1005 (July 1983).
Three-dimensional flowfield measurements were made near a transonic slotted wall. Field velocity vectors and static pressure distributions have been obtained. The boundary-layer displacement thickness was found to vary in the transverse plane with its maximum at the slot centerline but decreased with increasing suction rate through the slot. The boundary-layer characteristics were sensitive to the mass transfer through the slot. The projection of the flowfield velocity vectors on the transverse plane revealed a vortex-like flow formation. The center of this secondary flow was located nearly at the edge of the wall shear layer and decreased in strength with applied suction. The secondary vortex motion may be attributed to the mean flow skewing, inhomogeneous transverse plane boundary layer, and the wall turbulence anisotropy. These sources produced rotation of opposite sense and their contributions varied with the suction rate. (19 refs.)

101278 Calculation of three-dimensional transonic gas flow through a stage of an axial turbine. V.I.Gnesin.
Fluid Dyn. (USA), vol.17, no.6, p.927-34 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.6, p.138-46 (Nov.-Dec. 1982).
The authors describe the formulation of the problem and a numerical method of calculating the three-dimensional flow of an ideal gas in a turbomachine stage with allowance for the aerodynamic interaction of the directing apparatus and the working rotor, which are in relative motion. The idea of the method is to use the principle of stabilisation in the solution of the complete

system of nonstationary three-dimensional equations of motion of a compressible gas through a system of aerodynamically interacting cascades. (16 refs.)

101279 Nonlinear far field in the case of transonic flow past a nonlifting profile. G.D.Sevost'yanov.
Fluid Dyn. (USA), vol.17, no.6, p.957-9 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.6, p.171-3 (Nov.-Dec. 1982).
A new analytic solution is constructed for the nonlinear transonic equations describing the irrotational far flow field (with two symmetry axes) in the case of transonic flow past a nonlifting profile. With increasing distance from the profile, the nonlinear field goes over continuously into the field of the linear theory. The solution is expressed in terms of an elliptic Weierstrass function. (5 refs.)

Influence of nozzle profile on the characteristics of a gas-dynamic laser .... See Entry 100789

An investigation of the Mach disc and the Riemann wave formation in impulse jets .... See Entry 101299

47.40K Supersonic and hypersonic flows

101280 Effects of properties and location in the plume on droplet diameter for injection in a supersonic stream. A.S.Nejad, J.A.Schetz (Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
AIAA J. (USA), vol.21, no.7, p.956-61 (July 1983).
The mean droplet diameter in the spray resulting from transverse injection of liquid jets into supersonic airstream was investigated in detail by the use of diffractively scattered light method. The effects of viscosity, surface tension, jet/freestream dynamic pressure ratio, injector diameter, and location in the plume on the mean droplet diameter were determined. All tests were performed at $M_\infty=3.0$, with $P_0=4.2$ atm and $T_0=300$K. The injectants used were water, various solutions of glycerine and ethanol in water, and Fluorinert to produce wide variations in viscosity and surface tension. (18 refs.)

101281 Study of the aerodynamic characteristics of a diamond profile in translational oscillations in supersonic flow. A.N.Varnavskii.
Sov. Aeronaut. (USA), vol.25, no.2, p.56-7 (1982). Translation of: *Izv. VUZ Aviats. Tekh. (USSR)*, vol.25, no.2, p.51-2 (1982).
The author presents the results of a study of the influence of translational oscillations of a diamond profile in supersonic flow on the aerodynamic characteristics, obtained with the aid of the gashydraulic analogy method. He examines oscillations in the range of dimensionless oscillation frequencies p^* from 0 to 1.0 and relative amplitudes $y=0.008$, 0.02, 0.04 with incidence angle $\alpha_0=0°$. The diamond profile apex halfangle was $\theta=10°$ and the chord was $b=250$ mm. (4 refs.)

Numerical investigation of 'lateral' interaction with an obstacle of an axisymmetric jet exhausting into vacuum .... See Entry 101194

Configuration of subsonic regions formed by supersonic flow past a cylinder with spherical nose at large angles of attack .... See Entry 101274

Decay of a plane shock wave in a two-parameter medium with arbitrary equation of state .... See Entry 101285

Penetration and breakup of slurry jets in a supersonic stream .... See Entry 101298

Rotating supersonic flow about scoop inlet using an unsteady implicit technique .... See Entry 101334

47.40N Shock-wave interactions

101282 A self-similar flow behind a spherical shock wave with thermal radiation. I. J.B.Singh, P.R.Vishwakarma (Dept. of Maths., SGR Postgraduate Coll., Dobhi, Jaunpur, India).
Astrophys. & Space Sci. (Netherlands), vol.93, no.2, p.261-5 (June 1983).
Similarity solutions, for one-dimensional unsteady flow of a perfect gas behind a spherical shock wave produced on account of a sudden explosion or driven out by an expanding piston including the effects of radiative cooling, are investigated. The shock ahead of the point of explosion or piston is propagating into a transparent medium at rest with nonuniform density. The total energy of the wave is assumed to be time dependent obeying a power law. (8 refs.)

101283 Interaction of oblique shock and detonation waves. Y.Sheng, J.P.Sislian (Univ. of Toronto, Toronto, Ontario, Canada).
AIAA J. (USA), vol.21, no.7, p.1008-14 (July 1983).
The interaction of an oblique shock wave and an oblique detonation wave which deflect the flow in the same direction is analyzed. The detonation wave is assumed to be an exothermic gasdynamic discontinuity. A criterion is developed and used to determine whether or not a theoretical solution of the problem describes a physically realizable interaction configuration. It is found that the reflected wave is a rarefaction wave; however, if the heat release parameter of the detonation wave is sufficiently small, then the reflected wave can be a shock wave. Domains of existence of such resulting wave interaction configurations are established for different values of the oncoming Mach number, $6\leq M\leq 8$, the heat release parameter, $3\leq Q\leq 8$, and the specific heat ratios for the combustion products behind the detonation wave, $1.30<\gamma\leq 1.33$. (9 refs.)

101284 Problems with a direct simulation Monte Carlo method applied to the shock structure in a binary gas mixture. B.Schmidt, M.Worner (Inst. fur Stromungslehre und Stromungsmaschinen, Univ. Karlsruhe, Karlsruhe, Germany).
Arch. Mech. (Poland), vol.34, no.3, p.325-31 (1982).
The direct simulation Monte Carlo method as developed by G.A. Bird (1976) gives results independent of the number of molecules per cell for the shock structure in binary gas mixtures if the number of molecules per cell is sufficiently large. Up to a certain number, separation of the components, shock thickness and the temperature relaxation downstream of the shock are dependent on the number of molecules per cell. Two facts are responsible for the observed distortions of the computed results: the calculation procedure for the molecule collisions and the small perturbation propagation speed across a simulation cell. (8 refs.)

101285 Decay of a plane shock wave in a two-parameter medium with arbitrary equation of state. S.A.Egorushkin.
Fluid Dyn. (USA), vol.17, no.6, p.935-40 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.6, p.147-53 (Nov.-Dec. 1982).
Special curves, called shock polars, are frequently used to determine the state of the gas behind an oblique shock wave from known parameters of the oncoming flow. For the solution of problems associated with gas flow at high velocities and high temperatures it is necessary to use models of gases with complicated equations of state. A study is made of the form of the shock polars for two-parameter media with arbitrary equation of state, these satisfying the conditions of Cemplen's theorem. Some properties of oblique shocks in such media that are new compared with a perfect gas are established. On the basis of the obtained results, the existence of triple configurations in steady supersonic flows obtained by the decay of plane shock waves is considered. It is shown that D'yakov-unstable discontinuities decompose into an oblique shock and a centered rarefaction wave while spontaneously radiating discontinuities decompose into two shocks or into a shock and a rarefaction wave. (5 refs.)

101286 Shock wave structure in a monatomic gas in the case of power-law interaction potentials. V.V.Aristov, F.G.Cheremisin.
Fluid Dyn. (USA), vol.17, no.6, p.964-8 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.6, p.179-83 (Nov.-Dec. 1982).
The structure of a plane shock wave is the simplest example of a nonequilibrium state of a gas. The flow is one dimensional and there are no effects of interaction of the gas with the surface of a solid body. The authors investigate the shock wave structure on the basis of a conservative method of decoupling which makes it possible to raise the accuracy of the calculation compared with the methods previously used to solve the Boltzmann equation. Numerical results are given for the hard-sphere molecular model and power-law potentials with exponent corresponding to previous experiments. (14 refs.)

101287 Shock diffraction in channels with 90° bends. D.H.Edwards (Dept. of Phys., Univ. Coll. of Wales, Aberystwyth, Wales), P.Fearnley, M.A.Nettleton.
J. Fluid Mech. (GB), vol.132, p.257-70 (July 1983).
A study has been made of how initially planar shocks in air propagate around 90° bends in channels of nearly rectangular cross-section. In shallow bends for which the radius of curvature R is much greater than the radius r of the channel, the shock recovers from a highly curved profile at the start of the bend to regain planarity towards the end of the bend. This occurs on account of the acceleration of the triple point across the channel following its interaction with the expansion waves generated at the convex wall. In sharp bends the shock profiles retain their pronounced curvature for some distance downstream of the bend. (16 refs.)

Numerical investigation of 'lateral' interaction with an obstacle of an axisymmetric jet exhausting into vacuum .... See Entry 101194

Configuration of subsonic regions formed by supersonic flow past a cylinder with spherical nose at large angles of attack .... See Entry 101274

Analysis of viscous-inviscid interaction in transonic internal flows .... See Entry 101276

An investigation of the Mach disc and the Riemann wave formation in impulse jets .... See Entry 101299

On a relaxing model for the flow of a mixture of gas with porous particles .... See Entry 101310

Self-similar flows behind cylindrical shock waves in magnetogasdynamics .... See Entry 104723

47.45 RAREFIED GAS DYNAMICS

(see also 07.30 Vacuum production and techniques)

101288 Cylindrical Couette problem of rarefied binary mixture. Dang Hong Tiem (Univ. Paris-6, Paris, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.14, p.1015-18 (18 April 1983). In French.
The flow of a rarefied binary mixture between two coaxial cylinders is analysed by the moment method of Lees. It is found that, in the case where one cylinder rotates while the other is fixed, the heavier gas follows the rotating cylinder by throwing out the lighter to the other cylinder. (3 refs.)

47.50 NON-NEWTONIAN DYNAMICS

101289 Laminar entry length problem for power law fluids. Z.Matras, Z.Nowak (Tech. Univ. of Krakow, Kracow, Poland).
Acta Mech. (Austria), vol.48, no.1-2, p.81-90 (1983).
The authors present a new approximate method for predicting the changes in pressure drop in laminar entrance region flow of purely viscous power law fluids in circular tubes. The 'transformation method for describing the tube flow of non-Newtonian purely viscous fluids' has been extended and adopted to construct a pseudo-Newtonian model of the flow under consideration. To derive the dimensionless equations for calculating the changes in pressure drop in the entrance region flow and the velocity distribution in both the developing boundary layer and inside the inviscid core the momentum integral method has been applied. The analysis leads to only one single curve correlation—independent of any value of flow behaviour index—between the pressure drop and the axial distance from the tube entrance which is presented in a form suitable for engineering designs. (16 refs.)

101290 Flow of a non-Newtonian fluid in a convergent channel in a transverse magnetic field. M.A.Khidr, F.M.Hady (Dept. of Math., Assiut Univ., Assiut, Egypt).
Acta Phys. Pol. A (Poland), vol.A64, no.1, p.3-7 (July 1983).
The boundary-layer flow of a non-Newtonian fluid in a convergent channel in a transverse magnetic field is considered. A perturbation method to derive equations up to the first order is used, and numerical results are given. (4 refs.)

101291 Turbulent flow with polymer additives. B.Gampert, P.Wagner (Univ. of Essen, Essen, Germany).
Arch. Mech. (Poland), vol.34, no.4, p.493-502 (1982).
For a better understanding of the Toms phenomenon it is necessary to correlate molecular characteristics with the turbulent drag reduction effect. Experimental results concerned with the effect of molecular weight on drag reduction and mechanical degradation in turbulent fully-developed pipe flow are presented. The polymeric material investigated was very clean laboratory synthesized polyacrylamide. (7 refs.)

101292 Experimental study of velocity and scalar fields in grid-generated turbulence with dilute polymer solutions. A.Bennani, J.Mathieu (Ecole Centrale de Lyon, Ecully, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.16, p.1213-16 (2 May 1983). In French.
Measurements of some of the properties of velocity and scalar fields are made in grid generated turbulence for one concentration of a drag-reducing polymer additive in water (2.000×10^{-6} of polyacrylamide). The passive scalar used is a solution containing salt (NaCl) injected into flow water through the grid. A comparison was made between water and an aqueous solution of polyacrylamide. In particular, the decay of turbulence intensity and fluctuation concentra-

tion intensity of salt downstream from the grid are more rapid in the flow polymer solution. (10 refs.)

101293 Drag minimization on a body of revolution through evolution. W.E.Pinebrook, C.Dalton (Univ. of Houston, Houston, TX, USA).
Comput. Methods Appl. Mech. & Eng. (Netherlands), vol.39, no.2, p.179-97 (Aug. 1983).
This study deals with the determination of the minimum drage profile of a body of revolution. With the restriction that the boundary layer is not allowed to separate, the profile is described by a continuous, linear line-singularity distribution defined at a number of points placed parallel in a uniform stream with zero angle of attack. The drag calculation is based on the momentum deficit in the boundary layer at the trailing edge of the body. By gradually changing the body profile with the Evolution Strategy the minimum drag profile is found for a constant fineness ratio. For a particular case, the drag coefficient is reduced by 30 percent by means of this procedure. (25 refs.)

101294 Flow of a second-order fluid under torsionally oscillating disc. H.G.Sharma, D.S.Gupta (Dept. of Math., Univ. of Roorkee, Roorkee, India).
Indian J. Pure & Appl. Math., vol.14, no.6, p.728-34 (June 1983).
The flow of an incompressible second-order fluid under an infinite torsionally oscillating disc has been considered by expanding the velocity components and the pressure in powers of amplitude of oscillation (assumed small) of the disc. The transverse and the radial flows are investigated in detail. The effects of second-order forces is to increase the amplitude of the oscillation of the axial velocity. The steady parts of the velocity components for small values of Reynolds number have been studied and shown graphically. The transverse shearing stress and moment on the discs have also been obtained. (4 refs.)

101295 Application of nonlinear operator theory to the Edwards-Freed equations in the theory of polymer solutions. T.Yoshimura.
J. Math. Phys. (USA), vol.24, no.8, p.2056-60 (Aug. 1983).
Mathematical structure of nonlinear integral equations for 'screened hydrodynamic interaction' and 'self-energy' in the static version of Edwards and Freed's theory of polymer solutions with finite concentrations are analyzed and it is shown that algorithms developed by Lika (1975) and Altman (1977, 1980) for nonlinear operator equations without Frechet differentiability are applicable. Recipes for successive approximations are presented and questions to be investigated by those techniques are proposed. (14 refs.)

101296 Geometrical approach for the study of non-Newtonian fluid flows. A.Ramachandra Rao, A.V.Gopalakrishna (Dept. of Appl. Math., Indian Inst. of Sci., Bangalore, India).
J. Math. & Phys. Sci. (India), vol.17, no.1, p.87-93 (Feb. 1983). [received: Aug. 1983]
The geometry of vortex lines has been used to study the flow of an incompressible viscoelastic fluid. The intrinsic equations governing the flow have been derived and the conditions for the Bernoulli surfaces to contain the vortex lines have been obtained for a suitably defined Bernoulli function. (7 refs.)

Hydrodynamics and heat transfer in sphere assemblages—cylindrical cell models .... See Entry 101216

Behaviour of a mixture of a non-Newtonian fluid with spherical solid particles with fixed centre .... See Entry 101325

47.55 NONHOMOGENEOUS FLOWS

Trajectory of freely falling conducting particles in a nonuniform magnetic field .... See Entry 101349

47.55B Cavitation

Polymerization resulting from ultrasonic cavitation .... See Entry 103523

47.55C Jets

101297 Investigation of two plane parallel jets. H.Elbanna, S.Gahin (King Abdulaziz Univ., Jeddah, Saudi Arabia), M.I.I.Rashed.
AIAA J. (USA), vol.21, no.7, p.986-91 (July 1983).
Results of an experimental study on the interaction of two two-dimensional turbulent parallel jets are reported. The investigation includes measurements of mean velocity, turbulence intensities, and Reynolds shear stress. The structure of the combined flow is compared with that of a single jet. The results show that the velocity profiles of the combined flow are similar and agree well with that of the single jet. Up to 120 slot widths downstream from the nozzles, true similarity is not found. For a spacing of 12.5 slot widths between the axes of the two nozzles, the half-width of the combined flow grows linearly with downstream distance, but its spread angle is slightly lower than that of a single jet. The centerline velocity decays with the same rate as the single jet, but with a higher value of U_M/U_0. (13 refs.)

101298 Penetration and breakup of slurry jets in a supersonic stream. D.M.Less, J.A.Schetz (Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
AIAA J. (USA), vol.21, no.7, p.1045-6 (July 1983).
By adding metal powders to liquid fuels, the energy of the fuels can be greatly increased. Ramjets that burn slurry fuels can be compact and yet possess high specific thrust, high speed, and high continuous thrust. The study was directed toward examining the penetration and breakup behavior of transverse slurry jets. The suspended particles had an average diameter of 5 μm, which corresponds to the size of metal particles used in earlier NACA combustion studies (1-5 μm). (no refs.)

101299 An investigation of the Mach disc and the Riemann wave formation in impulse jets. V.V.Golub, I.M.Naboko (Inst. of High Temperatures, Acad. of Sci., Moscow, USSR).
Arch. Mech. (Poland), vol.34, no.4, p.465-75 (1982).
The shock waves in nonstationary jets of shock-heated n_2, Ar and CO_2 outflowing from flat and axisymmetrical sonic nozzles have been studied experimentally. The pressure range $N=P_{00}/P_\infty=20\div200$ was investigated. Here P_{00} is the pressure behind the reflected shock wave, P_∞ is the pressure in the vacuum chamber. Schlieren photographs for the nonstationary jet structure were obtained for different spatial orientations of the flat nozzle using a schlieren installation and a spark light source. On the basis of the obtained schlieren photographs of jet formation, the nonstationary wave structure of flow was reproduced. The geometrical characteristics of the nonstationary Reimann wave for three nozzles and different values of n were generalized in dimensionless similarity parameters. A dependence between the location of the Mach disc and time was obtained upto the stationary location. Moreover, a comparison with the calculation was also made. An analysis was performed for the acceptance of the model of a suddenly introduced source to the studied flow. (13 refs.)

101300 A study of concentration field of a round jet by a quantitative visualization method. J.-L.Balint, J.-M.Molines, M.Ayrault, J.-P.Schon, J.Mathieu (Univ. de Saint-Etienne, Lyon, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.14, p.1011-14 (18 April 1983). In French.
A quantitative flow visualisation technique employing an association of laser sweeping and image processing has been used to determine RMS values of the concentration fluctuation in a symmetry plane of a round jet. (2 refs.)

101301 Influence of acoustics and the flow regime in the boundary layer on nozzle walls on the mixing layer of an immersed jet. A.A.Pavel'ev, V.I.Tsyganok.
Fluid Dyn. (USA), vol.17, no.6, p.844-50 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.6, p.36-42 (Nov.-Dec. 1982).
Experimental determinations were made of the width of the mixing layer and the level of turbulent pulsations in the initial section of a subsonic circular immersed jet for different parameters of the boundary layer on the nozzle walls and in the presence of acoustic excitation. It was established that the rate of expansion of the turbulent mixing layer depends on the flow regime in the boundary layer. For laminar initial boundary layer, external acoustic excitation can lead to a decrease in the expansion velocity of the mixing layer and of the intensity of the velocity pulsations on the jet axis within the initial section. If the frequency and amplitude of acoustic excitation at which a decrease in the rate of expansion of the mixing layer and of the pulsation intensity was observed remained unchanged, the influence of the acoustics disappeared when the boundary layer became turbulent. The acoustic vibrations influenced the subsonic jets by generating vortex perturbations when they interact with the edge of the nozzle. (10 refs.)

101302 Jet flow of ideal fluid past a flexible shell. V.P.Zhitnikov, A.G.Terent'ev.
Fluid Dyn. (USA), vol.17, no.6, p.850-5 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.6, p.43-8 (Nov.-Dec. 1982).
A detailed study is made of Kirchhoff flow of an ideal, incompressible, and weightless fluid past a flexible shell with one or two fixed points. It is shown numerically that when the pressure is decreased in a soft balloon multisheeted flows and a wavelike deformation of the balloon are possible. (7 refs.)

101303 Instabilities in the slit-jet flow field. J.F.Foss, D.Korschelt (Dept. of Mech. Engng., Michigan State Univ., East Lansing, MI, USA).
J. Fluid Mech. (GB), vol.132, p.79-86 (July 1983).
Three modes of instabilities in the slit-jet flow field are recognized. Additional evidence for the universality of the Strouhal number for the second mode $S_T=fw/U_0\approx0.43$ and additional information on the wavelength (λ) between, and convection speed u_c of the symmetrically placed, large-scale motions that result from this instability are presented. Specifically $\lambda/w\approx1.2$ and $u_c/U_0\approx0.51$. The third instability mode is initiated at a Reynolds number U_0w/ν of approximately 1600; this instability results in a loss of the regular pattern associated with the large-scale motions. (7 refs.)

101304 Discharge of a turbulent jet in a monodisperse fluidized bed. N.N.Prokhorenko, Yu.I.Chernyaev (All-Union Sci.-Res. & Planning-Design Inst. for Assembly & Processing Lines, Moscow, USSR).
J. Eng. Phys. (USA), vol.43, no.6, p.1334-9 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.6, p.913-18 (Dec. 1982).
The velocity of initial circulation is calculated and explanations are given for the mechanism of jet collapse and the existence of bubble and jet regimes. (11 refs.)

101305 Stability of a system of current-carrying jets with currents alternating in direction. E.V.Poklonskii, A.I.El'kin.
Magnetohydrodynamics (USA), vol.18, no.4, p.362-8 (Oct.-Dec. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.4, p.39-45 (Oct.-Dec. 1982).
The authors examine the stability of a system consisting of an infinite number of rectangular free jets arranged periodically along the z coordinate, through which flow constant electric currents directed such that the currents in adjacent jets have a different direction. Such a system can perform functions of a liquid magnet, creating a magnetic field periodic along z. Instability of the kink type is possible in such a system. It is of practical interest to examine the stability of a system of jets in which their cross section is greatly extended in the direction of the y axis, i.e. $\Delta_1/\delta_0>1$. The authors note that in this case the rectangular sections of the jet cannot be replaced by strips oriented in the y direction, since then the kinks will not lead to intensification of the magnetic field and, consequently, to the development of instability. At the same time, in the case of sufficiently large currents the geometry under consideration can also prove to be unstable. (2 refs.)

101306 Interaction of a system of jets impinging on a plane barrier. V.V.Startsev, N.I.Syromyatnikov, A.M.Poletaev.
Sov. Aeronaut. (USA), vol.25, no.2, p.106-8 (1982). Translation of: *Izv. VUZ Aviats. Tekh. (USSR)*, vol.25, no.2, p.86-8 (1982).
There is interest in studying the development of flow and heat transfer in a system of jets impinging on a barrier. A characteristic feature of the flow is the appearance of a region of interaction of the spreading jets near the surface, characterized by intense vortical motion and determining the hydrodynamics and heat exchange on the surface, and also the nature of the flow directed away from the surface. Therefore detailed study of the flow in the interaction region of spreading jets near a surface is a very important problem. The authors propose a possible approach to description of the flow in this quite complex region with the aid of a two-dimensional rectilinear vortex filament model. (4 refs.)

101307 An experimental investigation of merging buoyant jets in a crossflow. M.Gregoric (Inst. Jozef Stefan, Ljubljana, Yugoslavia), L.R.Davis, D.J.Bushnell.
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.236-40 (May 1982).
Merging buoyant jets discharged in a crossflow were investigated experimentally using a unique visualization technique. Salt water jets were discharged from a constant head tank while being towed in an inverted position at desired rates through stagnant receiving water. Visualization of the jet cross section was produced by using fluorescent dye and a vertical slit light source. The results were photographed as a sequence of instantaneous cross sections taken by a motor-driven camera. Maximum heights, widths, and the vertical cross sections of the deflected jets were determined for different ratios of crossflow velocity to discharge velocity, number of discharge jets and discharge nozzle line orientation. Horseshoe shaped cross sections were observed in the cases of a single jet and multiple jets where the crossflow velocity was parallel to the line of discharge ports, but the horseshoe pattern was not clear when the cross flow was perpendicular to the line of multiple jets. The wake behind the multiple jets in the crossflow exhibited a distinct trailing vortex sheet. (17 refs.)

101308 Hydrodynamics of a subsonic vapor jet in subcooled liquid. M.E.Simpson, C.K.Chan (Dept. of Chem., Nuclear & Thermal Engng., Univ. of California, Los Angeles, CA, USA).
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.271-8 (May 1982).
Small scale experiments were performed to investigate the condensation process and hydrodynamic pressure oscillations when steam was discharged into a subcooled water pool. The dynamic behavior of subsonic jets, differed from that of sonic jets. The interfacial motion of a subsonic jet was periodic, composed by three intervals: bubble growth, bubble translation, and bubble separation (necking). The condensation rate for each interval was governed by different processes. The pressure transient of the subsonic jet was marked by periodic impulses, originated by the necking process. Of the intensive parameters studied, pool subcooling exhibited the largest influence on dynamic behavior. The pulse frequency and intensity were found to be best fit by correlations involving the Jacob number and the Reynolds number. (16 refs.)

Acoustic admittance of organ pipe jets ....See Entry 100985

Two-scale semiempirical theory of turbulent boundary layers and jets ....See Entry 101199

Similarity solutions of free shear flows with mean Reynolds stress turbulence models ....See Entry 101205

Edge tones in high-speed flows and their application to multiple-jet mixing ....See Entry 101271

Effects of properties and location in the plume on droplet diameter for injection in a supersonic stream ....See Entry 101280

Measurement of double and triple velocity-correlations by means of streamwise orientated rotated X-hot-wire probes ....See Entry 101368

On the free molecule quenching of a gas jet by another gas at rest ....See Entry 101372

47.55E Nozzles

Influence of nozzle profile on the characteristics of a gas-dynamic laser ....See Entry 100789

An experimental investigation of merging buoyant jets in a crossflow ....See Entry 101307

47.55H Stratified flows

101309 The KdV equation in stratified fluid flow. A.Jeffrey (Dept. of Engng. Math., Univ. of Newcastle upon Tyne, Newcastle upon Tyne, England).
Appl. Anal. (GB), vol.15, no.1-4, p.283-94 (1983).
The author describes a method for the formal derivation of the equation governing long waves on the surface of a shallow fluid which is stably and continuously stratified. By using a three variable expansion procedure involving the normal time scale together with two slow time scales suggested as a result of the formulation of the problem, the governing equation is shown to be the ordinary Korteweg-de Vries equation. (14 refs.)

Time-dependent density profiles in a filling box ....See Entry 101196

Study of internal waves in the case of rapid horizontal motion of cylinders and spheres ....See Entry 101259

Role of surface interactions in stratification of magnetic fluids ....See Entry 102728

47.55K Multiphase flows

101310 On a relaxing model for the flow of a mixture of gas with porous particles. F.Feuillebois, A.Lasek (Lab. d'Aerothermique, CNRS, Meudon, France).
Arch. Mech. (Poland), vol.34, no.3, p.253-62 (1982).
A suspension of solid porous particles in a perfect gas is considered. The gas penetrates into the particles and its quantity contained in the pores may vary with the flow conditions. It is assumed that the flow within the particles obeys Darcy's law. The pressure of the gas in the particle pores does not follow immediately the outer conditions, and relaxation phenomena in the flow are taken into account. One-dimensional analysis has been applied to the case of a shock wave in the considered suspension. (5 refs.)

101311 An unsteady Faxen's relation for the force including interaction effects (two-phase flow). I.Pienkowska (Inst. of Fundamental Technol. Res., Polish Acad. of Sci., Warsaw, Poland).
Arch. Mech. (Poland), vol.34, no.3, p.297-307 (1982).
Deals with unsteady hydrodynamic interactions between N spherical particles, immersed in an incompressible, unbounded fluid. It is assumed that the flow is governed by the unsteady Stokes equations. The integral equation approach, involving the Green function, depending explicitly on the time variable is used. The unsteady hydrodynamic drag, exerted on the j-th spherical particle in the presence of $N-1$ other particles, is calculated under some simplifying assumptions. (10 refs.)

101312 On the motion of gas bubbles in a perfect fluid. L.van Wijngaarden (Twente Technol. Univ., Enschede, Netherlands).
Arch. Mech. (Poland), vol.34, no.3, p.343-9 (1982).
Various forms have been proposed for the dynamic equation governing the relative motion of a body in a nonuniformly flowing liquid. The correct form is suggested by the recent work of Landweber and Miloh (1980). An alternative derivation of their result, avoiding an alleged error, is given. An application, restricted to the representation by dipoles only, is made to the nonsteady flow of bubbles through a widening pipe. (9 refs.)

101313 Heat and mass transfer by condensation in an incompressible turbulent boundary layer on a flat plate with low level exchange. Gia Ban Diep (Lab. d'Aerothermique, CNRS, Meudon, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.15, p.1143-6 (25 April 1983). In French.
An investigation was made in order to find the increase of heat transfer rate on a horizontal flat plate located in a low speed mixed air-water stream at saturated conditions; under a thermal gradient, a fully turbulent boundary layer produces vapor condensation by phase change and releases latent heat. A comparison of experimental results obtained from wind tunnel measurements with computed values shows good agreement when the temperature profile is in the asymptotic case. The best exchange is for the largest free stream temperature and for largest differences in temperature from the wall. (4 refs.)

101314 Pressure oscillations in bubble columns. J.Gluszek, R.Marcinkowski (Inst. of Chem. Engng., Tech. Univ. of Warsaw, Warsaw, Poland).
Chem. Eng. J. (Switzerland), vol.26, no.3, p.181-7 (June 1983).
Spontaneous pressure oscillations have been studied theoretically and experimentally. The authors have formulated a hypothesis concerning the oscillation mechanism and worked out a mathematical model that enables calculation of oscillation frequency for a system comprised of a bubble column, sieve plate and gas chamber representing the pneumatic capacity underneath the plate. The model has been verified experimentally. (12 refs.)

101315 Generalized boundary conditions for the axial dispersion model. E.B.Nauman, R.Mallikarjun (Dept. of Chem. Engng. & Environmental Engng., Rensselaer Polytech. Inst., Troy, NY, USA).
Chem. Eng. J. (Switzerland), vol.26, no.3, p.231-7 (June 1983).
The Danckwerts boundary conditions for the axial dispersion model predict concentration profiles which are unrealistic when the dispersion coefficient is determined mainly by convection rather than by diffusion. Modified boundary conditions have been suggested as a simple means of overcoming this limitation. These are explored in a systematic way which introduces two new adjustable parameters in the model. Time-domain and Laplace-domain solutions for the residence time distribution are given. The new parameters can be found from inert tracer experiments just as the Peclet number is found. Differences between the modified model and the standard model exist for axial Peclet numbers less than 16. (9 refs.)

101316 Analogy of motion of two-phase medium containing an incompressible phase, with gas motion. V.O.Vakhnenko, V.M.Kudinov, B.I.Palamarchuk.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.6, p.21-2 (1983). In Ukrainian.
A coordinate system is found where the motion of a two-phase mixture with an arbitrary content of an incompressible phase is similar to gas motion. (6 refs.)

101317 A calculation procedure for two phase flow distribution in manifolds with and without heat transfer. A.B.Datta, A.K.Majumdar (Central Mech. Engng. Res. Inst., Durgapur, India).
Int. J. Heat & Mass Transfer (GB), vol.26, no.9, p.1321-8 (Sept. 1983).
A finite-difference procedure has been developed for calculating two phase flows with heat transfer in parallel, reverse and mixed flow manifolds. The flows are assumed to be homogeneous and one dimensional. An iterative numerical scheme is used to solve the differential equations for longitudinal momentum and continuity, while in the lateral direction an integral equation for momentum is solved. Numerical predictions compare well with the available experimental results for a combining flow manifold. The effect of total flow rate, heat input on the lateral flow distribution and pressure drop characteristics have been demonstrated. (9 refs.)

101318 Interfacial area and nucleation site density in boiling systems. G.Kocamustafaogullari (Dept. of Mech. Engng., Univ. of Wisconsin-Milwaukee, Milwaukee, WI, USA), M.Ishii.
Int. J. Heat & Mass Transfer (GB), vol.26, no.9, p.1377-87 (Sept. 1983).
The number density, which is one of the most important parameters affecting the interfacial area concentration in the bubbly two-phase flow system, is formulated in terms of the differential transport equation. From this formulation it becomes apparent that the active nucleation site site on a heated channel surface is the key parameter in the prediction of the bubble number density. A constitutive relation for active nucleation site density is developed in pool boiling and extended to forced convective nucleate boiling. The active nucleation site densities predicted by this constitutive relation are in relatively good agreement with direct measurements available in the literature. (35 refs.)

101319 The effect of the heat-transfer, phase transitions and gas dissolutioned in liquid on the oscillations of the vapor-gas bubbles. F.B.Nagiev, F.M.Mamedova.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.4, p.128-34 (1982). In Russian.
The effect of heat-transfer and disbalanced phase transitions on the small free oscillations of a vapor-gas bubbles in a liquid is considered. Numerical calculations of the natural resonant frequency and logarithmic decrement of the vapor-gas bubbles in the water are reduced. (8 refs.)

101320 The plane-parallel motion of a two-component liquid caused by the source. N.M.Kh.Abdel'Aziz.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.5, p.44-5 (1982). In Russian.
The complete qualitative investigation of the problem on the plane-parallel motion of a two-component incompressible liquid caused by the source is conducted. The qualitative pattern of the integral curve problems is constructed. (2 refs.)

101321 The effective reaction rate and diffusion coefficients for a two-phase medium. D.Bedeaux (Inst. for Teoretisk Fysikk, Norges Tekniske Hogskole, Trondheim, Norway), R.Kapral.
J. Chem. Phys. (USA), vol.79, no.4, p.1783-8 (15 Aug. 1983).
The transport properties of a system composed of an ensemble of small particles moving in a two-phase medium are calculated. One phase is assumed to be finely dispersed in the other so that the homogeneous regions are small compared to the size of the system. The particles may diffuse and react (disappear) in either phase. The coarse-grained (effective) reaction rate and diffusion coefficients are calculated for arbitrary volume fractions of the two phases for various cases. The calculation utilizes the introduction of background rate and diffusion coefficients to motivate the definition of self- and local density fields. The introduction of these fields in conjunction with the assumption of the random distribution of the inclusions of one phase in the other leads to reasonable approximations for the effective transport coefficient for all volume fractions. The result of model calculations are presented. (20 refs.)

101322 Stokes flow past bubbles and drops partially coated with thin films. II. Thin films with internal circulation—a perturbation solution. R.E.Johnson (Dept. of Theoretical & Appl. Mech., Univ. of Illinois, Urbana, IL, USA), S.S.Sadhal.
J. Fluid Mech. (GB), vol.132, p.295-318 (July 1983).
For pt.I see ibid., vol.126, p.237 (1983). The authors examine the steady axisymmetric creeping flow due to the motion of a liquid drop or a bubble which is partially covered by a thin immiscible fluid layer or film. The analysis is based on the assumption that surface-tension forces are large compared with viscous forces which deform the drop, and that the circulation in the film is weak. The latter assumption is satisfied provided that the film-fluid viscosity is not too small. A perturbation scheme based on the thinness of the fluid layer is used to construct the solution. One of the principal results is an expression for the drag force on the complex drop. The authors also find that the extent to which the drop or bubble is covered by the film has a maximum value depending on the magnitude of the driving force on the film.

In addition, they find the rather interesting result that when the ratio of the primary drop viscosity and bulk fluid viscosity is greater than $^1/_2$, the circulation within the film may have a double-cell structure. (7 refs.)

101323 Motion of gas bubbles during vacuumization of liquid aluminum in MDV-type magnetodynamic vacuumization apparatus. Yu.M.Gel'fgat, M.Z.Sorkin, V.P.Polishchuk, L.P.Puzhailo.
Magnetohydrodynamics (USA), vol.18, no.4, p.422-6 (Oct.-Dec. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.4, p.105-9 (Oct.-Dec. 1982).
The authors quantitatively determine the appropriate dimensions of the active zone and parameters of metal processing in MDV-type sets on the basis of a theoretical analysis of the motion of an individual gas bubble through the upper T-zone in a magnetodynamic vacuumization set. (3 refs.)

101324 Identification of gas-liquid stream flow patterns. G.D.Khomyakov, R.N.Karataev, M.A.Kopyrin.
Sov. Aeronaut. (USA), vol.25, no.2, p.109-12 (1982). Translation of: *Izv. VUZ Aviats. Tekh. (USSR)*, vol.25, no.2, p.88-91 (1982).
The basic difference between the combined flow of gas and liquid through piping and the flow of a single-phase stream lies in the multiplicity of the structural forms (flow regimes), which are determined by the large number of parameters. In the general case the typical variables are the distribution of the components of the gas-liquid stream across the channel section, the flow velocity, the physical properties of the individual mixture components, and the variation of the pressure, density, and concentration. The study of gas-liquid steams is also complicated by the fact that the limits of their flow regimes are due not only to the channel walls but also to the internal phase interface surface, which varies in space and time. Therefore the laws describing the motion of gas-liquid mixtures in closed pipes are considerably more complex than the laws of single-phase media hydrodynamics. (8 refs.)

101325 Behaviour of a mixture of a non-Newtonian fluid with spherical solid particles with fixed centre. G.Maurice (Lab. d'Energetique et de Mecanique Theorique et Appl., Nancy, France).
Control of Distributed Parameter Systems 1982. Proceedings of the Third IFAC Symposium, Toulouse, France, 29 June-2 July 1982 (Oxford, England: Pergamon 1983), p.499-502
The problem of the determination of the law of behaviour of a composite material is an important question for new materials. This paper is concerned with a fluid-solid mixture and gives a contribution to the law of behaviour of a non-Newtonian fluid mixed with solid particles. It considers a regular flow around spherical particles whose centers have constant velocity. (13 refs.)

Vapour bubble formation during fast transient boiling on a wire .... See Entry 101013

Rheological behaviour of diluted suspensions of deformable particles in simple flow .... See Entry 101161

Heat transfer in the desublimation of phthalic anhydride .... See Entry 101212

Heat transfer in vertical upwards gas-liquid slug flow .... See Entry 101224

Effects of properties and location in the plume on droplet diameter for injection in a supersonic stream .... See Entry 101280

Penetration and breakup of slurry jets in a supersonic stream .... See Entry 101298

Features of two-phase flow in long channels .... See Entry 101335

Use of an electric field to keep bubbles and drops in a given shape and position in a liquid dielectric .... See Entry 101345

Boron particle ignition in a restricted thermodynamical equilibrium .... See Entry 103524

Motion of a cloud of particles under gravity and its sedimentation on a flat horizontal surface .... See Entry 103592

An observation on the Han-Villamizer critical pressure concept in thermoplastic foams .... See Entry 103605

47.55M Flow through porous media

101326 Steady and unsteady regimes of flow of a multicomponent sorbable mixture through porous media. L.K.Filippov-Tsabek.
Fluid Dyn. (USA), vol.17, no.6, p.908-15 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.6, p.114-23 (Nov.-Dec. 1982).
Contains an analysis, confirmed by computer-calculated numerical examples, of the one-dimensional nonstationary system of equations describing the concentration distributions of sorbable gases or liquids in a porous sorbent and in a flow through it. Solutions in the form of propagating waves are investigated in detail. The wave regimes for model sorption isotherms are classified. A representation for quasitraveling and quasispreading waves is introduced. (12 refs.)

101327 Moment method for the evaluations of heat transfer coefficients in a packed bed. H.-D.Juang, H.-S.Weng (Dept. of Chem. Engng., Nat. Cheng Kung Univ., Tainan, Taiwan).
Int. J. Heat & Mass Transfer (GB), vol.26, no.9, p.1275-81 (Sept. 1983).
The film heat transfer coefficient and thermal conductivity of solid particles in a packed bed can be determined from the moments of a response curve obtained by introducing a temperature pulse. The moment expressions are directly obtained from the Laplace transform of fluid temperature. The method and procedure to evaluate these two heat transport properties are described. (24 refs.)

101328 On Volterra's boundary value problem for axial-symmetric flows with free surfaces in porous media. M.T.Orasanu (Vocational School No.3, Bucharest, Rumania).
Mech. Res. Commun. (GB), vol.10, no.3, p.143-50 (May-June 1983). (4 refs.)

101329 How an initially stationary interface begins to move in porous medium flow. D.G.Aronson (School of Math., Univ. of Minnesota, Minneapolis, MN, USA), L.A.Caffarelli, S.Kamin.
SIAM J. Math. Anal. (USA), vol.14, no.4, p.639-58 (July 1983).
The interface studied is the boundary of a gas flowing in a homogeneous porous medium. It is known that for certain initial distributions the interface remains stationary for a positive time. The authors derive upper and lower estimates for this waiting time and give a condition which is sufficient to guarantee that the interface begins to move in a smooth manner. In some cases the estimates give the exact waiting time. (16 refs.)

101330 Seepage and heat flow in soil freezing. P.E.Frivik (Div. of Refrigeration Engng., Norwegian Inst. of Technol., Trondheim, Norway), G.Comini.
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.323-8 (May 1982).
The author describes a system of computer programs based on the finite element method, which can be used for the calculation of coupled velocity and temperature fields during freezing and thawing of soils in the presence of seepage flow. In the programs, the mass and energy conservation equations are solved simultaneously, without the use of too limiting assumptions. The results of the computations are compared with experimental measurements made on a laboratory model of a soil freezing system, and the agreement between measured and computed values is good. (15 refs.)

Effects of pore diameters and system pressure on saturated pool nucleate boiling heat transfer from porous surfaces .... See Entry 101019

Stability of Couette flow between rotating cylinders lined with porous material. I .... See Entry 101174

Heat transfer in large particle fluidized beds .... See Entry 101219

The boundary layer regime in a porous layer with uniform heat flux from the side .... See Entry 101221

Numerical study of high Rayleigh number convection in a vertical porous enclosure .... See Entry 101236

Natural convection in an attic-shaped space filled with porous material .... See Entry 101240

Analysis of viscous-inviscid interaction in transonic internal flows .... See Entry 101276

Discharge of a turbulent jet in a monodisperse fluidized bed .... See Entry 101304

On a relaxing model for the flow of a mixture of gas with porous particles .... See Entry 101310

Hall effects on an oscillatory MHD flow in the Stokes problem past an infinite vertical porous plate. I .... See Entry 101342

Hall effects on MHD free-convection flow in the Stokes problem for a vertical porous plate .... See Entry 101343

47.60 FLOWS IN DUCTS, CHANNELS, AND CONDUITS

(for biological fluid dynamics, see 87.45)

101331 Mode propagation in nonuniform circular ducts with potential flow. Y.C.Cho (NASA Lewis Res. Center, Cleveland, OH, USA), K.U.Ingard.
AIAA J. (USA), vol.21, no.7, p.970-7 (July 1983).
A previously reported closed-form solution is expanded to determine effects of isentropic mean flow on mode propagation in a slowly converging-diverging duct: a circular cosh duct. On the assumption of uniform steady fluid density, the mean flow increases the power transmission coefficient. The increase is related directly to the increase of the cutoff ratio at the duct throat. With the negligible transverse gradients of the steady fluid variables, the conversion from one mode to another is negligible, and the power transmission coefficient remains unchanged with the mean flow direction reversed. (5 refs.)

101332 Spin-up in Couette flow. R.S.Rivlin (Center for the Application of Math., Lehigh Univ., Bethlehem, PA, USA).
Appl. Anal. (GB), vol.15, no.1-4, p.227-53 (1983).
A viscoelastic fluid is contained in the annular region between two infinitely long coaxial circular cylinders. The relation between shearing stress and the history of the rate of shear in the fluid is assumed to be linear. At some instant of time the inner cylinder is given an angular velocity which is subsequently held constant. The resulting angular velocity and stress fields are calculated. (6 refs.)

101333 Plane channel flows with surface mass transfer and velocity slip on moving walls. A.Szaniawski (Inst. of Fundamental Technol. Res., Polish Acad. of Sci., Warsaw, Poland).
Arch. Mech. (Poland), vol.34, no.3, p.309-24 (1982).
Exact integrals of the Navier-Stokes equations are used to describe laminar, steady, plane flows of a viscous, incompressible fluid in channels with porous, moving walls. At the walls the Beavers-Joseph slip conditions are assumed. The problem is reduced to find successively two functions fulfilling ordinary differential equations of the fourth and second order and satisfying six boundary conditions. The solution is obtained in the form of power series expansion with an iteration scheme for their coefficients. (15 refs.)

101334 Rotating supersonic flow about scoop inlet using an unsteady implicit technique. H.Mikami (Tokyo Inst. of Technol., Tokyo, Japan).
Bull. Res. Lab. Nucl. React. (Japan), vol.8, p.29-52 (1983).
The inlet flow fields in a rotating supersonic free stream are calculated by an implicit shock-capturing approximate-factorization finite-difference method. Calculations are performed for the flow about and through a straight wall inlet placed in a rapidly rotating supersonic flow and the steady-state solutions are presented for various values of the back pressure imposed at the downstream boundary of the inlet. The effect of the rotation in the free stream upon the flow and shock wave pattern are found very significant. The mass flow through the inlet is given as a function of the back pressure. (8 refs.)

101335 Features of two-phase flow in long channels. V.V.Fisenko, Z.P.Bil'der, I.A.Ivakhnenko, Yu.P.Mamalygin.
Power Eng. (J. Acad. Sci. USSR) (USA), vol.20, no.3, p.153-5 (1982). Translation of: *Izv. Akad. Nauk SSSR Energ. & Transp.*, vol.20, no.3, p.156-8 (1982).
Results are reported for experimental investigations into the hydrodynamics of a flow of saturated fluid in long channels; they make it possible to establish a self-similar (with respect to pipeline length) region of variation in specific fluid flow rate and pressure loss corresponding to critical discharge. The possibility of using a two-phase flow of fluid for long-distance transport of heat is considered. (8 refs.)

101336 Simulation of two-dimensional turbulence in a planar channel. V.G.Priimak, B.L.Rozhdestvenskii.
Fluid Dyn. (USA), vol.17, no.6, p.835-43 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.6, p.26-35 (Nov.-Dec. 1982).
A study is made of the two-dimensional flow of an incompressible viscous fluid in a planar channel at supercritical Reynolds number $\mathrm{Re}=10^4$. Calculation of the flow over an appreciable time interval leads to the establishment of a statistically steady flow regime and stabilization of its averaged characteristics (the profile of the mean velocity, the mean pressure gradient, the pulsation energy, etc.). The calculations show that numerical simulation of turbulent flow of an incompressible fluid on the basis of the Navier-Stokes equations leads to qualitatively correct characteristics of this flow regime. (15 refs.)

101337 Experimental investigation of heat transfer and hydraulic resistance in the channels with alternating cross-section. I.N.Il'in, I.V.Bekmanis.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.3, p.56-61 (1983). In Russian.
Experimental results of the channel form influence on heat transfer and hydraulic characteristics are given. Dependence $Nu_S=f(Eu_S)$ expressing the direct correlation in a criterial form between heat transfer coefficient and hydraulic resistance is obtained. (2 refs.)

101338 Post-burnout heat transfer to Freon flowing in a vertical tube at high subcritical pressures. K.Nishikawa, S.Yohida, H.Mori, H.Takamatsu (Mech. Engng., Kyushu Univ., Fukuoka, Japan).
Mem. Fac. Eng. Kyushu Univ. (Japan), vol.43, no.1, p.109-32 (March 1983).
Experimental data were obtained of the post-burnout heat transfer to Freon 22 flowing upward in a vertical, uniformly heated round tube at high subcritical pressures over a range of reduced pressure from 0.68 to 0.84. Based on an assumed model, the actual quality was estimated from the heat transfer data. The distinctive characteristics of the difference between the vapor mass fraction in the thermodynamic equilibrium state and the actual quality were found in the low and high equilibrium quality region respectively. Dimensional correlations of this difference were tentatively obtained. (10 refs.)

101339 Numerical model for dynamic and thermal developments of a pulsed laminar ducted flow. R.Creff (Univ. d'Orleans, Orleans, France), J.Batina, P.Andre, V.S.Karunanithi.
Numer. Heat Transfer (USA), vol.6, no.2, p.173-88 (April-June 1983).
A numerical model is constructed to analyze the simultaneous development of the dynamic and thermal regimes of an incompressible viscous ducted flow under the influence of sinusoidal pulsations. The Navier-Stokes and energy equations are solved by a finite-difference method and by using asymptotic developments for the different dynamic and thermal functions. The model is validated by obtaining the Poiseuille regime for steady mean flow and by verifying Uchida's solutions for the unsteady dynamic components in fully developed flow. The model allows the description of Richardson's effect and depicts the existence of an annular effect for the pulsed temperature term. (11 refs.)

101340 Wave motion of a liquid in an inhomogeneous tube. R.Yu.Amenzade, V.G.Nasibov (S.M. Kirov State Univ., Azerbaidzhan SSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.909-10 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.318-21 (Nov. 1982).
The authors extend the method of Amenzade (1980) using the hydraulic approximation to include a wave travelling in the opposite direction in an infinite tube as a result of the system being closed (e.g. arterial). (8 refs.)

101341 Nonlinear periodic wave and fission of a solitary wave in a slowly varying channel with arbitrary cross-section. Zhou Xianchu (Inst. of Mech., Acad. Sinica, Beijing, China).
Sci. Sin. (China), vol.26, no.6, p.626-36 (June 1983).
The cnoidal wave, the solitary wave in a channel with slowly varying arbitrary cross-section in the flow direction and the fission of a solitary wave in this channel have been studied. The KdV equation with slowly varying coefficients is derived. The first term of its asymptotic solution, the phase velocity, the period and the relation between the elevation of wave and the channel geometry are obtained. The discriminant for the number of solitary wave after fission and the expression of its amplitude are also obtained. These results have been applied to the case of the rectangular and the triangular channels. For the rectangular channel, they are fairly consistent with those of Madsen and Mei (1969), Johnson (1973), Svendsen and Buhr Hansen (1978). (14 refs.)

Stability of Couette flow between rotating cylinders lined with porous material. I .... See Entry 101174

A note on the stability of low-Prandtl-number Hadley circulations .... See Entry 101183

On the prediction of pipe freeze-shut in turbulent flow .... See Entry 101191

Effect of a change of the turbulent structure of a flow on unsteady heat exchange upon heating of gases and liquids in pipes .... See Entry 101197

Turbulent flow in an axially rotating pipe (effect of inlet swirl) .... See Entry 101198

Heat transfer in temperature-dependent flow .... See Entry 101213

Local mass transfer for cross flow through tube banks of square in-line layout at intermediate Reynolds numbers .... See Entry 101217

Heat transfer in vertical upwards gas-liquid slug flow .... See Entry 101224

Forced convective heat transfer in the entrance region of a parallel plate channel .... See Entry 101225

Heat transfer from partially insulated hexagonal ducts .... See Entry 101226

Magnetohydrodynamic natural convection heat transfer from horizontal cylinders .... See Entry 101227

Critical heat flux in free convective flow through a uniformly heated vertical tube held in a large pool of saturated liquid .... See Entry 101230

Heat transfer between three media in triple countercurrent pipe flow .... See Entry 101233

A boundary integral method for some laminar forced convection problems .... See Entry 101235

Effect of laminarization and retransition on heat transfer for low Reynolds number flow through a converging to constant area duct .... See Entry 101245

Waves in a nonhomogeneous tube of variable circular section with running liquid .... See Entry 101260

Shock diffraction in channels with 90° bends .... See Entry 101287

Laminar entry length problem for power law fluids .... See Entry 101289

Flow of a non-Newtonian fluid in a convergent channel in a transverse magnetic field .... See Entry 101290

On the motion of gas bubbles in a perfect fluid .... See Entry 101312

Identification of gas-liquid stream flow patterns .... See Entry 101324

A technique for the direct measurement of volume flux of a plume .... See Entry 101363

A magnetic flowmeter with conducting pipe wall .... See Entry 101367

Flow of superfluid ^{3}He through micrometer-size channels .... See Entry 101900

Transient freezing of a liquid in a convectively cooled tube .... See Entry 101923

Estimating the intensity of heat transfer to supercritical helium when the specific variation of the thermophysical properties is taken into account .... See Entry 102089

47.65 MAGNETOHYDRODYNAMICS AND ELECTROHYDRODYNAMICS

(for MHD in plasma, see 52.30)

101342 Hall effects on an oscillatory MHD flow in the Stokes problem past an infinite vertical porous plate. I. A.K.Singh (Dept. of Math., Banaras Hindu Univ., Varanasi, India).
Astrophys. & Space Sci. (Netherlands), vol.93, no.1, p.1-13 (June 1983).
Hall effects on the hydromagnetic free convection flow of an electrically conducting incompressible viscous fluid past a steadily moving vertical porous plate has been analysed when the free stream oscillates in magnitude. The flow is subjected to a constant suction, through the porous plate, and the difference between wall temperature and the free-stream is moderately large causing the free convection currents. The mathematical analysis is presented for the hydromagnetic boundary layer flow without taking into account the induced magnetic field. (6 refs.)

101343 Hall effects on MHD free-convection flow in the Stokes problem for a vertical porous plate. A.K.Singh (Dept. of Math., Banaras Hindu Univ., Varanasi, India).
Astrophys. & Space Sci. (Netherlands), vol.93, no.1, p.177-84 (June 1983).
Hall effects on the MHD flow of an incompressible, electrically-conducting viscous fluid past an impulsively started infinite vertical porous plate has been analysed for the case of small magnetic Reynolds number. Exact solutions have been obtained for the axial and the transverse components of the velocity and the skin-friction by defining a complex velocity with the help of the Laplace transform technique. The velocity profiles are shown graphically and the numerical values of axial and transverse components of skin-friction are tabulated for different values of the dimensionless parameters occurring in the problem. (8 refs.)

101344 Precipitation of charged particles from flow filling cylindrical channel. F.G.Portnov, S.E.Fal'kenshtein, A.B.Shmidt.
Power Eng. (J. Acad. Sci. USSR) (USA), vol.20, no.3, p.88-91 (1982). Translation of: *Izv. Akad. Nauk SSSR Energ. & Transp.*, vol.20, no.3, p.90-4 (1982).
Numerical methods are used to solve a system of equations of electrogasdynamics that describes the two-dimensional unsteady mass transfer of charged particles in a cylindrical channel. An estimate is given for the influence of the value of a dimensionless parameter that characterizes the concentration and the charge of the particles on the degree of precipitation of the latter. (10 refs.)

101345 Use of an electric field to keep bubbles and drops in a given shape and position in a liquid dielectric. I.I.Ievlev, A.B.Isers.
Fluid Dyn. (USA), vol.17, no.6, p.899-902 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.6, p.101-5 (Nov.-Dec. 1982).
A study is made of the problem of finding an electric field that keeps a spherical gas bubble in a fixed position in a dielectric liquid in a gravity field. (5 refs.)

101346 Temperature-gradient-driven electrohydrodynamic instability with unipolar injection in air. J.F.Hoburg (Dept. of Electrical Engng., Carnegie-Mellon Univ., Pittsburgh, PA, USA).
J. Fluid Mech. (GB), vol.132, p.231-45 (July 1983).
Electrohydrodynamic instability is described in a planar region of gas, with unipolar injection through a linear temperature gradient, with corresponding mobility, viscosity, and density gradients. The role of charge-relaxation instability, which is incipient at a critical value of electric Rayleigh number in a uniform mobility layer, is distinguished from the mobility-gradient-driven mechanism, which can produce instability at much smaller voltage thresholds. Relative values of electroviscous time, viscous diffusion time and ion transit time determine the nature of the instability process. The instability is stationary or dynamic for wavenumbers respectively below or above a critical value. The fastest-growing wavenumber and corresponding growth rate are determined as functions of time constants and temperature gradient. (24 refs.)

101347 Relation of the generation coefficient to the mean spirality of an almost-toroidal hydrodynamic flow. E.P.Kropachev.
Magnetohydrodynamics (USA), vol.18, no.4, p.343-5 (Oct.-Dec. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.4, p.18-20 (Oct.-Dec. 1982).
Equations have been derived for magnetic field generation in the toroidal flow of a conducting liquid perturbed by small unsymmetrical velocities having a radial component. The examination is performed in a special quasispherical coordinate system, r, θ,ϕ (nonorthogonal) for which the components of the metrical tensor g_{ik} have been determined together with the basis vectors e_i and e^i, with the main flow (toroidal) localized along the basis vector e_ϕ in this system and taking the form $\nu e_\phi/S$. (2 refs.)

101348 Dynamics of a magnetizable fluid layer on the surface of a nonmagnetic fluid in an external magnetic field. A.I.Zhakin.
Magnetohydrodynamics (USA), vol.18, no.4, p.356-62 (Oct.-Dec. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.4, p.33-8 (Oct.-Dec. 1982).
The author investigates the motion of a magnetizable fluid layer on the surface of a nonmagnetic fluid medium in an external magnetic field; this problem is important, for example, in relation to the removal of petroleum products from the surface of water. (4 refs.)

101349 Trajectory of freely falling conducting particles in a nonuniform magnetic field. G.K.Grinberg, M.Z.Kaudze, O.A.Lielausis, E.V.Murav'ev.
Magnetohydrodynamics (USA), vol.18, no.4, p.369-73 (Oct.-Dec. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.4, p.46-50 (Oct.-Dec. 1982).
Strong magnetohydrodynamic interaction prevents liquid metals from being used as the working medium in equipment utilizing strong magnetic fields, for example in equipment with magnetic plasma confinement. A radical technique for diminishing the strength of MHD interaction is to break up the continuous flow of liquid metal into a system of droplets. One of the most important aspects of the investigated problem is the extent to which a strongly nonuniform field will deflect a particle from its initially rectilinear trajectory. Murav'ev (1980) has solved the problem of the motion of a conducting spherical particle in a nonuniform magnetic field and obtained expressions for the forces and torques acting on it. In the present study the authors test these expressions experimentally. (9 refs.)

101350 Three-dimensional effects generated in a finite-length container under the action of a rotating magnetic field. A.B.Kapusta, A.F.Zibol'd.
Magnetohydrodynamics (USA), vol.18, no.4, p.379-84 (Oct.-Dec. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.4, p.57-63 (Oct.-Dec. 1982).
If a rotating liquid is placed between planes perpendicular to the axis of rotation, three-dimensional axisymmetric flows occur near the planar surfaces, with the liquid flowing toward the axis near the wall and rejected outwards at

some distance from it, similar three-dimensional effects also occur when an axial magnetic field is applied to a rotating liquid. The necessity of investigating three-dimensional structure, generated in a finite-length vessel, and its evolution with parameter changes is related to the possibility of using one-dimensional models of primary laminar flow in stability problems. In the noninductive approximation ($\bar{\omega}<1$) the authors consider a three-dimensional axisymmetric stationary flow of a conducting liquid, excited in a cylindrical container of finite length by a rotating magnetic field of arbitrary symmetry, homogeneous along the z axis. It is assumed that the conductivity of the ends of the container is of the order of the liquid conductivity. Under these conditions it can be assumed that the field of electromagnetic forces is also homogeneous along the z axis. For magnetic field excitations the authors use an ideal inductor, creating only a primary harmonic field. (10 refs.)

101351 Energy characteristics of cylindrical induction pumps at large R_m numbers. B.B.Volchek, L.M.Dronnik, S.Yu.Reutskii, I.M.Tolmach, A.I.Elkin.
Magnetohydrodynamics (USA), vol.18, no.4, p.398-404 (Oct.-Dec. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.4, p.79-85 (Oct.-Dec. 1982).
Gailitis and Lielansis (1975) were the first to point out the possibility of the existence of a fixed nonuniformity in the distribution of the axial velocity and in the resulting induction along the ϕ-coordinate in the coaxial channel of cylindrical induction pumps. Criteria were derived for the establishment of such nonuniformity, which were obtained based on the asumption that the equation of motion for the liquid metal in the pump channel is algebraic, i.e. the equation of motion for the liquid metal in the pump channel is algebraic, i.e. the equation does not take into account the term with the second derivative of the velocity with respect to the ϕ-coordinate and the viscosity, which in the general case is turbulent. The present authors investigate the steady flow conditions in the coaxial channel of the cylindrical pump including the turbulent viscosity term in the equation of motion. (7 refs.)

101352 Calculation of the secondary circuit inductance in linear inductive MHD machines. A.M.Andreev.
Magnetohydrodynamics (USA), vol.18, no.4, p.405-8 (Oct.-Dec. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.4, p.86-8 (Oct.-Dec. 1982).
The inductance of the secondary circuit becomes noticeable inductive electromagnetic MHD machines when the thickness effect is clearly distinguishable. The secondary current is then no longer in phase with the EMF induced in the liquid metal. This leads to increases in the primary current and in the supplied voltage. Resistances r_a, x_s, x_m, current I_μ, and the EMF E_1 are calculated from well-known equations in use for electric machinery and magnetohydrodynamics. (2 refs.)

101353 End effect in MHD-type linear induction machine with finite-length inductor: mathematical model. M.S.Drits.
Magnetohydrodynamics (USA), vol.18, no.4, p.408-14 (Oct.-Dec. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.4, p.89-95 (Oct.-Dec. 1982).
Solution of the external problem of end effect is important in the theory of linear MHD induction machines. In the case of a narrow nonmagnetic gap, it is often possible to obtain sufficiently reliable results on the basis of one-dimensional models; in the case of a wide gap one requires at least two-dimensional models accounting for the distribution of fields lengthwise and over the thickness. The author proposes a new mathematical model, one that takes into account the finite inductor dimensions and the finite magnetic permeability, which can be useful for the design of a large class of machines (including chutes) with wide nonmagnetic gap. (14 refs.)

101354 Experimental study of flat MHD induction pump. Ya.Ya.Valdmanis, R.R.Krishberg, A.Ya.Shishko.
Magnetohydrodynamics (USA), vol.18, no.4, p.419-22 (Oct.-Dec. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.4, p.101-4 (Oct.-Dec. 1982).
An important problem in producing high-power MHD pumps is ensuring hydrodynamic flow stability in the active channel. Theoretical and experimental studies have revealed that at high values of the magnetic Reynolds number the average profile of turbulent flow becomes nonuniform and there may appear zones of reverse flow. Results of experimental studies are presented revealing further ways to simulate processes of hydrodynamic instability. (5 refs.)

101355 Some features of MHD separation process. U.I.Ivanov.
Magnetohydrodynamics (USA), vol.18, no.4, p.426-9 (Oct.-Dec. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.4, p.110-12 (Oct.-Dec. 1982).
The author describes the motion of particles during MHD separation by an analysis of the basic laws governing the constitution of the skin phase and the characteristics of mass transfer through it under the influence of an external electromagnetic field. The current densities in the region of inhomogeneities as well as the velocities and the direction of motion in a nonhomogeneous system under the influence of an electromagnetic field are all determined principally by the properties of the skin phase. An electromagnetic field acts on the skin layer throughout the thickness of the latter, but most strongly on its nearest layer whose thickness and properties will be altered as a result. The preceding analysis makes it possible to solve modeling problem and to identify classes of similar phenomena in MHD separation processes. (3 refs.)

Magnetohydrodynamic natural convection heat transfer from horizontal cylinders .... See Entry 101227

Amplification of azimuthal rotation in a meridional electric vortex flow in a hemisphere .... See Entry 101253

Excitation of finite-amplitude waves on the surface of a perfectly conducting liquid by a varying magnetic field .... See Entry 101268

Flow of a non-Newtonian fluid in a convergent channel in a transverse magnetic field .... See Entry 101290

Stability of a system of current-carrying jets with currents alternating in direction .... See Entry 101305

Motion of gas bubbles during vacuumization of liquid aluminum in MDV-type magnetodynamic vacuumization apparatus .... See Entry 101323

Kinetic description of Debye effect .... See Entry 101521

Principal electro-hydrodynamic instability types in nematic liquid crystals .... See Entry 101544

Role of surface interactions in stratification of magnetic fluids .... See Entry 102728

Self-similar propagation of axisymmetric radiative magnetogasdynamic shocks with increasing energy. II .... See Entry 104720

Self-similar flows behind cylindrical shock waves in magnetogasdynamics .... See Entry 104723

47.70 REACTIVE, RADIATIVE, OR NONEQUILIBRIUM FLOWS

101356 Critical fluctuations in a thermo-chemical instability. C.van den Broeck (Dept. Natuurkunde, Vrije Univ. Brussel, Brussels, Belgium).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.264-5
Thermo-chemical systems have been studied in detail in the engineering sciences, but only recently attention has been paid to the effect of fluctuations. In these systems the coupling of thermal and chemical variables can give rise to instabilities leading to multiple steady states, limit cycles and chaotic behaviour. The author has investigated the effect of both homogeneous and inhomogeneous fluctuations in the simplest case of an instability leading to multiple steady states. (5 refs.)

Influence of nozzle profile on the characteristics of a gas-dynamic laser .... See Entry 100789

The effective reaction rate and diffusion coefficients for a two-phase medium .... See Entry 101321

Boron particle ignition in a restricted thermodynamical equilibrium .... See Entry 103524

Influence of turbulence on the formation of high nonequilibrium concentrations of atoms and free radicals in diffusion flames .... See Entry 103526

A theoretical study of ignition in the laminar mixing layer ... See Entry 103528

47.75 RELATIVISTIC FLUID DYNAMICS

101357 Existence and unicity of the Cauchy problem for a relativistic heat conducting fluid. V.Carfi (Dipartimento di Matematica, Messina, Italy). •
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.13, p.477-80 (30 July 1983). In Italian.
Proves the existence and unicity of the Cauchy problem, in a certain Gevrey class, for the evolution system of a relativistic heat-conducting fluid. (4 refs.)

47.80 INSTRUMENTATION FOR FLUID DYNAMICS

101358 Seven-hole cone probes for high angle flow measurement: theory and calibration. K.N.Everett, A.A.Gerner, D.A.Durston (NASA Ames Res. Center, Moffett Field, CA, USA).
AIAA J. (USA), vol.21, no.7, p.992-8 (July 1983).
A non-nulling seven-hole conical pressure probe capable of measuring flow conditions at angles up to 75 deg relative to its axis is described. The theoretical rationale of the seven-hole probe is developed and the calibration procedure outlined. Three-variable third-order polynomial functions are used to represent local values of relative flow angles, total pressure, and total minus static pressure. These flow properties are determined explicitly from measured probe pressures. Flow angles are determined within 2.5 deg and Mach number within 0.05 with 95% certainty. The probe can be used in subsonic compressible and incompressible flows. (6 refs.)

101359 A user oriented analysis of a constant-temperature hot-wire anemometer—for practical applications. F.Sakao.
Bull. Fac. Eng. Hiroshima Univ. (Japan), vol.30, no.2, p.129-35 (Nov. 1982). In Japanese.
The operation of a constant-temperature hot-wire anemometer is analysed with naive physical interpretation and minimum of mathematics—actually only some algebra. Though extremely simple and easy to understand as it is, it can reproduce exactly all the relevant informations hitherto obtained only through number of equatoins: to name some, frequency limit of the response to the wind velocity fluctuation, a method for testing it, etc. (no refs.)

101360 Ultrasonic flow measurement. S.v.d.Groenendaal.
PT/Elektrotech. Elektron. (Netherlands), vol.38, no.6, p.36-41 (June 1983). In Dutch.
Eight alternatives for measuring the fluid flow in a pipe are outlined. The principles involved are identified as transmission time (subdivided into time, phase and frequency difference, and amodified time difference), Doppler effect, angular deflection, cross-correlation and wave frequency. The article is mainly concerned with the frequency difference or 'sing-around' principle, especially the system devised by Danfoss. This uses two 'clamp-on' scanners on either side of the pipe to make an angle of 45 degrees with the flow centre-line. A block diagram shows the layout of the main components (multiplexers, amplifier, phase detector, decoder, integration and summation units, and VCO) and illustrates the connections between these and current waveforms at various circuit stages. Advantages of the Danfoss system are summarised. The EMUF unit may be used with an EMAT type totaliser. (no refs.) *G.C.*

101361 Compact, pulsed laser Doppler anemometer for airborne and wind-tunnel applications. A.Koneke, P.G.Sava, J.P.Hancy (Inst. Franco-Allemand de Recherches de Saint-Louis, Saint-Louis, France).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.356, p.26-32 (1983). (Field Measurement and Calibration Using Electro-Optical Equipment: Issues and Requirements, San Diego, CA, USA, 24-25 Aug. 1982).
Describes a laser Doppler anemometer working in backscatter over distances of 2 to 5 meters based on a pulsed laser source. After a description of the optical set-up and the pulsed laser the authors describe a number of experiments carried out under conditions normally found in industrial testing facilities. (6 refs.)

101362 Thermoanemometric measurement of three-dimensional flow velocity. A.M.Novikov, A.I.Yatsenko.
Izv. VUZ Priborostr. (USSR), vol.26, no.6, p.26-30 (June 1983). In Russian.
The problem of measuring the mean velocity vector of a three-dimensional flow by means of thermoanemometric sensors of various different designs is considered. The error in determining the mean flow velocity vector is found to be not more than 6%, making the method and equipment described suitable for use in practical experiments. (2 refs.) *L.M.H.*

101363 A technique for the direct measurement of volume flux of a plume. W.D.Baines (Dept. of Mech. Engng., Univ. of Toronto, Toronto, Canada).
J. Fluid Mech. (GB), vol.132, p.247-56 (July 1983).
It is observed that an interface is established in any open-ended vertical cylinder when a plume flows in the direction of a mean flow through the cylinder. The location of the interface defines the volume flux of the plume because the total discharge in the environment has been entrained at this level. Experiments have been conducted to verify this relation and to define the limits within which the interface is established. It is found that, as the

buoyancy in the plume is reduced or the area of the environment is reduced, limits do exist. An application of the interface in industrial-building ventilation is described. (4 refs.)

101364 On the calculation of the signal rate with the laser Doppler anemometer in burst operation. W.Fuchs, H.-E.Albrecht, W.Kroger.
MSR (Mess. Steuern Regeln) (Germany), vol.26, no.6, p.331-5 (June 1983). In German.
The laser Doppler anemometer allows a quasi point-related flow speed measurement. The measurement principle is connected with an evaluation of the absolute value of the velocity and due to the ellipsoidal form of the measurement volume with an evaluation of the flow direction in the signal rate. The scanning volume is determined by the minimal measurement time necessary for the electronic evaluation device. Starting from a statement of Buchhave the influences of the measurement volume and the minimal measurement time upon the signal rate are determined. By use of error propositions in the data rate the velocity limits for the known information processing methods are given in dependence upon the used pre-shifting frequencies. (9 refs.)

101365 Use of the photochromic properties of mercury dithizonate in hydrodynamics. M.Cloitre, J.Chauveau (Lab. d'Hydrodynamique et Mecanique Physique, ESPCI, Paris, France).
Opt. Commun. (Netherlands), vol.47, no.1, p.42-6 (1 Aug. 1983). In French.
Presents the results of using mercury dithizonate (which is a photochromic compound) in a visualization experiment in hydrodynamics. The authors describe its chemical preparation and its photochemical properties. Finally, the authors apply the mercury dithizonate to the measurement of mass diffusivity coefficients in liquids by forced Rayleigh scattering. (8 refs.)

101366 Burst-correlation laser Doppler velocimetry. R.G.W.Brown, R.Jones (Royal Signals & Radar Establ., Great Malvern, England).
Opt. Lett. (USA), vol.8, no.8, p.449-51 (Aug. 1983).
The first continuous real-time burst-correlation laser velocimetry results obtained to the authors' knowledge are reported. Measurements of turbulence power spectra and velocity-correlation functions with photon-correlation techniques are demonstrated. (9 refs.)

101367 A magnetic flowmeter with conducting pipe wall. H.Yamasaki, S.Honda, T.J.Chin (Univ. of Tokyo, Tokyo, Japan), C.Akiyama.
Trans. Soc. Instrum. & Control Eng. (Japan), vol.19, no.5, p.394-9 (May 1983). In Japanese.
The internal pipe wall of magnetic flowmeters should be nonconductive to prevent generated electromotive force from short circuiting. Usually the inside of the metallic pipe is lined by insulating material. The lining material limits applicable temperature range of measured fluid and also reliability of meter. This paper describes a technique to eliminate the lining and to improve the reliability and performance of magnetic flowmeters. (5 refs.)

101368 Measurement of double and triple velocity-correlations by means of streamwise orientated rotated X-hot-wire probes. L.Paulsen (Univ. Karlsruhe, Karlsruhe, Germany).
Tech. Mess. tm (Germany), vol.50, no.7-8, p.267-72 (July-Aug. 1983). In German.
The equations for the experimental determination of double and triple velocity-correlations are derived. The expression for the effective cooling velocity has been expanded in a series and higher-order terms neglected. A method has been developed which allows one to simulate a turbulent velocity field with an arbitrary Reynolds tensor. The results show that serious errors occur as the turbulence intensity exceeds 1% for third-order correlations and 10% for second-order correlations. This is emphasized by a comparison of actual measurements in a free jet. (7 refs.)

101369 Calibration of film probes using a submerged jet. A.J.Johnston, I.Grant, A.R.Halliwell (Dept. of Civil & Mining Engng., Wollongong Univ., Wollongong, Australia).
Trans. Inst. Eng. Aust. Civ. Eng. (Australia), vol.CE25, no.2, p.143-7 (May 1983).
A simple but practical experimental method is presented for calibrating hot-film anemometer probes and other small velocity transducers in low velocity flows. (5 refs.)

Nd:YAG holographic interferometer for aerodynamic research ....See Entry 100691

Oscillatory flow through a sharp-edged sudden contraction of a circular tube ... .See Entry 101173

A spanwise structure in the plane shear layer ....See Entry 101184

Transition of Taylor-Gortler vortex flow in spherical Couette flow ....See Entry 101190

Problems in flow acoustics ....See Entry 101209

Local mass transfer for cross flow through tube banks of square in-line layout at intermediate Reynolds numbers ....See Entry 101217

An application of the optical correlation computer to the detection of the Malkus transitions in free convection ....See Entry 101242

Three-dimensional flow studies on a slotted transonic wind tunnel wall ....See Entry 101277

Investigation of two plane parallel jets ....See Entry 101297

Penetration and breakup of slurry jets in a supersonic stream ....See Entry 101298

A study of concentration field of a round jet by a quantitative visualization method ....See Entry 101300

An experimental investigation of merging buoyant jets in a crossflow ....See Entry 101307

A pulsed-wire spirometer using sing-around method ....See Entry 104150

47.90 OTHER TOPICS IN FLUID DYNAMICS

101370 Drag of crisscross bundles of finned tubes in transverse stream of fluid. A.A.Zhukauskas, R.V.Ulinskas, F.V.Zinyavichyus.
J. Eng. Phys. (USA), vol.43, no.6, p.1314-20 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.6, p.891-8 (Dec. 1982).
Experimental data are presented on the form resistance and the hydraulic drag of crisscross bundles of finned tubes, whereupon the Berman number and the Chen number are calculated for the near zone of the wake behind a finned tube. (12 refs.)

50.00 FLUIDS, PLASMAS AND ELECTRIC DISCHARGES

(for fluid dynamics, see 47.; for the physics of condensed matter, see 60. and 70.)

51.00 KINETIC AND TRANSPORT THEORY OF FLUIDS; PHYSICAL PROPERTIES OF GASES

51.10 KINETIC AND TRANSPORT THEORY

101371 H-theorem and trend to equilibrium in the kinetic theory of gases. C.Cercignani (Istituto di Matematica, Politecnico di Milano, Milano, Italy).
Arch. Mech. (Poland), vol.34, no.3, p.231-41 (1982).
The present status of the *H*-theorem and its role in establishing the trend to equilibrium of a dilute gas are reviewed. In particular the alleged counterexamples are shown to contain some features which do not allow the use of the standard arguments. (34 refs.)

101372 On the free molecule quenching of a gas jet by another gas at rest. L.Trilling (MIT, Cambridge, MA, USA).
Arch. Mech. (Poland), vol.34, no.3, p.333-41 (1982).
The collision rate of jet molecules with reservoir molecules is considered as a function of the jet velocity and the temperature of the gases. Both the total number of collisions and the collisions with relative velocities bounded by some threshold velocity are found. Further the computation of the relative kinetic energy flux is discussed. The results obtained are a generalization of those known previously. Their applicability to the problem of nucleation of freely expanding vapour is briefly discussed. (1 ref.)

101373 On material frame-indifference, intrinsic spin, and certain constitutive relations motivated by the kinetic theory of gases. A.I.Murdoch (Dept. of Maths., Univ. of Strathclyde, Glasgow, Scotland).
Arch. Ration. Mech. & Anal. (Germany), vol.83, no.2, p.185-94 (1983). (14 refs.)

101374 Example of exact solution of a problem of gas compression by a spherical shell. A.M.Svalov.
Fluid Dyn. (USA), vol.17, no.6, p.961-4 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.6, p.176-9 (Nov.-Dec. 1982).
A study is made of the problem of isentropic compression of gas by a spherical shell of finite thickness on the exterior of which there is a vacuum. The complete solution to the problem with different boundary conditions and different equations of state for the shell and the compressible medium is possible only numerically. However, there exists a class of exact solutions to the equations of gas dynamics with linear radial distribution of the velocities of the particles in which contact discontinuities are allowed. For this it is necessary that both the shell and the compressible medium be described by the same equation of state $p=(\gamma-1)\rho E$ with the same specific heat ratio $\gamma=c_p/c_v$. There can be arbitrarily many such discontinuities in the solution, i.e., this class of solutions can describe the compression of matter by multilayer shells. A restriction is made to a single-layer shells with specific heat ratio $\gamma=5/3$. (2 refs.)

101375 Simulation of a two-dimensional gas. Y.Kohayakawa, R.Mainieri, O.Helene (Inst. de Fisica, Univ. de Sao Paulo, Sao Paulo, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.4, p.709-19 (Dec. 1982). In Portuguese.
The authors present the result of a computer simulation of two two-dimensional gases, initially at different temperatures. The results are effective in demonstrating the energy equipartition. The observed energy and velocity distribution after the equilibrium agree with the proper (two-dimensional) theoretical distribution. (4 refs.)

101376 Distortion of Maxwell distribution in relaxing gas. T.T.Karasheva, D.K.Otorbaev, V.N.Ochkin, V.A.Rykov, S.Yu.Savinov, N.N.Sobolev.
Sov. Phys.-Lebedev Inst. Rep. (USA), no.10, p.47-52 (1982). Translation of: *Sb. Kratk. Soobshch. Fiz. AN SSSR Fiz. Inst. P.N. Lebedeva*, no.10, p.53-8 (1982).
By using a numerical solution of the Boltzmann equation in the hard-sphere approximation for a gas in a thermostat, arbitrary values of the ratio of masses of the colliding particles, and an arbitrary deviation from equilibrium, it is shown that during the relaxation process, the initial Maxwell velocity distribution of particles is not conserved, and the deviation from this distribution can be considerable. (7 refs.)

Transport properties of ground state nitrogen atoms ....See Entry 100494

Classical energy-sudden calculations of diffusion and viscosity cross sections for atom-diatom interactions ....See Entry 100514

Shock wave structure in a monatomic gas in the case of power-law interaction potentials ....See Entry 101286

51.20 VISCOSITY AND DIFFUSION: EXPERIMENTAL

101377 The viscosity of carbon-monoxide mixtures with four gases in the temperature range 25-200°C. Supplement. J.Kestin (Div. of Engng., Brown Univ., Providence, RI, USA), S.T.Ro.
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.7, p.600-2 (July 1983).
Reports new, absolute measurements of the viscosity of carbon monoxide (CO) with krypton (Kr), carbon dioxide (CO_2), methane (CH_4) and carbon tetrafluoride (CF_4). The measurements have been carried out in an oscillating-disk viscometer at a pressure of 0.1 MPa in the temperature range 25-200°C. The accuracy is estimated to lie between ±0.1% and ±0.2%. The data have been correlated by means of the two-parameter extended law of corresponding states. They have been utilised to derive binary diffusion coefficients. The paper is a supplement to an earlier publication on mixtures with He, Ne, Ar, and N_2. The great similarity between the viscosity of binary mixtures with N_2 and CO, respectively, is confirmed to a high degree of accuracy. (7 refs.)

51.30 THERMAL PROPERTIES OF GASES

101378 Question of the heat conductivity of inert gases at low temperatures. O.A.Kolenchits, N.A.Nesterov (Inst. of Appl. Phys., Acad. of Sci., Minsk, Belorussian SSR).
J. Eng. Phys. (USA), vol.43, no.6, p.1384-8 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.6, p.970-6 (Dec. 1982).
Theoretical and experimental data on the heat conductivity of inert gases at temperatures below 273K are shown to be in agreement. (14 refs.)

101379 Excess enthalpies for (water+nitrogen)(g) up to 698.2K and 12.6 MPa. C.J.Wormald, C.N.Colling (School of Chem., Univ. of Bristol, Bristol, England).
J. Chem. Thermodyn. (GB), vol.15, no.8, p.725-37 (Aug. 1983).
A new flow mixing calorimeter has been used to make measurements of the excess enthalpy of (water+nitrogen)(g) at temperatures up to 698.2K and pressures up to 12.6 MPa. Tests on the calorimeter, and consistency tests on the measurements, suggest that the results are free from significant errors. The measurements are fitted to an equation from which excess volumes and compression factors for the mixture are calculated. (20 refs.)

Existence conditions for stationary state of a free convection flow in a confined medium .... See Entry 101211

On the free molecule quenching of a gas jet by another gas at rest .... See Entry 101372

Surface resistance dominated thermal transport in thin specimens .... See Entry 102082

51.50 ELECTRICAL PHENOMENA IN GASES

(see also 52. Plasma and electric discharges)

101380 Mobilities and interaction potentials for Br^--Ar, Br^--Kr, and Br^--Xe. D.R.Lamm, R.D.Chelf, J.R.Twist, F.B.Holleman, M.G.Thackston, F.L.Eisele, W.M.Pope, I.R.Gatland, E.W.McDaniel (School of Phys., Georgia Inst. of Technol., Atlanta, GA, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.1965-8 (15 Aug. 1983).
Mobilities of Br^- ions in Ar, Kr and Xe gases at 300K have been measured in a drift tube mass spectrometer over a wide range of E/N (the ratio of the electric field to the neutral gas number density). For any ion-neutral gas interaction potential, implementation of the Viehland-Mason kinetic theory (accurate for arbitrary E/N) yields theoretical mobility data. This theory is employed in conjunction with an iterative-inversion scheme which uses experimental mobility data to modify an initial 'guess' 4,6,12 potential to produce a 'directly determined' potential which accurately reproduces the experimental mobilities for a given ion-neutral atom pair. These potentials are tabulated for Br^--Ar, Br^--Kr, and Br^--Xe and their salient features are compared to previous 'directly derived' potentials of other ions in these gases. (12 refs.)

101381 Mobilities of various mass-identified positive ions in helium, neon, and argon. H.Bohringer, M.Durup-Ferguson, D.W.Fahey (Aeronomy Lab., NOAA Environment Res. Labs., Boulder, CO, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.1974-6 (15 Aug. 1983).
The mobilities of several mass-identified positive ions in helium, neon, and argon buffer gases were measured in a flow drift tube apparatus as a function of E/N at 297K. The systems studied were N_2O^+, ${NO_2}^+$, and ${SO_2}^+$ in He, H_2O^+, ${O_2}^+$, and N_2O^+ in Ne, and H_2O^+, H_3O^+, N_2O^+, ${NO_2}^+$, and ${SO_2}^+$ in Ar. The values obtained were compared to previous measurements and Langevin mobilities and were used to estimate the well depth of the ion buffer interaction potential. (20 refs.)

Divergences and long-time tails in two- and three-dimensional quantum Lorentz gases .... See Entry 98944

Polarizabilities of interacting polar molecules .... See Entry 100596

51.60 MAGNETIC PHENOMENA IN GASES

(for liquids, see 75.)

101382 Kinetic studies of the bromine-oxygen system: a new paramagnetic particle, BrO_2. N.I.Butkovskaya, I.I.Morozov, V.L.Tal'rose, E.S.Vasiliev (Inst. of Chem. Phys., Acad. of Sci., Moscow, USSR).
Chem. Phys. (Netherlands), vol.79, no.1, p.21-30 (15 Aug. 1983).
The paramagnetic BrO_2 molecule with lifetime $\tau > 10$ s has been found among the products of the $O+Br_2$ reaction in a discharge flow system. Identification was made by the technique of molecular beam focusing in an inhomogeneous magnetic field with mass-spectrometric detection. Its symmetry appeared to be C_{2v}, like the stable OClO molecule, as was determined by focusing in an inhomogeneous electric field. Approximate rate constants for the reactions $O+BrO_2$ ($k_5=(2.5\text{-}6)\times 10^{-12}$ cm^3/s) and $Br+BrO_2$ ($k_7 \approx 5\times 10^{-11}$ cm^3/s) were obtained. (18 refs.)

51.70 OPTICAL PHENOMENA IN GASES

(for liquids, see 78.)

Calibration of wavelengths by optogalvanic spectroscopy .... See Entry 99072

Collision induced light scattering in gaseous H_2S .... See Entry 100406

Line shape and moment analysis in depolarized induced light scattering .... See Entry 100458

Polarizabilities of interacting polar molecules .... See Entry 100596

52.00 THE PHYSICS OF PLASMAS AND ELECTRIC DISCHARGES

(for solid-state plasma, see 72.30)

52.20 ELEMENTARY PROCESSES IN PLASMA

101383 Calculation of the probability of ionization of a hydrogen atom by a linearly polarized wave by the method of complex coordinates. V.E.Semenov.
Opt. & Spectrosc. (USA), vol.54, no.1, p.20-2 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.36-40 (Jan. 1983).
The method of complex coordinates combined with the method of quasi-energies and the method of numerical integration of the time-dependent Schrodinger equation have been applied to the calculation of the probability of ionization of the hydrogen atom by a linearly polarized wave. (10 refs.)

Dynamic structure factors in two-component plasmas .... See Entry 101392

Nuclear spin-polarized fuel in inertial fusion .... See Entry 101464

Model of optogalvanic effects in the neon positive column .... See Entry 101495

Line radiation from a hot, optically thin plasma: collision strengths and emissivities .... See Entry 104725

52.20F Electron collisions

101384 Collision dominated relaxation of electrons in a weakly ionized nitrogen plasma after abrupt change of the electric field. M.Capitelli, C.Gorse (Univ. di Bari, Bari, Italy), J.Wilhelm, R.Winkler.
Chem. Phys. (Netherlands), vol.79, no.1, p.1-7 (15 Aug. 1983).
The investigations are related to the relaxation of the electron component to new stationary states and start from different stationary states, caused by an abrupt change of the electric field in a molecular nitrogen plasma. By numerically solving the time-dependent Boltzmann equation for the electron the temporal evolution of the energy distribution and of resulting macroscopic quantities is obtained. A relaxation time of $\approx 10^9$ cm^{-3} s has been obtained in all cases considered, independent of the eventual presence of vibrationally excited molecules. The results are discussed on the basis of the effectiveness of energy transfer in the collisional processes. (13 refs.)

Subclassical diffusion in the Coulomb regime and in toroidal geometry .... See Entry 101397

Coupling between ECRH-driven and ohmic plasma currents .. See Entry 101441

Non-ideal plasmas of metal vapours .... See Entry 101443

52.20H Atomic, molecular, heavy-particle collisions

101385 Influence of plasma-chemical processes of formation of electronegative molecules on the parameters of non-self-sustained discharges. K.S.Klopovskii, A.P.Osipov, I.G.Persiantsev, A.T.Rakhimov, T.V.Rakhimova, N.V.Suetin, M.A.Timofeev (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.951-3 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.607-10 (Nov. 1982).
Attention is drawn to the fact that new electronegative molecules, the attachment of electrons to which proceeds with higher efficiency, leading to a decrease in plasma conductivity, can be formed as a result of plasma-chemical reactions in the process of burning of a discharge in an electronegative gas. An example of such a reaction is ozone formation in a non-self-sustained discharge in air. (5 refs.)

Collision dominated relaxation of electrons in a weakly ionized nitrogen plasma after abrupt change of the electric field .... See Entry 101384

Subclassical diffusion in the Coulomb regime and in toroidal geometry .... See Entry 101397

Non-ideal plasmas of metal vapours .... See Entry 101443

Radial and axial losses in a multiple-mirror experiment .... See Entry 101459

Non-Maxwellian ion distributions caused by neoclassical heat conduction .... See Entry 101465

52.25 PLASMA BASIC PROPERTIES

101386 General form for the electron distribution function for an inhomogeneous fully ionized and magnetized plasma interacting with an alternating electric field. I.Burdujan, D.Zoler (Inst. Politehnic Iasi, Iasi, Rumania).
Beitr. Plasma Phys. (Germany), vol.23, no.4, p.399-409 (1983).
The authors give a general form for the isotropic and vectorial part of the distribution function for electrons, in a fully ionized and magnetized plasma, interacting with an alternating electric field. By making the assumption that the ions have an equilibrium distribution, the authors obtain the needed solutions as series with respect to time and complex exponentials. Also they indicate a new manner in which the solution may be obtained with any precision. A general form for density current is obtained. It should be noted that these results are obtained without any previous assumption being made on the temporal dependence of the distribution function. (9 refs.)

101387 Local temperature of a plasma corona. V.V.Aleksandrov, S.I.Anisimov, N.G.Koval'skii, A.M.Rubenchik, L.N.Shur.
JETP Lett. (USA), vol.37, no.2, p.81-4 (20 Jan. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.2, p.68-70 (20 Jan. 1983).
The temperature of a laser plasma is usually determined from its X-ray emission. The electron temperature T_e found by this method, however, is an average over space and time, while one is often more interested in the local value of this temperature in the absorption zone. The authors show that the electron temperature in the absorption zone can be determined over a broad range of laser beam intensities by measuring the temporal profile of the emission at the $(3/2)\ \omega_0$ harmonic. (7 refs.)

101388 Fast annihilation of oppositely directed magnetic fields in a plasma. G.E.Vekshtein (Inst. of Nuclear Phys., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.2, p.84-8 (20 Jan. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.2, p.70-3 (20 Jan. 1983).
The calculated rate at which oppositely directed magnetic fields annihilate is dramatically increased by incorporating the heat capacity and emission of the plasma. (4 refs.)

101389 Thermal relaxation in a strongly coupled two-temperature plasma. J.P.Hansen (Lab. de Phys. Theorique des Liquides, Univ. Pierre et Marie Curie, Paris, France), I.R.McDonald.
Phys. Lett. A (Netherlands), vol.97A, no.1-2, p.42-4 (8 Aug. 1983).
Thermal relaxation in a strongly coupled two-temperature plasma is investigated by computer simulation of a semi-classical model of a fully ionized hydrogen plasma. The estimated relaxation times are unexpectedly close to their Landau-Spitzer values. (4 refs.)

101390 Kinetic description of a relativistic plasma with a one-dimensional momentum distribution in initial state. A.B.Mikhailovskii, O.G.Onishchenko, A.I.Smolyakov (Space Res. Inst., Acad. of Sci., USSR).
Phys. Lett. A (Netherlands), vol.97A, no.3, p.103-4 (15 Aug. 1983).
A new kinetic description of a relativistic plasma in which the component of the momentum of the particles perpendicular to the magnetic field vanishes in the initial equilibrium state is proposed. The method is based on expressing the transverse momentum of a particle as a function of the coordinates, time and longitudinal momentum. (6 refs.)

101391 The measurement of large-scale density fluctuations in toroidal plasmas from the 'phase scintillation' of a probing electromagnetic wave. L.E.Sharp (Plasma Res. Lab., Australian Nat. Univ., Canberra, Australia).
Plasma Phys. (GB), vol.25, no.7, p.781-92 (July 1983).
The plasma electron density fluctuation spectrum can be obtained from the measurement of the phase fluctuation spectrum of a probing electromagnetic wave measured some distance from the plasma. If the mean square fluctuation of the probing beam is much less than unity and the observer-plasma distance is well within the Fresnel distance of the irregularities, a direct relationship exists between the density and phase spectra. As an example of this procedure, an experiment is described which uses a probing beam wavelength of 2 mm to measure the density irregularities. It is then proposed that a suitable wavelength for the present large toroidal plasma devices is in the 10 μm region. (14 refs.)

101392 Dynamic structure factors in two-component plasmas. R.Cauble (Berkeley Res. Associates, Springfield, VA, USA), D.B.Boercker.
Phys. Rev. A (USA), vol.28, no.2, p.944-51 (Aug. 1983).
The general kinetic equation for the charge-charge structure factor of a fully ionized strongly coupled hydrogen plasma is solved in three distinct collision approximations. The equilibrium correlation functions necessary to these solutions are provided by solution of the hypernetted-chain integral equations in which an effective pair potential has been used to take into account short-range quantum effects. The results are compared with molecular-dynamics simulations of the plasma using the effective potential and with a hierarchical approach involving known sum rules. (30 refs.)

The quantum mechanical Landau equation .... See Entry 98837

Experimental study of launched ion-acoustic waves in a plasma using continuous wave CO_2 laser scattering .... See Entry 101411

Kinetic description of propagation and absorption structures of ICRF waves .... See Entry 101413

Turbulent absorption of lower hybrid waves due to scattering by low frequency fluctuations .... See Entry 101426

On the size of the plasma region .... See Entry 101454

Particle loss from an electron cyclotron resonance discharge plasma in the WT-2 device .... See Entry 101462

Experimental observation on sloshing-ion distribution and associated potential-dip formation .... See Entry 101463

The influence of the fluctuation amplitude on the probe characteristic .... See Entry 101472

Determination of the quadrupole moment of the electron distribution function in a plasma .... See Entry 101473

Measurement of electron concentration of a weakly ionized glow discharge plasma in nitrogen at intermediate pressures .... See Entry 101475

Plasma measurements from neutral-beam attenuation .... See Entry 101478

Electron temperature measurements using a 12-channel array probe .... See Entry 101479

Dynamics of long-lived states of strontium atoms and ions in a pulsed discharge in a mixture with helium .... See Entry 101493

Neutral particle temperature field in cylindrical glow discharge with axial gas flow .... See Entry 101500

An estimate of the error in the measurement of a constant electric field by the method of a double Langmuir probe .... See Entry 104584

52.25F Transport properties

101393 Fast-ion orbit effects during ion cyclotron range of frequency experiments on the Princeton large torus. R.Kaita, R.J.Goldston, P.Beiersdorfer, D.L.Herndon, J.Hosea, D.Q.Hwang, F.Jobes, D.D.Meyerhofer, J.R.Wilson (Plasma Phys. Lab., Princeton Univ., Princeton, NJ, USA).
Nucl. Fusion (Austria), vol.23, no.8, p.1089-92 (Aug. 1983).
The angular dependence of the flux of fast neutrals was measured in conjunction with ion cyclotron range of frequency experiments on the Princeton large torus. A regime was found where the energetic tail of the charge-exchange neutral flux was strongly anisotropic. Unexpectedly, however, the flux from co-going ions was peaked at an angle intermediate between perpendicular and parallel. This could be the consequence of a preferential filling of that class of banana orbits whose tips are located within the ion cyclotron resonance layer. (7 refs.)

101394 The effects of parallel viscosity on stationary convection in plasmas. R.B.Paris (Dept. de Recherches sur la Fusion Controlee, CEN, Fontenay-aux-Roses, France).
Phys. Lett. A (Netherlands), vol.96A, no.7, p.350-3 (18 July 1983).
Stationary convection in a simple cylindrical plasma model driven interchange-unstable by an applied heat source is considered in the presence of large parallel ion viscosity. The nature of the spectrum and the cellular convective pattern at marginal stability are quite different from that obtained using only perpendicular ion viscosity. (9 refs.)

101395 Effects of internal disruptions on impurity transport in Tokamaks. F.H.Seguin, R.Petrasso (American Sci. & Engng. Inc., Cambridge, MA, USA), E.S.Marmar.
Phys. Rev. Lett. (USA), vol.51, no.6, p.455-8 (8 Aug. 1983).
The effects of diffusion, convection, and internal disruptions on impurity profile evolution in Tokamaks are investigated by use of experimental measurements, numerical simulations, and a new analytic eigenfunction formalism for confinement times and profile shapes. Experimental observations on the Alcator-*C* Tokamak show that internal disruptions flatten radial profiles of impurity densities in the plasma core, and theoretical calculations indicate that periodic internal disruptions should significantly decrease impurity confinement times under some circumstances. (17 refs.)

101396 Penetration of oxygen in the edge region of Tokamak plasma. M.Tendler (Dept. of Plasma Phys. & Fusion Res., Royal Inst. of Technol., Stockholm, Sweden).
Plasma Phys. (GB), vol.25, no.7, p.767-79 (July 1983).
Transport of oxygen atoms and molecules in a two-component plasma is considered. It is shown that the oxygen atoms consist of some components. One of them has the penetration depth typical for the neutral hydrogen, while the other component has the penetration depth of the order of the total mean free path for the oxygen neutrals. The oxygen molecules desorbed from the wall are included, their influence on the impurity transport is studied. The diffusion coefficient of the first ionization state of the oxygen is estimated and is shown to be enhanced by one order of magnitude. Implications for Tokamak discharges are discussed. (22 refs.)

101397 Subclassical diffusion in the Coulomb regime and in toroidal geometry. R.Jones (Dept. of Phys., Nat. Univ. of Singapore, Singapore).
Plasma Phys. (GB), vol.25, no.8, p.901-10 (Aug. 1983).
Fast waves have been launched on a magnetized plasma column which was initially diffusing at the rate determined by classical Coulomb electron-ion collisions. As the injected wave amplitude is increased an energetic tail forms on the electron distribution and the crossfield particle diffusion coefficient declines to one quarter of its classical value. Similar experiments performemd in a toroidal octopole operated in the electron-neutral collision dominated regime have likewise yielded subclassical diffusion in closed toroidal geometry, the world record for plasma confinement. (19 refs.)

101398 Axisymmetric scrape-off plasma transport. C.E.Singer, W.D.Langer (Plasma Phys. Lab., Princeton Univ., Princeton, NJ, USA).
Phys. Rev. A (USA), vol.28, no.2, p.994-9 (Aug. 1983).
The two-dimensional flow of a collision-dominated hydrogen scrape-off plasma in an axisymmetric Tokamak is examined. This flow is described by a set of equations which contain the dominant terms in a maximal ordering appropriate to high-density experimental divertors and reactor scrape-off plasmas. Comparison of the theory to estimates of scrape-off parameters in the Doublet III expanded boundary plasmas suggests that analysis of classical and neoclassical processes alone may be sufficient to predict plasma transport in high-density scrape-off plasmas of practical importance. (14 refs.)

General form for the electron distribution function for an inhomogeneous fully ionized and magnetized plasma interacting with an alternating electric field .... See Entry 101386

The Knudsen ion layer problem in the theory of the collisionless sheath .... See Entry 101405

Spectrum of gas-dynamic perturbations and stability of a supersonic plasma flow in the presence of Joule heating .... See Entry 101407

Stability of a self-gravitating partially ionized plasma .... See Entry 101409

The effect of LH wave on the peripheral plasma of TM-1-MH Tokamak .... See Entry 101412

Current responses of first and second order in a collisionless plasma. III. Three-wave interaction in periodic plasma .... See Entry 101428

Current responses of first and second order in a collisionless plasma. IV. Applications .... See Entry 101429

Quasilinear theory of cyclotron heating of plasma in toroidal systems by monochromatic radiation .... See Entry 101440

Non-ideal plasmas of metal vapours .... See Entry 101443

Return-current heating and implosion of cylindrical CO_2-laser-driven targets .... See Entry 101447

Impurity transport and plasma rotation in the ISX-B Tokamak .... See Entry 101457

Radial and axial losses in a multiple-mirror experiment .... See Entry 101459

Effect of the ambipolar potential on stellarator confinement .... See Entry 101460

Non-Maxwellian ion distributions caused by neoclassical heat conduction .... See Entry 101465

Effect of mobilities and electric field on the stability of magnetized positive column .... See Entry 101494

52.25P Emission, absorption, and scattering of radiation

101399 Theory of radiation in an anisotropic plasma. P.C.W.Fung, T.P.Kwan (Phys. Dept., Univ. of Hong Kong, Hong Kong).
Astrophys. & Space Sci. (Netherlands), vol.93, no.2, p.281-93 (June 1983).
Follows up the work of Fung and Young (1982) to derive explicit expressions for the power emitted and the power observed per unit solid angle along the direction of the group velocity in an anisotropic plasma. The authors deduce the ratio of the time interval during which the energy is emitted and the corresponding time interval during which the energy is received in this anisotropic case. The result obtained is consistent to the basic well-known concept of group-ray propagation in a plasma. (10 refs.)

101400 Experimental evidence of X-ray line reabsorption in a laser plasma. M.Louis-Jacquet, P.Combis (Centre d'Etudes de Limeil, Villeneuve Saint Georges, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.14, p.1019-22 (18 April 1983). In French.
By using a suitable target geometry, opacity of X-ray emission has been measured on an aluminium laser created plasma. By means of simple theoretical models optical depths are inferred and seem to be in accordance with Stark and Doppler line broadening. (7 refs.)

101401 Spectral line limiting and polarization shift in plasmas of high particle and energy density. B.I.Henry (Dept. of Theoretical Phys., Univ. of New South Wales, Kensington, Australia).
Laser & Part. Beams (GB), vol.1, pt.1, p.11-28 (Feb. 1983).
The change of the energetic quantum levels of electrons in atoms or ions within plasma due to the electrostatic energy of the Debye sphere is discussed on the basis of an electrostatic quantum model which permits an immediate, and therefore an integrated, inclusion of the Debye screening. The resulting Debye field leads to an alternative (temperature dependent) formulation of the Inglis-Teller Stark merging of spectral lines. In the new model the drowning of lines gives values closer to the Inglis-Teller limit than values given by the quantum approximation of the hydrogenic model. The straightforward calculation of the polarization shift based on the new model is closest to the experimental values and is between the very low values given by the semiclassical approach and the too high values given by the quantum approach of the hydrogenic effective charge model. (48 refs.)

101402 Spectral-line intensities of multiply charged Be-like ions in a high-temperature plasma. I.Yu.Skobelev, S.Ya.Khakhalin.
Opt. & Spectrosc. (USA), vol.54, no.1, p.13-16 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.25-30 (Jan. 1983).
The processes by which the spectra of Be-like ions are excited in a high-temperature plasma are analyzed. The results of a numerical calculation of the density-sensitive relative intensities of the $2p^2$-$2s2p$ transitions in Ca XVII and Fe XVIII ions at densities and temperatures characteristic for a laser plasma are given. The theoretical and experimental data are compared, and it is shown that there is good agreement between them. (20 refs.)

101403 Radon inversion of plasma emission. D.N.Ghosh Roy (Dept. of Radiology, Univ. of Utah, Salt Lake City, UT, USA).
Phys. Lett. A (Netherlands), vol.96A, no.9, p.463-6 (1 Aug. 1983).
An analytical inversion of plasma spectral emission using the Radon transform is discussed for a plasma with a constant coefficient of absorption and a

model displaced gaussian as the spatial distribution of its coefficients of emission. (13 refs.)

Capture of radiation in complex configuration volumes ....See Entry 100290

Mechanism of pulse emission from high-pressure electric-discharge He-Ar, He-Kr, and He-Xe infrared lasers ....See Entry 100736

Local temperature of a plasma corona ....See Entry 101387

Gas-dynamic proceses in a strongly radiation-heated layer of gas which accelerates a barrier ....See Entry 101406

Stimulated Raman and Brillouin scattering of a Gaussian electromagnetic beam in ordinary mode in a magnetoplasma ....See Entry 101432

Numerical modelling of an explosion plasma generator, taking into account radiative energy transport and evaporation of the walls ....See Entry 101453

Determination of the quadrupole moment of the electron distribution function in a plasma ....See Entry 101473

Characterization of laser-produced plasma X-ray sources for use in X-ray radiography ....See Entry 104035

Radiation spectrum of optically thin relativistic electron-positron plasma ....
....See Entry 104722

52.30 PLASMA FLOW; MAGNETOHYDRODYNAMICS

(see also 47.65 Fluid dynamics)

101404 Compressible, conductive, steady MHD flow in a gravitational field. V.Osherovich (Space Environment Lab., NOAA/ERL, Boulder, CO, USA).
Astrophys. & Space Sci. (Netherlands), vol.93, no.2, p.221-8 (June 1983).
The magnetohydrodynamics of a compressible fluid with finite electrical conductivity in a gravitational field is treated analytically. For the case of one ignorable coordinate in cylindrical and Cartesian coordinates the problem is reduced to a scalar partial differential equation. The ideal gas equation of state is considered. For simplicity, the new equation is derived for a two-component motion. The application of this result to mass flow in sunspots is discussed. (18 refs.)

101405 The Knudsen ion layer problem in the theory of the collisionless sheath. I.B.Chekmarev, E.M.Sklyaroba, E.N.Kolesnikova (A.F. Ioffe Phys. Tech. Inst., Acad. of Sci., Leningrad, USSR).
Beitr. Plasma Phys. (Germany), vol.23, no.4, p.411-21 (1983).
The interaction of a partially ionized continuum gas with a negatively charged electrode is investigated theoretically. It is supposed that $l_d \ll 1$, where l_d is the Debye length, l is the mean-free-path. The self-consistent solution is given for two cases: $l_I \gg l$ and $l_I \sim l$, l_I is the effective ionisation length. The matched asymptotic expansions method is used. The Bohm sheath criterion is shown to be satisfied automatically in the considered cases. (14 refs.)

101406 Gas-dynamic proceses in a strongly radiation-heated layer of gas which accelerates a barrier. I.V.Nemchinov, V.M.Khazins.
Fluid Dyn. (USA), vol.17, no.6, p.922-7 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.6, p.131-7 (Nov.-Dec. 1982).
Numerical methods involving two variables have been used to study gas-dynamic processes in a gas layer next to a barrier. A flow of gas arises because of absorption by the gas of intense radiation. It is shown that cumulative effects can occur leading to the establishment of a quasi-steady flow and heating regime if the radiation is applied for a prolonged period. (17 refs.)

101407 Spectrum of gas-dynamic perturbations and stability of a supersonic plasma flow in the presence of Joule heating. I.M.Rutkevich.
Fluid Dyn. (USA), vol.17, no.6, p.940-7 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.6, p.154-62 (Nov.-Dec. 1982).
The author analyzes the perturbation spectrum for supersonic flow of a plasma heated by a current from an external source. In this case, the spectrum arises exclusively due to the influence of the external circuit. It is shown that when a current flows along a channel and there is a sufficiently rapid increase in the electrical conductivity with the temperature the steady current-voltage characteristic exhibits a section in which the voltage decreases with increasing current density. For perturbations that vary in time in accordance with the law exp λt and fixed gas-dynamic parameters at the entrance to the channel, the existence of a countable set of eigenvalues λ is established. (18 refs.)

101408 Microscopic derivation of plasma electro-hydrodynamics. G.L.Sewell (Dept. of Phys., Queen Mary Coll., London, England).
Phys. Lett. A (Netherlands), vol.97A, no.1-2, p.35-8 (8 Aug. 1983).
The authors present a new, essentially rigorous, method of deriving phenomenological electro-hydrodynamical equations of Euler and Maxwell from the Schrodinger equation for a quantum mechanical plasma. (5 refs.)

Axisymmetric scrape-off plasma transport ....See Entry 101398

Linear MHD stability studies of helically symmetric equilibria with HERA ......
....See Entry 101414

Interaction of a converging cylindrical shock wave with a transverse magnetic field for large magnetic Reynolds numbers ....See Entry 101427

Two-dimensional numerical simulation of an inductively driven imploding foil plasma ....See Entry 101452

Characteristics of the magnetic field fluctuations in the ETA-BETA II reversed field pinch experiment ....See Entry 101468

Magnetic field of a plasma flow past a blunt body [Earth magnetosphere] ....
....See Entry 104663

52.35 WAVES, OSCILLATIONS, AND INSTABILITIES IN PLASMA

101409 Stability of a self-gravitating partially ionized plasma. V.D.Sankhla, J.L.Bansal (Dept. of Math., Univ. of Jodhpur, Jodhpur, India).
Beitr. Plasma Phys. (Germany), vol.23, no.4, p.423-32 (1983).
The dynamic stability of a stratified layer of a partially ionized, self-gravitating plasma is studied to investigate the effects of finite electrical conductivity. The whole system is immersed in a uniform vertical magnetic field. It is first shown that the solution is characterized by a variational principle. An explicit solution has been then obtained for a semi-infinite composite plasma in which the density has a one-dimensional gradient along the vertical. Numerical calculations show that the influence of neutral gas friction and self-gravitation is stabilizing whereas character of finite electric conductivity is destabilizing. (18 refs.)

101410 Upper-hybrid solitons. B.K.Shivamoggi (Phys. Res. Lab., Ahmedabad, India).
Can. J. Phys. (Canada), vol.61, no.8, p.1205-11 (Aug. 1983).
Modulational instability and formation of envelope solitons of the upper-hybrid waves are considered. A more consistent calculation is given here which also includes the effect of ion inertia. A strong magnetic field can eliminate the existence of subsonic upper-hybrid solitons but can make possible the existence of supersonic upper-hybrid solitons. In order to describe the upper-hybrid solitons travelling at the speed of sound, the ion nonlinearity is included in the calculation with the assumpion of charge neutrality in the low frequency plasma response. An exact soliton solution moving at the speed of sound is then exhibited. Finally, a fully nonlinear theory of the formation of envelope solitons of upper-hybrid waves is given. The assumption of charge neutrality in the low frequency plasma response is abandoned. The solution shows a smooth transition from a single-hump soliton as the Mach number increases to unity. Furthermore, the dip at the centre for the double-hump soliton is found to become smaller as the magnetic field becomes stronger. (2 refs.)

101411 Experimental study of launched ion-acoustic waves in a plasma using continuous wave CO_2 laser scattering. P.Brodeur, H.W.H.Van Andel, D.C.Schram, V.M.M.Glaude (Dept. de Phys., Univ. de Montreal, Montreal, Quebec, Canada).
Can. J. Phys. (Canada), vol.61, no.8, p.1231-41 (Aug. 1983).
A study of coherent density fluctuations in a low density plasma using continuous wave CO_2 laser scattering diagnostics is reported. A simple and direct description of collective scattering theory from monochromatic electrostatic waves is presented. The diagnostic technique is described in detail and its performance is analyzed. Experimental results on externally launched ion-acoustic waves are presented and it is demonstrated that accurate measurements of certain plasma parameters are possible. (19 refs.)

101412 The effect of LH wave on the peripheral plasma of TM-1-MH Tokamak. J.Badalec, J.Datlov, K.Jakubka, V.Kopecky, S.Korbel, L.Kryska, P.Magula, J.Stockel, F.Zacek (Inst. of Plasma Phys., Czechoslovak Acad. Sci., Praha, Czechoslovakia), S.Nanobashvili.
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.7, p.787-90 (1983).
The work is devoted to the study of the LH wave effect on the peripheral plasma of the TM-1-MH Tokamak. The observed enhancement of the ion saturated current in the limiter shadow is interpreted as heating of the peripheral ions by absorption of decay waves generated in this region due to the nonlinear wave-plasma interaction. (6 refs.)

101413 Kinetic description of propagation and absorption structures of ICRF waves. A.Fukuyama, S.Nishiyama (School of Engng., Okayama Univ., Okayama, Japan), K.Itoh, S.-I.Itoh.
Nucl. Fusion (Austria), vol.23, no.8, p.1005-16 (Aug. 1983).
Propagation and absorption of waves in the ion cyclotron range of frequencies (ICRF) are investigated using the kinetic theory in a high-temperature plasma. The wave equation which includes kinetic effects (such as finite-gyroradius effect and wave/particle interactions) is solved as a boundary-value problem for a two-ion-component plasma (majority deuterium and minority hydrogen) with one-dimensional inhomogeneities. The global structure of the wave field and the absorption mechanism are explained. The power deposition profile for each plasma species and the coupling to the antenna are obtained. The mode conversion of the fast wave to the ion Bernstein wave is associated with the two-ion hybrid resonance, and the latter is absorbed by electrons and deuterons via Landau damping and collisional damping, respectively. Protons absorb the wave which tunnels through the cut-off-layer (for strong-field-side excitations) by cyclotron damping. The existence of cavity resonances is also confirmed; these considerably influence the energy absorption. (16 refs.)

101414 Linear MHD stability studies of helically symmetric equilibria with HERA. P.Merkel, J.Nuhrenberg (Max-Planck-Inst. fur Plasmaphys., Garching, Germany), R.Gruber, F.Troyon.
Nucl. Fusion (Austria), vol.23, no.8, p.1061-7 (Aug. 1983).
Helically symmetric equilibria without net longitudinal current and their linear MHD stability are studied with the HASE quasi-analytical equilibrium code and the HERA 2D spectral code. The modes investigated comprise low-m-number internal, external, high-m-number modes obtained with the large-k-number option of the HERA code and localized ($k \rightarrow \infty$) ballooning modes. Stable straight Heliotron equilibria with beta up to $\langle\beta\rangle = 0.01$ and stable straight Heliac equilibria with beta up to $\langle\beta\rangle = 0.29$ are obtained. The correspondence between instability as obtained from the ballooning-mode equation in part of the plasma volume and from finite-k analysis is discussed. (20 refs.)

101415 Efficient parametric decay in dissipative media. K.Papadopoulos, K.Ko, V.Tripathi (Sci. Appl. Inc., McLean, VA, USA).
Phys. Rev. Lett. (USA), vol.51, no.6, p.463-6 (8 Aug. 1983).
Three-wave-coupling interactions have been examined for a dissipative medium. It is shown that in the semicollisional regime, where the frequency of the low-frequency wave (ω_3) is smaller than the collision frequency ν that affects the weakly damped high-frequency waves (ω_1, ω_2), i.e. $\omega_1, \omega_2 \gg \nu > \omega_3$, the thermal nonlinearity predominates and decay efficiencies in excess of that expected from the Manley-Rowe relations can be achieved. In addition, the pump threshold power for complete decay is substantially reduced. (12 refs.)

101416 Absolute parametric instabilities in inhomogeneous plasmas. G.Picard, T.W.Johnston (Inst. Nat. de la Recherche Sci. Energie, Univ. du Quebec, Varennes, Quebec, Canada).
Phys. Rev. Lett. (USA), vol.51, no.7, p.574-7 (15 Aug. 1983).
For one-dimensional three-wave parametric instabilities with oppositely directed group velocities for the decay waves in unbounded plasmas, it is known that for uniform coupling amplitude and constant wave-vector mismatch ($d\Sigma k_i/dx = \mathrm{const}$) there cannot be an absolute instability. It is shown that this is an exceptional case, and that in general an absolute instability can be obtained in an inhomogeneous plasma with a sufficiently strong pump. A simple criterion is given for the threshold of the absolute instability. (11 refs.)

101417 Comment on 'Collapse of longitudinal waves in a plasma [and reply]. K.Rypdal (Inst. for Math. & Phys. Sci., Univ. of Tromso, Tromso, Norway), J.J.Rasmussen, K.Thomsen, D.D.Tskhakaia.
Phys. Rev. Lett. (USA), vol.51, no.7, p.613-14 (15 Aug. 1983).
Taskhakaia (1982) claims to demonstrate that Langmuir-wave collapse as described by the Zakharov equations (1981) is two dimensional. First he derives a 'virial theorem' which has a useful form for collapse predictions for dimensionality $D=2$ only. Second, a self-similar transformation is performed, which is possible only for $D=2$. The authors have serious objections to both arguments. Tskhakaia responds by agreeing that the 'virial theorem' of his original paper does not deny, in general, the existence of three-dimensional collapse. However, until now no selfsimilar transformation satisfying the conservation laws in the three-dimensional case has been found. The selfsimilar solution used satisfies the laws in the two-dimensional case. (11 refs.)

101418 Fast and ion-cyclotron surface waves at a plasma-vacuum interface. N.F.Cramer (School of Phys., Univ. of Sydney, Sydney, NSW, Australia), I.J.Donnelly.
Plasma Phys. (GB), vol.25, no.7, p.703-12 (July 1983).
The effect of a finite frequency on the dispersion relation of low-frequency surface waves propagating on a magnetized plasma-vacuum interface is investigated. It is shown that two distinct modes exist depending on the sign of the wavenumber perpendicular to both the magnetic field direction and the normal to the surface, which may be related to the fast and ion-cyclotron body waves. The damping of these waves due to resonance absorption is calculated, and it is shown that the fast surface wave is undamped if its frequency is higher than the ion-cyclotron frequency. (17 refs.)

101419 Characteristics of the nonlinear suppression of ionization waves. H.Amemiya (Inst. of Phys. & Chem. Res., Saitama, Japan).
Plasma Phys. (GB), vol.25, no.7, p.735-54 (July 1983).
It is demonstrated that a spontaneously excited ionization wave in a small radius positive column is suppressed resonantly by an externally launched wave at some discrete frequencies. Waves whose frequency is not equal to these discrete frequencies have only a small effect of suppression. Results suggesting a feedback effect through the column are shown. It has been found that asynchronous quenching as described by van der Pol's equation should be modified. Also, the energy relation between the wave deviates from that given by van der Pol's relation. These characteristics are explained by considering nonlinearities of ionization rate and loss factor in Pekarek's equation. (41 refs.)

101420 Numerical calculation of Trivelpiece-Gould modes in a torus with circular cross-section. R.Keil (Inst. fur Informatik, Univ. Innsbruck, Innsbruck, Austria).
Plasma Phys. (GB), vol.25, no.8, p.841-54 (Aug. 1983).
The Trivelpiece-Gould modes in a quasielectrostatic approximation are calculated for a torus with circular cross-section. The results obtained with a Galerkin method are compared with those obtained for a torus with square cross-section. The lowest modes and eigenvalues are shown for aspect ratios varying from 2 to 5. (7 refs.)

101421 Coupled-mode equations for nonresonant interaction of high-frequency surface waves. N.Kostov, A.Shivarova (Faculty of Phys., Sofia Univ., Sofia, Bulgaria).
Plasma Phys. (GB), vol.25, no.8, p.891-900 (Aug. 1983).
Coupled-mode equations for the nonresonant interaction of two high-frequency surface waves, propagating along a plasma column bounded by vacuum, are derived directly by solving the equations of the one-fluid cold collisionless/collisional plasma model. The coupling coefficients are obtained in explicit form. The results are verified by analysing the simple case of harmonic generation by a high amplitude wave. The theory is extended to three-wave interaction in loss plasma in the general case of imperfect synchronism. (11 refs.)

101422 Electrostatic instabilities in a positive column. S.R.Sreenivasan, M.B.Schroeder (Dept. of Phys., Univ. of Calgary, Calgary, Alberta, Canada).
Plasma Phys. (GB), vol.25, no.8, p.925-35 (Aug. 1983).
A stability analysis of electrostatic perturbations in a positive column is reported. The positive column is considered as a three-component, low-pressure fluid, in which ionization and collisions play a significant role. The application of the generalized Hurwitz criterion for stability is found to predict an instability when the electron drift velocity exceeds 5/6 of the electron thermal velocity, in excellent agreement with experiments on current limitation in positive columns. (24 refs.)

101423 Nonlinearly evolved Faraday rotation due to strong radiation in a plasma. B.Chakraborty, Manoranjan Khan, B.Bhattacharyya (Dept. of Math., Jadavpur Univ., Calcutta, India).
Phys. Rev. A (USA), vol.28, no.2, p.1047-55 (Aug. 1983).
Faraday rotation (FR) has a nonlinear part which can be excited by a strong elliptically polarized electromagnetic wave in a plasma, even in the absence of a static magnetic field. It is due to the different dispersion rates of the strong left- and right-circular polarization components of the wave (the corresponding refractive indices are denoted by n_L and n_R) and induces weak nonuniformities in a magnetized plasma. As a result the study of the nonlinear characteristics requires the WKB type of nonlinearly correct first-harmonic field solutions. This nonlinear evolution problem has been investigated in this paper. The new results, depending on both the field intensity and the nonlinearly induced spatial inhomogeneity, are (1) the nonlinearly correct expressions for n_L and n_R, (2) the amplitude evolution equations in which the coefficients are slowly varying with respect to x (the Cartesian coordinate parallel to the direction of propagation) and their WKB solution, (3) the expression for the nonlinearly correct FR angle, and (4) a numerical estimation on the interaction of a plasma with a CO_2 pulsed laser in which it has been shown that the nonlinear increment of FR is opposite in sign to the value found in the linearized approximation of the field equations. The new results have been discussed in some special cases and some comments are given on enlarging the scope of further work on the FR of strong waves. (21 refs.)

101424 Properties of envelope solitons at the upper-hybrid layer. R.P.Sharma, P.K.Shukla (Inst. fur Theoretische Phys., Ruhr-Univ. Bochum, Bochum, Germany).
Phys. Rev. A (USA), vol.28, no.2, p.1182-5 (Aug. 1983).
Reports finite-frequency density modifications due to the electron Bernstein wave at the upper-hybrid resonant layer of a magnetoplasma. Envelope solitons consisting of nonlinear density perturbations together with localized Bernstein wave envelopes are found to exist. (16 refs.)

A plasma wave accelerator—Surfatron. II .... See Entry 99781

Suppression of noise by a plasma shield .... See Entry 100969

Formation of saturated solitons in a nonlinear dispersive system with instability and dissipation .... See Entry 101171

The effects of parallel viscosity on stationary convection in plasmas .... See Entry 101394

Spectrum of gas-dynamic perturbations and stability of a supersonic plasma flow in the presence of Joule heating .... See Entry 101407

Coherence in chaos and caviton turbulence .... See Entry 101425

Turbulent absorption of lower hybrid waves due to scattering by low frequency fluctuations .... See Entry 101426

On mechanisms of anomalous absorption of electromagnetic waves near a critical point of a plasma target .... See Entry 101431

Weak monotonic double layers .... See Entry 101433

Brillouin backscattering in an electron beam-plasma system . See Entry 101434

Filamentation and magnetic field generation by charged particle beams in laser produced plasmas .... See Entry 101435

On the nonlinear theory of surface wave generation in an electron beam-plasma system .... See Entry 101436

Nonlinear equilibrium state of relativistic electron beam and EM waves of large amplitude in a plasma .... See Entry 101437

Shock waves excited by a fast charged beam in media with dissipation .... See Entry 101439

Self-consistent calculations of short-pulse laser-heated plasma dynamics .... See Entry 101445

Two-dimensional numerical simulation of an inductively driven imploding foil plasma .... See Entry 101452

Plasma equilibrium equation for a stellarator of arbitrary aspect ratio .... See Entry 101461

Effects of nonadiabaticity on applications of the ponderomotive force near gyroresonance .... See Entry 101466

Characteristics of the magnetic field fluctuations in the ETA-BETA II reversed field pinch experiment .... See Entry 101468

Heterodyne detection of lower hybrid waves in a plasma by microwave scattering .... See Entry 101477

52.35R Plasma turbulence

101425 Coherence in chaos and caviton turbulence. G.D.Doolen, D.F.DuBois, H.A.Rose (Los Alamos Nat. Lab., Los Alamos, NM, USA), B.Hafizi.
Phys. Rev. Lett. (USA), vol.51, no.5, p.335-8 (1 Aug. 1983).
The chaotic nature of 'caviton turbulence' is studied in one-dimensional, many-Fourier-mode numerical simulations of the driven dissipative Zakharov equations. Above the modulational instability threshold the system evolves into a variety of stable patterns of cavitons which become chaotic for stronger driving. The cavitons remain coherent for times long compared to the shortest Lyapunov time. (5 refs.)

101426 Turbulent absorption of lower hybrid waves due to scattering by low frequency fluctuations. G.Bohm, H.Schluter, L.Schmitz (Inst. fur Experimentalphysik II der Ruhr-Univ. Bochum, Germany).
Plasma Phys. (GB), vol.25, no.8, p.911-23 (Aug. 1983).
Wave absorption in the range of the lower hybrid frequency ($\omega_{LH} \leq \omega_0 \leq 3\omega_{LH}$, $P_{RF} \leq 1$ kW) is investigated in a 1=2 toroidal stellarator with very low shear ($B_t \leq 0.3$ T, $\theta \leq 0.05$). The target plasma is produced at the electron cyclotron frequency ($\omega_{ce}/2\pi \simeq 7.8$ Gc). After application of the RF-heating pulse, a fast rise of the electron and ion temperature within a few μs is found regardless of the presence of a linear turning point ($\omega \simeq \omega_{LH}$) in the plasma. Strong scattering of the incident LH-wave by low frequency density fluctuations ($\omega_L \ll \omega_{ci}$, $\delta n/n \leq 0.4$) of the target plasma is observed. Correlation measurements of the $k_\parallel$-and $k_\perp$-spectrum of the low frequency density fluctuations as well as the scattered lower hybrid spectrum are presented. Several indications for turbulent particle heating are found. The effective collision frequencies necessary to explain the observed particle heating are calculated from the plasma energy balance. (13 refs.)

On mechanisms of anomalous absorption of electromagnetic waves near a critical point of a plasma target .... See Entry 101431

Impurity transport and plasma rotation in the ISX-B Tokamak .... See Entry 101457

52.35T Shock waves

101427 Interaction of a converging cylindrical shock wave with a transverse magnetic field for large magnetic Reynolds numbers. D.A.But, S.M.-A.Koneev.
Magnetohydrodynamics (USA), vol.18, no.4, p.389-95 (Oct.-Dec. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.4, p.69-75 (Oct.-Dec. 1982).
The authors study the interaction between a conducting gas and a magnetic field behind a converging cylindrical shock wave in the presence of strong magnetohydrodynamic interaction and the influence of induced magnetic fields. (10 refs.)

Shock waves excited by a fast charged beam in media with dissipation .... See Entry 101439

52.40 PLASMA INTERACTIONS

52.40D Electromagnetic wave propagation in plasma

101428 Current responses of first and second order in a collisionless plasma. III. Three-wave interaction in periodic plasma. J.Larsson (Dept. of Plasma Phys., Umea Univ., Umea, Sweden).
J. Math. Phys. (USA), vol.24, no.8, p.2222-30 (Aug. 1983).
For pt.II see ibid., vol.23, p.183 (1982). Three-wave interaction in a possibly strongly inhomogeneous plasma was considered in Paper II. These results are now generalized in order to treat also time-dependent periodic systems. The coupled mode equations as given in this paper are applicable to a very large class of unperturbed systems including those in Paper II and plasmas with self-consistence or in external oscillating fields and also plasmas with some crystal symmetry in space-time. In the particular case when the relativistic Vlasov equation is used to describe the plasma the author gives symmetric expressions for the coupling coefficients such that the Manley-Rowe relations follow if wave-particle interaction is neglected. (10 refs.)

101429 Current responses of first and second order in a collisionless plasma. IV. Applications. J.Larsson (Dept. of Plasma Phys., Umea Univ., Umea, Sweden).
J. Math. Phys. (USA), vol.24, no.8, p.2231-9 (Aug. 1983).
For pt.III see ibid., vol.24, no.8, p.2222-30 (1983). The purpose of this paper is to illustrate with a few concrete examples how the general formulas given in the preceding papers I-III may be used. The author considers three different background plasmas: a homogeneous static magnetized plasma, a homogeneous magnetized plasma in an oscillating electric field, and a semi-infinite homogeneous static magnetized plasma. The coupled mode equations governing resonant three-wave interaction are given in each case. (21 refs.)

101430 The study of Nd-glass laser radiation influence upon the plasma generated in a plasma-focus device. S.Denus, J.Chlodzinski, L.Pokora, T.Pisarczyk, M.Scholz, W.Skrzeczanowski, R.Socha, A.Szydlowski, J.Wolski.
J. Tech. Phys. (Poland), vol.23, no.2, p.153-65 (1982).
The plasma-focus (PF) systems are among the systems intended to be used for the accomplishment of nuclear fusion. The achievement of the ultimate aim is likely to be hastened by the possibility of heating up the focus plasma

with laser radiation. The interaction of CO_2 laser, of maximum energy 200 J and pulse width about 100 ns, with the plasma generated in a PF device of nominal charging energy $E_n=150$ KJ has been studied. The results of these studies are indicative of the complete absorption of laser radiation, and of double increase of neutron yield at discharges with laser. (14 refs.)

101431 On mechanisms of anomalous absorption of electromagnetic waves near a critical point of a plasma target. L.M.Degtyarev, A.S.Reztsov, R.Z.Sagdeev, V.D.Shapiro, V.I.Shevchenko (Space Res. Inst., Acad. of Sci., Moscow, USSR).
Phys. Lett. A (Netherlands), vol.96A, no.7, p.354-7 (18 July 1983).
Anomalous absorption of a strong P-polarized electromagnetic waves is studied by a numerical technique near a critical point of a plasma target $n_c=m\omega^2/4\pi e^2$. It is shown that three absorption regimes can be implemented depending on the incident wave amplitude and the angle of incidence: linear transformation into plasma oscillations, transformation of the modified density profile, and absorption due to the strong plasma turbulence excited near the plasma resonance. (3 refs.)

101432 Stimulated Raman and Brillouin scattering of a Gaussian electromagnetic beam in ordinary mode in a magnetoplasma. M.S.Sodha, K.Ramamurthy, P.K.Malhotra, R.P.Sharma (Centre of Energy Studies, Indian Inst. of Technol., New Delhi, India).
Phys. Rev. A (USA), vol.28, no.2, p.1098-102 (Aug. 1983).
Presents an investigation of the interaction of a high-power Gaussian electromagnetic beam in ordinary mode with the electrostatic modes of the plasma and the resulting Raman and Brillouin scattering process. Taking into proper account the nonuniformity of the pump Gaussian beam, the authors have derived the expressions for the spatial amplification factor and temporal growth rate within the WKB and paraxial-ray approximations for stimulated Raman and Brillouin scattering. The effect of the nonuniformity of the pump is seen to affect the scattering phenomena significantly. (9 refs.)

A study of statistical moments of shortwave fields, propagating in a medium with strong, Gaussian random inhomogeneities. The system of moment equations .... See Entry 100638

Brillouin backscattering in an electron beam-plasma system . See Entry 101434

Nonlinear equilibrium state of relativistic electron beam and EM waves of large amplitude in a plasma .... See Entry 101437

Self-consistent calculations of short-pulse laser-heated plasma dynamics .... See Entry 101445

Unlimited electron acceleration in laser-driven plasma waves .... See Entry 101482

52.40H Solid-plasma interactions

Numerical modelling of an explosion plasma generator, taking into account radiative energy transport and evaporation of the walls ....See Entry 101453

52.40K Sheaths

101433 Weak monotonic double layers. K.Y.Kim (ERL, Univ. of California, Berkeley, CA, USA).
Phys. Lett. A (Netherlands), vol.97A, no.1-2, p.45-50 (8 Aug. 1983).
The authors present analytic evidence for the existence of small amplitude electron and ion monotonic double layers. These are the nonlinear extensions of the slow electron acoustic wave and the slow ion acoustic wave, respectively: one related to the electron solitary hole (electron phase space vortex), the other related to the ion acoustic solitary hole (ion phase space vortex), both having negative trapping parameters. (27 refs.)

The Knudsen ion layer problem in the theory of the collisionless sheath .... See Entry 101405

Two-dimensional numerical simulation of an inductively driven imploding foil plasma .... See Entry 101452

The formation of double-valued sheaths in thermionic converters .... See Entry 101481

52.40M Beam interactions in plasma

101434 Brillouin backscattering in an electron beam-plasma system. J.E.Willett, Y.Aktas (Dept. of Phys., Univ. of Missouri-Columbia, Columbia, MO, USA).
Plasma Phys. (GB), vol.25, no.7, p.819-25 (July 1983).
The stimulated Brillouin backscattering of an intense electromagnetic wave propagating in a plasma traversed by an electron beam is investigated. A dispersion relation for the unstable backscattered electromagnetic wave and ion-acoustic scatterer wave in the presence of the pump wave is derived. Formulas are then obtained for the growth rate of the unstable waves and the threshold power of the pump wave required to excite the parametric instability. The results of a numerical study indicate that the electron beam can have a substantial effect on the threshold and growth rate. (4 refs.)

101435 Filamentation and magnetic field generation by charged particle beams in laser produced plasmas. Yu.M.Aliev, V.Yu.Bychenkov, A.A.Frolov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Plasma Phys. (GB), vol.25, no.8, p.827-31 (Aug. 1983).
The kinetic electromagnetic instability caused by collisionless dissipation under anomalous skin-effect conditions is investigated in plasma penetrated by fast electron beams. Characteristic scales of rising periodical current structure are determined and magnitude of the generated magnetic field is estimated. (5 refs.)

101436 On the nonlinear theory of surface wave generation in an electron beam-plasma system. V.K.Grishin (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR), S.T.Ivanov, M.F.Kanevsky.
Plasma Phys. (GB), vol.25, no.8, p.855-64 (Aug. 1983).
The nonlinear interaction of a relativistic charged beam with the surface wave excited when the beam slides along a plasma layer is considered. The self-consistent nonlinear state of the wave-beam system has been analyzed on the basis of the Maxwell and kinetic equations. The saturation amplitude, wave-phase velocity, the wave generation efficiency, and other quantities have been obtained as a function of the initial parameters of the system. (17 refs.)

101437 Nonlinear equilibrium state of relativistic electron beam and EM waves of large amplitude in a plasma. S.T.Ivanov (Faculty of Phys., Sofia Univ., Sofia, Bulgaria), K.A.Reshetnikova.
Plasma Phys. (GB), vol.25, no.8, p.865-74 (Aug. 1983).
Using the Maxwell and relative hydrodynamics equations, the equilibrium wave-beam in a plasma has been analyzed and considered, provided that the wave is purely harmonic. Taking into account the equilibrium of pulse and energy conservation law, the nonlinear characteristics of the system have been obtained for a large wave amplitude (the beam and plasma are nonlinear). Redistribution of the beam kinetic energy and the dependence of the generation efficiency on the parameters of the system have been investigated and studied. (15 refs.)

101438 Two-dimensional model of the interaction of a relativistic electron beam with the fields excited in a plasma. O.I.Klimov, Ye.I.Ostrenskiy.
Radio Eng. & Electron. Phys. (USA), vol.27, no.10, p.126-32 (Oct. 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.10, p.2001-7 (Oct. 1982).
A two-dimensional self-consistent model has been developed for the interaction of a relativistic electron beam with the fields excited during injection of the beam into a plasma. The obtained equations can be used to study the nonlinear interaction of magnetized (one-dimensional) as well as nonmagnetized electron beams with the plasma. The two-dimensional dynamics of the electron beams in the collective electric field of the space charge and the intrinsic magnetic field are calculated. (13 refs.)

101439 Shock waves excited by a fast charged beam in media with dissipation. V.K.Grishin, A.A.Kolomenskii.
Sov. Phys.-Lebedev Inst. Rep. (USA), no.10, p.35-40 (1982). Translation of: *Sb. Kratk. Soobshch. Fiz. AN SSSR Fiz. Inst. P.N. Lebedeva*, no.10, p.40-5 (1982).
The authors consider an electromagnetic wave with shock front, excited by a fast beam of charged particles in plasma media with dissipation. A self-consistent nonlinear analysis determines the nature of the particle distribution in the beam, and the structure of the shock wave. (3 refs.)

Impurity transport and plasma rotation in the ISX-B Tokamak .... See Entry 101457

Experimental observation on sloshing-ion distribution and associated potential-dip formation .... See Entry 101463

Plasma measurements from neutral-beam attenuation ....See Entry 101478

52.50 PLASMA PRODUCTION AND HEATING

101440 Quasilinear theory of cyclotron heating of plasma in toroidal systems by monochromatic radiation. E.V.Suvorov, M.D.Tokman (inst. of Appl. Phys., Acad. of Sci., Gorky, USSR).
Plasma Phys. (GB), vol.25, no.7, p.723-34 (July 1983).
Averaged equations are obtained for electron motion under cyclotron resonance conditions in the electromagnetic field of the ordinary wave of finite amplitude for the case of quasi-transverse propagation. The characteristic time intervals are pointed out, for which the wave-electron interaction is essentially different in the initial problem. The conditions are given under which this interaction is determined by the linear theory. Taking into account the rotational transform in toroidal systems, a quasilinear equation for the evolution of the electron distribution function is obtained, which is equivalent to that describing a heating in the h.f. field with a noise spectrum. The optical plasma depth for an ordinary wave is shown to remain constant during the course of quasilinear relaxation. (8 refs.)

101441 Coupling between ECRH-driven and ohmic plasma currents. D.F.H.Start (Culham Lab., UKAEA, Abingdon, England).
Plasma Phys. (GB), vol.25, no.7, p.793-8 (July 1983).
A Fokker-Planck calculation of the interaction between ECRH-driven and ohmic currents is presented. For high values of the parallel velocity of the resonant electrons, the current driven by electron cyclotron resonance heating is found to be substantially enhanced as a result of the distortion of the electron distribution function due to the electric field. The increase in current results principally from the increase in the number of resonant electrons. For absorption by resonant electrons of low parallel velocity the electron cyclotron heating reduces the ohmic current. (11 refs.)

101442 Self-organization phenomena in the plasma focus. R.Deutsch, W.Grauf, H.Herold, H.Schmidt (Inst. fur Plasmaforschung, Univ. Stuttgart, Stuttgart, Germany).
Plasma Phys. (GB), vol.25, no.8, p.833-40 (Aug. 1983).
The structure of the final minimum-energy state of the focus plasma was studied, using Taylor's relaxation theory (1974). A superposition of the reversed pinch field and the field of eddies was obtained. Similar structures could be observed experimentally. (8 refs.)

101443 Non-ideal plasmas of metal vapours. V.A.Alekseev (I.V. Kurchatov Inst. of Atomic Energy, Moscow, USSR), I.T.Iakubov.
Phys. Rep. (Netherlands), vol.96, no.1, p.1-69 (June 1983).
Non-ideal plasmas of metal vapours are created at a compression of gaseous weakly conductive plasmas in the course of their transition into the liquid-metal state. In this situation the interaction between the charged particles (electrons and ions) and the neutral atoms become important. The interaction energy is exceeding the kinetic energy. A result of this process is a radical change of the particle states: a lowering of the atomic ionization potential and a deformation of the atomic spectra, a formation of electronic and ionic clusters. This leads to an essential change in the matter properties, such as the electric conductivity, the optical absorption, the thermoelectric power etc. (158 refs.)

Geometrical efficiency of the prototype neutral beam injector unit for JT-60 .... See Entry 99725

Fast-ion orbit effects during ion cyclotron range of frequency experiments on the Princeton large torus .... See Entry 101393

Spectrum of gas-dynamic perturbations and stability of a supersonic plasma flow in the presence of Joule heating .... See Entry 101407

Turbulent absorption of lower hybrid waves due to scattering by low frequency fluctuations .... See Entry 101426

Strong ion coupling effects at high density of inertial confinement fusion plasmas .... See Entry 101455

Inertial confinement fusion research by particle beams at ILE Osaka .... See Entry 101456

Impurity transport and plasma rotation in the ISX-B Tokamak .... See Entry 101457

Nuclear spin-polarized fuel in inertial fusion .... See Entry 101464

Application of Epstein technique to study the coupling properties of an ICRH antenna .... See Entry 101467

On the metallic phase arc at the break of W-contacts .... See Entry 101501

52.50J Plasma production and heating by laser beams

101444 Laser driven compression experiments using low X-ray opacity polymer shells. J.D.Kilkenny, B.J.MacGowan (Blackett Lab., Imperial Coll. of Sci. & Technol., London, England), P.T.Rumsby.
Appl. Phys. Lett. (USA), vol.43, no.3, p.233-5 (1 Aug. 1983).
The use of polymer shells, filled with dichlorodifluoromethane in laser compression experiments is described. The absence of shell emission leads to chlorine spectra with little contaminating shell continuum emission. The low X-ray opacity of polymer indicates that chlorine heliumlike emission could be detected even with compressed shell areal density of 0.1 gm cm^{-2}. (9 refs.)

101445 Self-consistent calculations of short-pulse laser-heated plasma dynamics. P.Ladrach, J.Balmer (Inst. of Appl. Phys., Univ. of Bern, Bern, Switzerland).
Laser & Part. Beams (GB), vol.1, pt.1, p.67-79 (Feb. 1983).
A one-dimensional, time-dependent fluid code is presented that numerically solves the hydrodynamic equations together with the wave equation for a picosecond pulse laser heated plasma. The laser light absorption by classical inverse bremsstrahlung and the ponderomotive force are evaluated self-consistently from the computed electromagnetic field quantities. At oblique incidence of *p*-polarized 1.054 μm laser radiation the resonant electric field is saturated by plasma wave convection through the nonlinear density profile steepening prior to wave breaking. (20 refs.)

101446 Dependence of lateral energy transport on laser irradiance in laser-induced plasmas. S.Sharma, B.Moncef, H.C.Pant (Laser Section, Bhabha Atomic Res. Centre, Bombay, India).
J. Appl. Phys. (USA), vol.54, no.8, p.4666-7 (Aug. 1983).
An experimental study of lateral energy transport in laser-produced plasmas is presented. X-ray pinhole photography has been used for studying the variation of the plasma diameters at the target surface as a function of the laser intensity. A scaling law has been found for this variation. (15 refs.)

101447 Return-current heating and implosion of cylindrical CO$_2$-laser-driven targets. A.Hauer, R.J.Mason (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
Phys. Rev. Lett. (USA), vol.51, no.6, p.459-62 (8 Aug. 1983).
The Helios laser system has been used to deliver 2.3 kJ to the capped end of 0.75-mm-long, 130-μm-diam hollow rods of 5-μm wall thickness. Soft-X-ray pinhole pictures demonstrate the cylindrical implosion of these targets. The measured 130-eV core temperatures from the filtered pictures and the 7×10^6-cm/s collapse velocity from optical streak photographs are consistent with heating by a 0.8×10^6-A return current, representing the recycling of 15% of the hot-electron emission. (10 refs.)

101448 Double-shell-target implosion by four beams from the GEKKO IV laser system. Y.Kitagawa, N.Miyanaga, H.Hama, T.Yabe, K.Fujiwara, Y.Kawai, M.Nakatsuka, T.Norimatsu, Y.Izawa, T.Yamanaka, C.Yamanaka (Inst. of Laser Engng., Osaka Univ., Osaka, Japan).
Phys. Rev. Lett. (USA), vol.51, no.7, p.570-3 (15 Aug. 1983).
A double-shell-target implosion was studied with the GEKKO IV glass-laser system. The inner-shell trajectory, recorded for the first time by a newly developed two-frame X-ray shadowgraphy technique, was analyzed by a self-similar flow model, implying more than 20% outer-inner kinetic-energy conversion. The trajectory also agreed with a one-dimensional code result including a vacuum insulation effect. A two-dimensional particle-in-cell simulation analyzed the illumination nouniformity printed on the inner shell. (16 refs.)

101449 Detailed observation and analysis of radiation from high-density laser-imploded targets. A.Hauer (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
Phys. Rev. A (USA), vol.28, no.2, p.963-75 (Aug. 1983).
High-energy CO$_2$-laser radiation has been used to implode gas-filled spherical targets to very high densities ($10^{23}<n_e<10^{24}$ cm^{-3}) and temperatures ($\sim$800 eV). The imploded gas was composed primarily of DT with a small amount of argon seed. The detailed observations of radiation from the argon was a primary diagnostic of the imploded-plasma conditions. An extensive analysis of the emitted argon spectrum provides a rich source of information on plasma parameters. In most cases one could not assume local-thermodynamic-equilibrium conditions. A very detailed collisional-radiative model was constructed in order to analyze the spectrum. In view of the complexity of the calculations that had to be performed and the care needed in data acquisition and processing, the agreement between theory and experiment was very good. (43 refs.)

101450 Investigation of soft X-ray population inversion in laser produced plasmas. Xu Zhizhan, Yin Guangyu (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, Shanghai, China).
Sci. Sin. (China), vol.26, no.6, p.657-65 (June 1983).
The authors have observed spectroscopic evidence for the population inversion between $n=3$ $n=4$ levels of Mg^{+10} ions in a laser target experiment where a given high power time-structured pulses were used. There are population inversions not only in the expansion plume region far from the target but also in the high electron density region near the target surface. It has been shown that the laser produced plasmas both temporally and spatially involve the 'overheated' and 'supercooled' conditions significantly deviated from the ionization equilibrium owing to the presence of prepulse, then two categories of temporal and spatial regions characterized by the population inversion are evolved. (14 refs.)

101451 Ionization equilibrium in laser plasma. I.L.Beitman, A.E.Stepanov.
Sov. Phys.-Lebedev Inst. Rep. (USA), no.10, p.6-11 (1982). Translation of: *Sb. Kratk. Soobshch. Fiz. AN SSSR Fiz. Inst. P.N. Lebedeva*, no.10, p.8-14 (1982).
The authors solve the kinetic problem of formation of the ionization equilibrium in a laser plasma. The experimental data for the Fe XXI-Fe XXV ions are described by using a gas-dynamic spherical corona model of the laser targets. (8 refs.)

Observation of compression of high-aspect-ratio shell targets in the DEL'FIN-1 laser-fusion device ....See Entry 99719

Local temperature of a plasma corona ....See Entry 101387

Experimental evidence of X-ray line reabsorption in a laser plasma ....See Entry 101400

Gas-dynamic proceses in a strongly radiation-heated layer of gas which accelerates a barrier ....See Entry 101406

Strong ion coupling effects at high density of inertial confinement fusion plasmas ....See Entry 101455

Inertial confinement fusion research by particle beams at ILE Osaka ....See Entry 101456

Use of Laue-geometry X-ray diffraction in the spectroscopy of laser plasmas ....See Entry 101476

Characterization of laser-produced plasma X-ray sources for use in X-ray radiography ....See Entry 104035

52.50L Plasma production and heating by shock wave and wire explosion

101452 Two-dimensional numerical simulation of an inductively driven imploding foil plasma. B.J.Kohn, N.F.Roderick, C.W.Beason (Air Force Weapons Lab., Kirtland Air Force Base, NM, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4348-53 (Aug. 1983).
A 1.9-MJ capacitor bank with intermediate inductive energy storage for pulse shortening has been used to implode a thin cylindrical sheath in a *z*-pinch geometry. Theoretical investigations of two-dimensional axisymmetric effects in the *r-z* plane, which lead to a thickening of the sheath, have been made using a two-dimensional magnetohydrodynamics code. The results of several calculations are presented which demonstrate how imperfections in the initial sheath geometry affect development of the acceleration-driven magnetohydrodynamic Rayleigh-Taylor instability. (6 refs.)

101453 Numerical modelling of an explosion plasma generator, taking into account radiative energy transport and evaporation of the walls. G.S.Romanov, V.V.Urban (V.I. Lenin Sci.-Res. Inst. of Appl. Phys. Problems, State Univ., Minsk, Belorussian SSR).
J. Eng. Phys. (USA), vol.43, no.6, p.1418-25 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.6, p.1012-20 (Dec. 1982).
Using a generalized theoretical model, the authors study the effect of geometrical dimensions and a variety of physical processes on the operation of the explosion plasma generator. (18 refs.)

52.55 PLASMA EQUILIBRIUM AND CONFINEMENT

101454 On the size of the plasma region. C.Bandle (Math. Inst., Univ. Basel, Basel, Switzerland), M.Marcus.
Appl. Anal. (GB), vol.15, no.1-4, p.207-25 (1983).
A simple model for the shape at equilibrium of a confined plasma is presented. The authors consider the variational solutions under assumptions of a free boundary, and derive asymptotic estimates for the size of the plasma domain. (8 refs.)

101455 Strong ion coupling effects at high density of inertial confinement fusion plasmas. K.I.Golden (Dept. of Electrical Engng., Northeastern Univ., Boston, MA, USA).
Laser & Part. Beams (GB), vol.1, pt.1, p.3-9 (Feb. 1983).
Strong ion coupling effects could play an important role in laser—and particle beam—compressed ICF layered targets. Some light is shed on these effects by examining structure and pair correlation functions calculated from some of the well known strongly coupled plasma approximation schemes.

101456 Inertial confinement fusion research by particle beams at ILE Osaka. S.Nakai, K.Imasaki, S.Miyamoto, S.Higaki, T.Ozaki, A.Yoshinouchi, H.Fujita, K.Mima, K.Nishihara, T.Yabe, S.Ido, Y.Ohgaki, C.Yamanaka (Inst. of Laser Engng., Osaka Univ., Suita, Osaka, Japan).
Laser & Part. Beams (GB), vol.1, pt.1, p.29-65 (Feb. 1983).
The analysis of key issues based on the conceptual design of a reactor and the investigations by experimental, theoretical and computational methods have revealed the feasibility of LIB-ICF (light ion beam-inertial confinement fusion) and the objectives for R&D. A pulse power generator with MJ output is well within present technology. Research on the pellet implosion physics is progressing in the laser fusion and shows high potential and the required conditions for ICF by pellet implosion. The experimental results on the deposition of ion beam energy on target and the generation of ablation pressure, together with the progress on implosion physics by lasers, seem to show the LIB to be a possible alternative driver to the laser. The basic conditions to be achieved for the inertial fusion application of LIB are power concentration in time and space, to the required level of 10^{14} W/cm^2, and beam transport without loss of concentration over the distance of a reactor size of order 3$\sim$5 m. (51 refs.)

101457 Impurity transport and plasma rotation in the ISX-B Tokamak. R.C.Isler, L.E.Murray, E.C.Crume, C.E.Bush, J.L.Dunlap, P.H.Edmonds, S.Kasai, E.A.Lazarus, M.Murakami, G.H.Neilson, V.K.Pare, S.D.Scott, C.E.Thomas, A.J.Wootton (Fusion Energy Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Nucl. Fusion (Austria), vol.23, no.8, p.1017-37 (Aug. 1983).
Recent calculations have shown that when external momentum sources and plasma rotation are included in the neoclassical theory, the standard results for impurity transport can be strongly altered. Under appropriate conditions, inward convection is reduced by co-injection and enhanced by counter-injection. In order to examine the theoretical predictions, several observations of impurity transport have been made in the ISX-B Tokamak during neutral-beam injection for comparison with the transport seen with Ohmic heating alone. Both intrinsic contaminants and deliberately introduced test impurities display a behaviour that is in qualitative agreement with the predicted beam-driven effects. These correlations are particularly noticeable when the comparisons are made for deuterium where the impurity transport in the Ohmically heated discharges exhibits neoclassical-like characteristics, i.e. accumulation and long confinement times. Similar but smaller effects are observed in beam-heated hydrogen discharges; neoclassical-like behaviour is not seen in Ohmically heated hydrogen sequences. Emphasis has been placed on measuring toroidal plasma rotation, and semi-quantitative comparisons with the theories of beam-induced impurity transport have been made. It is possible that radial electric fields other than those associated with momentum transfer and increased anomalous processes during injection could also play a role. (33 refs.)

101458 Closed expressions for the magnetic field of toroidal multipole configurations. G.V.Sheffield (Plasma Phys. Lab., Princeton Univ., Princeton, NJ, USA).
Nucl. Fusion (Austria), vol.23, no.8, p.1039-42 (Aug. 1983).
Closed analytic expressions for the vector potential and the magnetic field for the lower-order toroidal multipoles are presented. These expressions can be applied in the study of Tokamak plasma cross-section shaping. An example of such an application is included. These expressions also allow the vacuum fields required for plasma equilibrium to be specified in a general form, independent of a particular coil configuration. (6 refs.)

101459 Radial and axial losses in a multiple-mirror experiment. H.D.Price, A.J.Lichtenberg, M.A.Lieberman (Dept. of Electrical Engng., Univ. of California, Berkeley, CA, USA), M.Tuszewski.
Nucl. Fusion (Austria), vol.23, no.8, p.1043-52 (Aug. 1983).
Plasma confinement is studied experimentally in the Berkeley Ten Meter Multiple-Mirror Device. Stability is achieved by a set of linked quadrupoles which produce an average minimum-B field configuration. The density decay is measured from the high-density regime ($10^{13}<n<10^{15}$ cm^{-3}) dominated by radial loss through the multiple-mirror regime ($10^{11}<n<10^{13}$ cm^{-3}) for which either axial or radial loss may be more important. The effect of mirror ratio ($2\leq M\leq 4$) and magnetic field strength ($1.1\leq B_0\leq 2.1$ kG) on plasma loss is investigated. The observed confinement times are predicted reasonably well by an analytical estimate and by a numerical simulation. Each calculation accounts for axial and radial loss due to classical processes only, with the radial diffusion enhanced by the highly eccentric elliptical flux surfaces. A multiple-mirror normal mode is achieved with centre-cell density in the range $n\approx 10^{12}$ cm^{-3} and with axial profiles in qualitative agreement with those predicted by the numerical simulation. The results indicate that the confinement in a stabilized multiple-mirror can be governed by classical collisions alone. (9 refs.)

101460 Effect of the ambipolar potential on stellarator confinement. H.E.Mynick, W.N.G.Hitchon (Torsatron/Stellarator Lab., Univ. of Wisconsin, Madison, WI, USA).
Nucl. Fusion (Austria), vol.23, no.8, p.1053-9 (Aug. 1983).
The confinement properties of reactor-scale stellarators in the presence of a self-consistent ambipolar potential Φ are examined in the light of the current theoretical expectations for the dependence of the transport coefficients on collisionality and radial electric field. Stellarators have sufficiently good confinement to be viable as reactors. In addition, multiple roots of the ambipolarity constraint can exist in stellarators (as in other devices) and, for appropriate parameters, confinement can be improved by operating at a root different from the one usually considered. (9 refs.)

101461 Plasma equilibrium equation for a stellarator of arbitrary aspect ratio. V.D.Pustovitov (I.V. Kurchatov Inst. of Atomic Energy, Moscow, USSR).
Nucl. Fusion (Austria), vol.23, no.8, p.1079-88 (Aug. 1983).
In reducing the three-dimensional plasma equilibrium equations for a stellarator to two-dimensional form (a single scalar equation or a system of vector equations), the aspect ratio A is usually considered to be large and an expansion is performed in A^{-1}. A two-dimensional scalar equation is derived for plasma equilibrium, with accurate allowance for toroidality and without expansion in A^{-1}, so that it can also be used to describe compact small-aspect-ratio stellarators, e.g. systems of the stellatron type. The analysis is performed by the method of inversion of variables, and the result is a complete three-dimensional description of the equilibrium configuration. (23 refs.)

101462 Particle loss from an electron cyclotron resonance discharge plasma in the WT-2 device. S.Nakao, K.Ogura, Y.Terumichi, S.Tanaka (Dept. of Phys., Faculty of Sci., Univ. of Kyoto, Kyoto, Japan).
Phys. Lett. A (Netherlands), vol.96A, no.8, p.405-8 (25 July 1983).
The dominant particle loss from an electron cyclotron resonance discharge plasma in a simple toroidal configuration is ascribed to the $E\times B$ drift due to the vertical electric field produced by the electrons' toroidal drift. The electron density is increased by adding a small vertical field. This is explained by the electron flow along the line of force canceling the toroidal drift, resulting in reduction of the $E\times B$ drift. (7 refs.)

101463 Experimental observation on sloshing-ion distribution and ass ciated potential-dip formation. K.Yatsu, H.Tamai, M.Hoshino, Y.Kusam Y.Kiwamoto, Y.Kiyohara, A.Sakasai, I.Wakaida, M.Inutake, K.Sawa S.Miyoshi (Plasma Res. Center, Univ. of Tsukuba, Ibaraki, Japan).
Phys. Rev. Lett. (USA), vol.51, no.5, p.388-91 (1 Aug. 1983).
The sloshing-ion density distribution is produced in one of the minim-B mirrors of GAMMA 6 by injection of neutral beams at 62° to the axis he formation of sloshing ions is confirmed by pitch-angle distributions meared with secondary emission detector arrays and a gridded energy analyzer dip of plasma potential is observed associated with the density minimumf the sloshing-ion distribution. (10 refs.)

101464 Nuclear spin-polarized fuel in inertial fusion. M.More (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
Phys. Rev. Lett. (USA), vol.51, no.5, p.396-9 (1 Aug. 1983).
Examines the possibility of using spin-polarized DT fuel f inertial-confinement fusion. Analytic models and estimates are developed determine whether an initial spin-polarized state would survive target irdiation and implosion. It is found that collisional depolarization cross seons are not large enough to give significant depolarization, and that the sht duration of inertial-fusion implosions precludes spin resonance for magnetields that can be reasonably expected in the target fuel. (12 refs.)

101465 Non-Maxwellian ion distributions caused by neossical heat conduction. A.A.Ware (Inst. for Fusion Studies, Univ. of Tas, Austin, TX, USA).
Phys. Rev. Lett. (USA), vol.51, no.5, p.400-3 (1 Aug. 1983.
It is shown that in Tokamaks with neoclassical banana-ime heat conduction and ion self-collisions dominant for energy scatteringhe distribution tail diffuses outwards radially and downwards in energy mtaining a constant effective temperature $(-\partial \ln f_i/\partial\epsilon)^{-1}$, as observed in sie experiments. (9 refs.)

101466 Effects of nonadiabaticity on applicationsf the ponderomotive force near gyroresonance. G.Dimonte, B.M.Lamb, J.Morales (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
Plasma Phys. (GB), vol.25, no.7, p.713-22 (July 1983
The enhancement of the ponderomotive potential negyroresonance is investigated both experimentally and theoretically. Duto nonadiabaticity the maximum value of the ponderomotive potential is ited by the transit time of the particle through the r.f. field structure. T results have important implications for isotope separation and r.f. plugg of fusion plasmas. (12 refs.)

101467 Application of Epstein technique to dy the coupling properties of an ICRH antenna. R.P.Bhatnagar, V.P.Bhatnar, R.Koch, R.R.Weynants (Lab. de Phys. des Plasmas, Ecole Royale Milite, Brussels, Belgium).
Plasma Phys. (GB), vol.25, no.7, p.755-65 (July983).
An analytic solution of the wave equation foan inhomogeneous Tokamak plasma is obtained in terms of hypergeometric nctions by fitting the Epstein profile, with a maximum of five free pararers, to the dispersion curve. Power radiated from an ICRH antenna is th evaluated by solving a boundary value problem. The radiation resistancend inductance obtained by this method are compared in a particular case, fillustration, with those employing numerical integration and are found to typically 10% higher. Replacing the numerical integrn by the curve fitting procedure in the plasma region, a considerable savinf computer time can be achieved. (18 refs.)

101468 Charactstics of the magnetic field fluctuations in the ETA-BETA II reversed ld pinch experiment. V.Antoni, S.Ortolani (Centro di Studio sui Gas Ionati, CNR, Padova, Italy).
*Plasma Phys. (GB*vol.25, no.7, p.799-818 (July 1983).
Magnetic field fluations have been studied in the ETA-BETA II experiment as a functi of density, time and radius. The spectral analysis of the measured fluctuons has shown that the higher frequency portion of the spectrum (>50 Iz) is more sensitive to the density variation, whereas the lower frequencyortion (~10 kHz) shows a radial profile which, especially at later times ring the discharge, resembles the characteristic shape of MHD resistiveodes. Radial correlation lengths of several centimeters are found. In gene the amplitude of the fluctuations increases at lower densities and is larger vard the end of the discharge and in the outer plasma region. These trends ay be correlated with the typical variation of the streaming parameter Hever, the lower frequency fluctuations, in particular, can be interpreted MHD instabilities which can produce large distortion of the magnetic suces leading to island formation and overlapping resulting in stochastic aviour of the magnetic field lines in a relevant radial extent (≈1 cm) ohe outer plasma regions. (15 refs.)

A simple del of liner compression of plasma in a cylindrical system .... See Entry 99720

Burn permance of deuterium-tritium, deuterium-deuterium, and catalyzed deuteriurCF targets .... See Entry 99721

Energy n of D-T targets for inertial confinement fusion ..... See Entry 99722

Hydrog recycling processes in plasma device .... See Entry 99723

The msurement of large-scale density fluctuations in toroidal plasmas from the 'ple scintillation' of a probing electromagnetic wave .... See Entry 101391

Fast- orbit effects during ion cyclotron range of frequency experiments on the Pceton large torus .... See Entry 101393

Effe of internal disruptions on impurity transport in Tokamaks .... See Entry 101395

Peration of oxygen in the edge region of Tokamak plasma .... See Entry 101396

Sclassical diffusion in the Coulomb regime and in toroidal geometry .... See Entry 101397

isymmetric scrape-off plasma transport .... See Entry 101398

merical calculation of Trivelpiece-Gould modes in a torus with circular oss-section .... See Entry 101420

elf-organization phenomena in the plasma focus .... See Entry 101442

Two-dimensional numerical simulation of an inductively driven imploding foil plasma .... See Entry 101452

Computer simulations of the toroidal cusp experiment .... See Entry 101471

Spectroscopy and diagnostics of highly ionized plasma .... See Entry 101474

Thermochemical hydrogen production based on magnetic fusion .... See Entry 103733

52.60 RELATIVISTIC PLASMA

101469 Pair equilibrium in a relativistic plasma with magnetic fields. M.Kusunose (Dept. of Astron., Univ. of Tokyo, Tokyo, Japan), F.Takahara.
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1443-56 (May 1983).
The authors investigate the influence of magnetic fields on the electron-positron pair equilibrium in an optically thin relativistic plasma. They assume that the plasma is uniform and static with a proton density N and a size R and that magnetic fields are randomly oriented. They found that qualitative features are similar to those of a plasma without magnetic fields; there exist two branches of solution for the pair density, and there exist the maximum value attainable of the electron temperature $T_*\equiv kT_e/m_eC^2$ for a given $\tau_N\equiv\sigma_T NR$, where σ_T is the Thomson cross section, and the maximum τ_N allowable for a given T_*. With magnetic fields synchrotron-Compton process produces so many hard photons that pair creation rate of photon processes should increase. As a result the maximum values of T_* and τ_N decreases and the equilibrium pair density decreases (increases) for the higher (lower) branch solution. It is found that these effects are significant, even if the magnetic energy density is below the equipartition value by several orders of magnitude. (15 refs.)

Unlimited electron acceleration in laser-driven plasma waves .... See Entry 101482

Radiation spectrum of optically thin relativistic electron-positron plasma .... See Entry 104722

52.65 PLASMA SIMULATION

101470 Direct implicit large time-step particle simulation of plasmas. A.B.Langdon, B.I.Cohen, A.Friedman (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
J. Comput. Phys. (USA), vol.51, no.1, p.107-38 (July 1983).
A recently developed implicit method for solving the set of coupled particle and field equations arising in particle-in-cell plasma simulation is described in detail. This implicit integration scheme is motivated by the desire to study efficiently low-frequency, long-wavelength plasma phenomena using a large time step. In particular, this method allows the use of a time step which is larger than the electron plasma period, when electron plasma oscillations are not of interest, and provides selective damping of the distorted remnant of the electron plasma oscillation. The implicit scheme presented here uses particle data directly without introducing fluid moment equations as an intermediary between the field and particle equations. In an electrostatic model, the essence of this scheme is a linearization of the charge density at the advanced time about an explicit approximate density and the computation of the incremental correction to the charge density that is linear in the advanced field. The authors are led to an elliptic field equation whose coefficients depend directly on particle data accumulated on the spatial grid in the form of an effective linear susceptibility. Prediction and iterative refinement of the solution of the implicit equations, and spatial difference representations of the equations are given. Residual restrictions on time step are described. It is demonstrated that convergence is superior when spatial differencing and filtering are done in a consistent manner. (30 refs.)

101471 Computer simulations of the toroidal cusp eriment. S.T.Ratliff, J.M.Dawson (Dept. of Phys., Univ. of California Los Angeles, CA, USA), J.N.Leboeuf, M.Rhodes, N.C.Luhmann,Jr..
Nucl. Fusion (Austria), vol.23, no.8, p.987-1004 (Aug. 19 .
Computer simulations have been performed for the toroi cusp experiment (TCX), a plasma device built and operated at the Unive ty of California, Los Angeles. TCX is a toroidal MacKenzie machine with n external magnetic field provided by 48 magnetic cusps arranged in polo rings. A transformer generates a toroidal electric field which causes a cur t to flow in the plasma. Experimentally, the following parameters are obse d in hydrogen: $n_e = 2 \times 10^{13}$ cm^{-3}, $T_e = 10$-20 eV, $T_i = 40$-110 eV. The to dal current is carried mostly by the ions. A computer model of TCX has en developed, using a two-and-one-half-dimensional electromagnetic particle de. Basically, the simulation results (the electrons are restrained by the agnetic cusp fields, the ions are free to move, there is ion heating, and a atively large fraction of the current is ion current) agree with those of the eriment and are explained by simple physical theoretical arguments. Thes provide the scalings observed in the simulation model. (39 refs.)

Burn performance of deuterium-tritium, deuterium-deuterium, a catalyzed deuterium ICF targets ....See try 99721

A plasma wave accelerator – Surfatron. II ....See ry 99781

Thermal relaxation in a strongly coupled two-temperature plasma ....See En 101389

Effects of internal disruptions on impurity transport in Tokamaks ....See Entr 01395

Two-dimensional numerical simulation of an inductively driven implo g foil plasma ....See Entry 01452

52.70 PLASMA DIAGNOSTIC TECHNIQUES A D INSTRUMENTATION

101472 The influence of the fluctuation amplitude on the probe cha teristic. S.Klagge (Dept. of Phys./Electronics, Ernst-Moritz-Arndt U Greifswald, Greifswald, Germany), M.Maass.
Beitr. Plasma Phys. (Germany), vol.23, no.4, p.355-68 (1983).
The time-averaged probe current is calculated by using a sampling metho for sinusoidal and sawtooth-like oscillations of the space potential. The effec of oscillations on the measured plasma parameters obtained with the aid o the single probe method, double probe method and the method of the second derivative of the probe characteristic is discussed, with the electron saturation current being taken into account. In the ion current the values r_p/λ_D, λ/r_p and M_i characterizing the working regime are varied. The calculated results are checked by corresponding measurements in a beam generated plasma. (22 refs.)

101473 Determination of the quadrupole moment of the electron distribution function in a plasma. S.A.Kazantsev (Inst. of Phys., A.A. Zhdanov Leningrad State Univ., Leningrad, USSR).
JETP Lett. (USA), vol.37, no.3, p.158-60 (5 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.3, p.131-3 (5 Feb. 1983).
The first physical evidence of a quadrupole moment of the electron distribution function in a plasma has been detected: the total angular momenta of the ensemble of excited particles become aligned and give rise to a partial linear polarisation of the spontaneous emission. (5 refs.)

101474 Spectroscopy and diagnostics of highly ionized plasma. K.Mori (Inst. of Phys. & Chem. Res., Wako, Japan), T.Kato.
Oyo Buturi (Japan), vol.52, no.3, p.192-211 (March 1983). In Japanese.
Summarizes recent topics in the spectrometry of highly ionized plasma, in reference to impurity measurements in nuclear fusion reactions, 2s-2p level transition in the $2s^k2p^l$ electron configuration spectrum has been well investigated and has become a powerful tool in examination of plasma. It is often used to measure Doppler temperature, impurity density and electron density of a Tokamak plasma. On the other hand, the attention to phenomena relating to two-electron capture has been given in laser plasma and Tokamak plasma studies. Satellite rays concentrated to a narrow wavelength range appear together with two-electron recombination, and thus are useful for examining the state of plasma. (83 refs.) *K.B.*

101475 Measurement of electron concentration of a weakly ionized glow discharge plasma in nitrogen at intermediate pressures. Yu.B.Golubovskii, V.M.Telezhko.
Opt. & Spectrosc. (USA), vol.54, no.1, p.33-7 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.60-7 (Jan. 1983).
Holographic-interference methods are developed for measuring the temperature field and absolute value of the gas temperature by the method of counting interference fringes traversing the interference field after switching on the discharge. A comparison is made with measurements of the rotational temperature of the $C^3\pi_u$ state of nitrogen. The authors show that information can be obtained concerning the electron component of the plasma. A comparison with experimental results is made on the basis of analyzing the ionization balance. Concrete measurements and calculations are made for a nitrogen discharge at pressures of 20-200 Torr and currents of 25-100 mA. (14 refs.)

101476 Use of Laue-geometry X-ray diffraction in the spectroscopy of laser plasmas. A.Hauer (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
Opt. Lett. (USA), vol.8, no.8, p.434-6 (Aug. 1983).
Laue X-ray crystal diffraction geometry offers a number of advantages for the spectroscopic diagnosis of laser plasmas. Applications of this diffraction configuration, such as absorption spectroscopy, time-resolved spectroscopy, and X-ray polarization measurements, are described. (7 refs.)

101477 Heterodyne detection of lower hybrid waves in a plasma by microwave scattering. Y.Uesugi, T.Itoh, S.Takamura, T.Okuda (Dept. of Electrical Engng., Nagoya Univ., Nagoya, Japan).
Plasma Phys. (GB), vol.25, no.8, p.875-82 (Aug. 1983).
Lower hybrid waves externally excited by a meander-line slow-wave antenna were observed by scattering of 70 GHz microwaves. The spatial distribution and wavenumber spectrum of lower hybrid waves travelling in a linear plasma were obtained. The up-shifted and down-shifted scattering signals from the incident microwave were separately observed by a phase locked heterodyne receiver. These observations make clear not only the magnitude but also the direction of the wavenumber vector. These are consistent with the auxiliary wave measurements using an electrostatic probe. (10 refs.)

101478 Plasma measurements from neutral-beam attenuation. J.H.Foote, A.W.Molvik, W.C.Turner (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.928-34 (Aug. 1983).
Extensive and informative plasma measurements have been made with the intense and energetic neutral-particle beams that are used for fueling and heating magnetically confined, controlled-fusion experimental plasmas. This diagnostic technique does not perturb the plasma because only the unused transmitted fraction of a neutral beam is detected. Orthogonal arrays of highly collimated detectors of the simple secondary-electron-emission type are used in magnetic-mirror experiments to measure neutral-beam attenuation (directly related to the plasma line density) along chords through the plasma volume at different radial and axial positions. Data from these arrays yield radial and axial plasma-density profiles, ion angular distributions at the plasma midplane, estimates of the neutral-beam input power to the plasma, and information on macroscopic plasma motion. Representative results obtained by applying this useful diagnostic technique to the recently completed tandem-mirror experiment TMX are included here. This diagnostic method can also be advantageously applied to other controlled-fusion experiments that use neutral-beam injection. (25 refs.)

101479 Electron temperature measurements using a 12-channel array probe. N.Wild, R.L.Stenzel, W.Gekelman (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.935-9 (Aug. 1983).
The electron temperature in a pulsed high-β ($\beta \equiv 2\mu nkT/B^2 \approx 1$) plasma is studied as a function of time using a miniature array of 12 planar Langmuir probes. Instead of sweeping the bias voltage on the collectors, each is set at a different voltage corresponding to points along the characteristic *I-V* curve. A fast-analog multiplexer, together with a computerized data-acquisition system, allows determination of T_e to within a few percent accuracy, with a time resolution of 1 μs. The probe is used to study temperature fluctuations and heat transport in a plasma current sheet. (8 refs.)

101480 Effect of resonant absorption of laser-induced plasma on temporal resolved spectrum and temporal integrated spectrum. Yu Wenyan, Tan Weihan, Ding Liming, Zhou Fuzheng, Zhang Weiqing, Huang Guanlong, Deng Ximing (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, Shanghai, China).
Sci. Sin. (China), vol.26, no.6, p.666-72 (June 1983).
Plane aluminium targets are irradiated with Nd: glass laser light of 3-6J, 100 ps pulses with a power density of 10^{15} W/cm^2. The authors have measured the resonant absorption curve by means of a box calorimeter, by changing the laser polarization and the light incident angles with respect to the surface. The temporal resolved spectrum and the temporal integrated spectrum of the second harmonics are measured by the temporal resolved spectrometer. The electron temperature is measured from the X-ray spectral lines. The experimental results show that the resonant absorption increases with the incident angles, while the spectral broadening of the second harmonics produced by the *P*-polarization component gets narrower in comparison with that of the *S*-polarization component. (9 refs.)

Local temperature of a plasma corona ....See Entry 101387

The measurement of large-scale density fluctuations in toroidal plasmas from the 'phase scintillation' of a probing electromagnetic wave ....See Entry 101391

Experimental evidence of X-ray line reabsorption in a laser plasma ....See Entry 101400

pectral-line intensities of multiply charged Be-like ions in a high-temperature asma ....See Entry 101402

perimental study of launched ion-acoustic waves in a plasma using continu- wave CO_2 laser scattering ....See Entry 101411

R rn-current heating and implosion of cylindrical CO_2-laser-driven targets ....See Entry 101447

Do e-shell-target implosion by four beams from the GEKKO IV laser system ....See Entry 101448

Deta observation and analysis of radiation from high-density laser-imploded target ....See Entry 101449

Ionizat equilibrium in laser plasma ....See Entry 101451

Laser-in ced fluorescence diagnostics of $CF_4/O_2/H_2$ plasma etching ....See Entry 103367

Time-reso d laser-induced breakdown spectrometry of aerosols ....See Entry 103769

An estimate f the error in the measurement of a constant electric field by the method of a uble Langmuir probe ....See Entry 104584

52.75 PL SMA DEVICES AND APPLICATIONS

(see also 28.5 Fusion reactors, 86.30L Electrogasdynamic and magnetohydro namic conversion; for ion sources, see 29.25 Particle source nd targets)

101481 The fo ation of double-valued sheaths in thermionic converters. L.Lundgren (Res. b. of Electronics, Chalmers Univ. of Technol., Gothenberg, Sweden).
J. Appl. Phys. (USA vol.54, no.8, p.4354-8 (Aug. 1983).
A theory for the sh h in an ignited thermionic converter is presented. The theory includes the fect of the velocity spread of the particles but the charge-particle collisi are neglected. Conditions for the appearance of a virtual emitter are giv The theory is compared with a beam approximation theory and a hydrody mic theory. All three theories give almost the same condition for the appe nce of a virtual emitter in an ignited thermionic converter. (9 refs.)

101482 Unlimited e tron acceleration in laser-driven plasma waves. T.Katsouleas, J.M.Daws (Univ. of California, Los Angeles, CA, USA).
Phys. Rev. Lett. (USA), v 51, no.5, p.392-5 (1 Aug. 1983).
It is shown that the lim tion to the energy gain of $2(\omega/\omega_p)^2mc^2$ of an electron in the laser-plas beat-wave. This accelerates particles parallel to the phase fronts of the acc rating wave which keeps them in phase with it. Arbitrarily large energy is t oretically possible. (9 refs.)

101483 Unsteady phen ena in high-interaction MHD generators. M.Ishikawa (Inst. of Atomic ergy, Kyoto Univ., Kyoto, Japan).
Tech. Rep. Inst. At. Energy oto Univ. (Japan), no.192, p.1-15 (Dec. 1982).
Details of a code which trea unsteady phenomena in MHD generators are described. Governing equation consist of unsteady, one-dimensional Navier Stokes equations, the Maxwe equations, and the generalized Ohm's Law. The usual infinite segmentatio assumption is adopted in the electrical calculations. An artificial viscosity added to maintain the numerical stability. The 1969 MacCormack proced is used to solve the equations. A short

fault of the external load of a subsonic Faraday type MHD generator induces a large pressure overshoot, which propagates upstream to an entrance. An open fault produces a large velocity overshoot and a pressure undershoot. In contrast with the short fault case, the backward wave (*u-a* wave) becomes very weak. The behaviour of a subsonic diagonal type MHD generator is complicated, showing a slow response against the short fault. No backward wave is calculated in the case of supersonic generators. (14 refs.)

Hydrogen recycling processes in plasma device ....See Entry 99723

Geometrical efficiency of the prototype neutral beam injector unit for JT-60 ... .See Entry 99725

A plasma wave accelerator—Surfatron. II ....See Entry 99781

The study of Nd-glass laser radiation influence upon the plasma generated in a plasma-focus device ....See Entry 101430

Computer simulations of the toroidal cusp experiment ....See Entry 101471

Status and perspectives of MHD generators ....See Entry 103707

52.80 ELECTRIC DISCHARGES

(see also 51.50 Electrical phenomena in gases)

101484 Studies of exploding wire. K.Isuzugawa, T.Fujimura (Dept. of Electrical Engng., Osaka Univ., Osaka, Japan).
Bull. Univ. Osaka Prefect. Ser. A (Japan), vol.31, no.2, p.111-16 (1982).
The simulation of the exploding process of copper wire through an impulse current is tried in this paper. The equations of the equivalent circuit for the wire explosion which contains the wire resistance expressed as a function of temperature, are solved numerically, so that the discharging current i and the voltage drop v_r across the wire are obtained. These are compared with the oscillograms observed experimentally, the results of which show the success in the simulation for the duration in which the value of the wire temperature rises from room temperature to the boiling point at atmospheric pressure (2583°C). However, for the temperature region above the boiling point more studies are required. (3 refs.)

101485 Temperature measurement of copper wire in process of the electrical explosion. K.Isuzugawa, T.Fujimura (Dept. of Electrical Engng., Osaka Univ., Osaka, Japan).
Bull. Univ. Osaka Prefect. Ser. A (Japan), vol.31, no.2, p.117-23 (1982).
Deals with radiometric temperature measurements of a copper wire heated be passing of an impulse current. The radiant fluxes from the wire 800 nm, the band width: 10 nm, are detected by a photomultiplier tube, whose outputs are observed with a cathode ray oscillator scope. Copper wire's temperature is calculated from the observed values of the intensities of radiations using Planck's equation, but the effects of temperature on the spectral emissivity are disregarded. The results agree with the values estimated in terms of energies supplied to the wire. (3 refs.)

101486 On the anomaly of the electrical field strength in the magnetized positive column of glow discharges at small currents. H.Deutsch, S.Klagge (Sektion Phys./Elektronik, Ernst-Moritz-Arndt-Univ. Greifswald, Greifswald, Germany).
Beitr. Plasma Phys. (Germany), vol.23, no.4, p.341-54 (1983).
The axial electrical field strength in the positive column of glow discharges at small currents in noble gases passes through a maximum with the increase of an axially directed magnetic field. This maximum is explained of the contrary processes of extension of the radial profiles of the electron energy and the concentration of the metastable atoms on the one hand and the decrease of the ambipolar diffusion losses on the other hand. Using the results of measurements of metastable atom concentrations, the electrical field strength is calculated as a function of magnetical induction with the aid of a set of balance equations. The radial and axial distribution of the electrons is checked by probe measurements. The methods for measuring the concentration of the excited atoms and the electrons are described. (27 refs.)

101487 DC breakdown of ultra-high vacuum gaps. V.A.Nevrovsky, V.I.Rakhovsky, V.G.Zhurbenko (Res. Centre for Surface & Vacuum Investigation, Moscow, USSR).
Beitr. Plasma Phys. (Germany), vol.23, no.4, p.433-58 (1983).
A review of mechanisms of the initiation of vacuum breakdown is presented and role of anode surface contaminations in enhancement of prebreakdown currents and initiation of breakdown is emphasized. The experimental investigation of vacuum breakdown and prebreakdown phenomena is described. The desorption of anode contaminations under electron bombardment to be an essential factor of stimulation of electrical breakdowns. Possible influence of desorbed gases on prebreakdown state of electrodes is analysed. (68 refs.)

101488 Flashover voltage of spacer insulators in a vacuum at 290-6K. J.Wankowicz (Inst. of Fundamental Electrotech. & Electrotechnol., Tech Univ. of Wroclaw, Wroclaw, Poland).
Cryogenics (GB), vol.23, no.9, p.482-6 (Sept. 1983).
The dependence of insulator surface strength on temperature in the range of 290-6K in a vacuum is presented. The insulator surface strength was found to increase in the range of liquid nitrogen and liquid helium temperatures compared with the flashover voltage measurements at ambient temperatures. Complex distributions of flashover voltage were obtained and were plotted on Weibull probability paper. The effect seems to be the result of the increase in insulator temperature near the triple junction. A suitable model of the correlation between the insulator flashover voltage and its temperature was proposed. (14 refs.)

101489 Formation of current of positive leader in air. E.M.Bazelyan.
Power Eng. (J. Acad. Sci. USSR) (USA), vol.20, no.3, p.80-7 (1982). Translation of: *Izv. Akad. Nauk SSSR Energ. & Transp.*, vol.20, no.3, p.82-9 (1982).
Measurements have been made of the charge carried to the cathode by the heads of individual streamers together with their rate of generation in the development of a positive leader in an air gap with nonuniform electric-field distribution. An experimental estimate has been made of the per-unit-length conduction of streamer channels; it has been established that it is of little significance in the formation of the discharge current. Validation has been provided for the hypothesis that the leader current is organized owing to the effect of transportation at electronic speeds of the positive charge at streamer heads. A computational model of the current is proposed; quantitative estimates have been made that are in satisfactory agreement with the experimental data. (9 refs.)

101490 Effect of matrix on the magnetic enhancement of spectral lines in the DC arc. M.A.Eid, A.A.Fakhry, K.M.Elbehery, M.S.Hashem (Dept. of Phys., Nat. Res. Centre, Cairo, Egypt).
Indian J. Pure & Appl. Phys., vol.21, no.5, p.293-7 (May 1983).
Five matrices of different ionization potentials, containing traces of different elements were prepared. The optimal arcing conditions were determined. Application of the magnetic field revealed a relation between the ionization potential of the matrix and the magnetic enhancement factor of spectral lines. Matrices of high ionization potentials caused remarkable magnetic enhancement of the spectral lines, while those having low ionization potentials showed decrease in the intensity of spectral lines on application of the magnetic field to the arc. Moreover, it was found that the changes in the temperature and the electron pressure of the arc plasma, induced by the application of the magnetic field, may be one of the reasons for the magnetic enhancement of spectral lines. (9 refs.)

101491 Time-dependent behavior of high-pressure mercury discharges. H.P.Stormberg, R.Schafer (Philips GmbH Forschungslab. Aachen, Aachen, Germany).
J. Appl. Phys. (USA), vol.54, no.8, p.4338-47 (Aug. 1983).
A numerical model has been developed for studying the time-dependent behavior of cylindrical high-pressure mercury discharges. The model makes it possible to calculate time-dependent plasma parameters such as temperature profiles, arc conductance, etc., for arbitrary supply voltage waveforms and frequencies. The model is based on an expansion of the heat flux potential into a series of Bessel functions of zero order. An analytical approximation for the local net emission has to be provided for the model. It has been evaluated as a function of lamp diameter, mercury pressure, axis temperature, and temperature profile by calculating the radiation transport in the mercury lines. The calculated wall temperature and luminous flux as well as the calculated time-dependent lamp voltage, current, and arc temperature profiles are compared with corresponding measurements. (28 refs.)

101492 Two-temperature modeling of the free-burning, high-intensity arc. K.C.Hsu, E.Pfender (Dept. of Mech. Engng., Univ. of Minnesota, Minneapolis, MN, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4359-66 (Aug. 1983).
In this paper a two-temperature model ($T_e > T_h$) is applied to a free-burning, high-intensity, atmospheric pressure argon arc. With appropriate boundary conditions and nonequilibrium thermodynamic and transport properties, solutions of the conservation equations are obtained for the entire arc, except for the electrode sheath regions. Significant temperature discrepancies between electrons and heavy particles are found in the arc fringes. The elevated electron temperatures in the arc fringes lead to a rearrangement of the current density distribution which, in turn, has some effect on the temperature as well as on the velocity field in the arc core. Comparisons of the results of this study with spectrometric temperature measurements show better agreement than with results based on a one-temperature model. (14 refs.)

101493 Dynamics of long-lived states of strontium atoms and ions in a pulsed discharge in a mixture with helium. E.K.Karabut, V.F.Kravchenko, V.S.Mikhalevskii.
J. Appl. Spectrosc. (USA), vol.37, no.4, p.1123-7 (Oct. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.4, p.564-9 (Oct. 1982).
It is necessary in connection with the investigation of mechanisms for the excitation of the levels of atoms and ions in the plasma of a pulsed discharge and the determination of the optimal conditions for the creation of a population inversion to have as complete a conception as possible about the formation and deactivation processes of long-lived states. The paper is devoted to an investigation of a pulsed discharge plasma in a mixture of strontium vapors with helium. This metal is a typical representative of the group of alkali earth elements whose vapors serve in a mixture with buffer gases as active media both of recombination lasers and of lasers based on self-limiting transition. By virtue of the fact that the structure of the atoms of these elements is identical, data on the processes which occur in an Sr-He plasma can be generalized to the plasma of these elements as a whole. The validity of such a generalization is also confirmed by a comparison of the results of a series of experiments which the authors have performed with Ca and Ba with a pulsed discharge in a mixture of the vapors of these metals with helium. (9 refs.)

101494 Effect of mobilities and electric field on the stability of magnetized positive column.
Plasma Phys. (GB), vol.25, no.8, p.937-42 (Aug. 1983).
The effect of the ratio of the mobilities of electrons and ions and non-dimensional electric field, on the stability of magnetized positive column for all unstable modes is studied in a self-consistent formulation for the perturbations of plasma density and electric potential. The minimum non-dimensional electric field at which magnetized positive column becomes unstable for different ratios of the mobilities of electrons and ions is also investigated. The analysis covers a wider range of modes than done previously. (3 refs.)

101495 Model of optogalvanic effects in the neon positive column. D.K.Doughty, J.E.Lawler (Dept. of Phys., Univ. of Wisconsin, Madison, WI, USA).
Phys. Rev. A (USA), vol.28, no.2, p.773-80 (Aug. 1983).
An experimental and theoretical investigation of the 594.5-nm, optogalvanic effect in the Ne positive column is described. The effect is a decrease in discharge conductance due to laser-induced depletion of metastable atoms. Absolute measurements of the effect per unit of absorbed laser power are reported for a wide range of discharge conditions. Positive-column discharges with radius-pressure products of 0.1-1.0 cm Torr and with sustaining direct currents of 1-16 mA are studied. The effect is modeled in this regime by applying perturbation theory to key rate equations that describe the discharge. The model predictions are in agreement with the experimental measurements. Absolute densities of atoms excited to the $2p^5 3s$ levels are also reported. The regime studied covers the transition from a discharge sustained primarily by single-step electron-impact ionization to a discharge sustained primarily by two-step ionization via the $2p^5 3s$ metastable levels. The global power balance of the discharge is domsinated by wall losses of atom excited to the $2p^5 3s$ levels at all pressures and currents studied. (29 refs.)

101496 Electric arc and its applications. C.Gary.
Rev. Gen. Electr. (France), no.4, p.264-5 (April 1983). In French.
The author indicates the various possible electric arc applications as well as the processes in which it occurs. The author emphasizes the work being done at the universities, whose approach is that of a fundamental viewpoint study permitting a hard and fast description of the arc and increasing our knowledge about this phenomenon. (no refs.)

101497 Studies into the mercury-argon discharge at an elevated supply frequency. Yu.F.Kalyazin, V.M.Milenin, N.A.Tomofeev.
Svetotekhnika (USSR), no.6, p.10-11 (1983). In Russian.
Theoretical and experimental studies of gas discharge plasma (AC, at a higher-than-normal frequency) in a mercury vapour-argon mixture have been carried out. The solution of the balance equations for a positive discharge column permitted the calculation of variations in the instantaneous electrokinetic plasma characteristics (concentration and mean electron energy, strength of the longitude electric field and their time-averaged values) in respect with the current oscillation period. The calculation results are in good agreement with the theory. (2 refs.)

101498 A mechanism of anode initiation of vacuum breakdown. A.S.Dmitriev, O.A.Sinkevich (Energy Inst., Moscow, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.961-3 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.363-6 (Nov. 1982).
The anode mechanism may be due to fast processes that take place in a time shorter than the delay time of the breakdown. One of these processes may be the destruction of local areas of the anode by thermoelastic stresses and by subsequent breakdown which is aided by fragments of the anode material. The authors examine the simplest quantitative theory of this process. The kind of anode-initiated breakdown that they are considering is not an alternative to the thermal-instability mechanism and can act in the initial stages of the latter. Moreover, the investigation of the thermoelastic mechanism of anode destruction is linked to a number of experimental facts that are difficult to explain without invoking this mechanism. Thus, many experiments indicate that there is transport of anode material during the prebreakdown stage. (14 refs.)

101499 Laser spark with a continuous channel in air. F.V.Bunkin, V.V.Korobkin, Yu.A.Kurinyi, L.Ya.Polonskii, L.N.Pyatnitskii (Inst. of High Temperatures, Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.254-5 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.443-4 (Feb. 1983).
Radiation from a neodymium gas laser (with an output power ~1 GW) was focused by an axicon to produce a laser spark with a continuous channel in the atmosphere. The length of the channel reached 11 cm. (6 refs.)

101500 Neutral particle temperature field in cylindrical glow discharge with axial gas flow. R.F.Yunyusov, R.B.Mukhametzyanov.
Sov. Aeronaut. (USA), vol.25, no.2, p.43-8 (1982). Translation of: *Izv. VUZ Aviats. Tekh. (USSR)*, vol.25, no.2, p.40-4 (1982).
The authors solve the energy equation describing the neutral particle temperature field in a glow discharge with axial gas flow and obtain formulas which make it possible to calculate the gas temperature and Nu number as a function of the power deposited in the discharge, gas velocity, wall temperature, channel geometry, initial temperature profile and the gas properties. (7 refs.)

101501 On the metallic phase arc at the break of W-contacts. K.Sawa, K.Noda, T.Murakoshi, K.Miyachi (Faculty of Sci. & Technol., Keio Univ., Yokohama, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part C (Japan), vol.J66C, no.5, p.361-8 (May 1983). In Japanese.
It is found that a metallic phase arc is definitely distinguished by measurement of a spectral-line intensity from metal vapor. By this method, the metallic phase arc is investigated in an inductive circuit and the following are made clear. (1) The relation between metallic phase duration and its termination current is independent of inductance values, and the spectral-line intensity at the metallic phase termination is also a sole function of the metallic phase duration. (2) When peak values of the spectral-line intensity just after the break are the same, even if the circuit currents and inductance values are different, the metallic phase durations become equal. (8 refs.)

Flowing afterglow studies of organic positive ions generated by Penning ionization using metastable argon atoms .... See Entry 100532

Study of $O_2(^1\Delta)$ production in a glow discharge at large molar flow rates .... See Entry 100533

Mechanism of pulse emission from high-pressure electric-discharge He-Ar, He-Kr, and He-Xe infrared lasers .... See Entry 100736

Low temperature operation of an S_2 laser using radio frequency simmer discharges .... See Entry 100817

Influence of plasma-chemical processes of formation of electronegative molecules on the parameters of non-self-sustained discharges .... See Entry 101385

Local temperature of a plasma corona .... See Entry 101387

Electrostatic instabilities in a positive column .... See Entry 101422

Impurity transport and plasma rotation in the ISX-B Tokamak .... See Entry 101457

Measurement of electron concentration of a weakly ionized glow discharge plasma in nitrogen at intermediate pressures .... See Entry 101475

Changes in the chemical reactivity of metals exposed to an inert gas glow discharge .... See Entry 103404

60.00 CONDENSED MATTER: STRUCTURE, THERMAL AND MECHANICAL PROPERTIES

Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS .... See Entry 98627

61.00 STRUCTURE OF LIQUIDS AND SOLIDS; CRYSTALLOGRAPHY

(see also 68.20 Solid surface structure, 71. Electron states)

101502 A possible algorithm for the entropy method of constructing the electron density in a crystal. E.A.Soldatov, E.A.Kuz'min, V.V.Ilyukhin, N.V.Belov (Physicotech. Res. Inst., N.I. Lobachevski State Univ., Gorki, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.904-5 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.388-90 (Nov. 1982).
The authors have previously proposed a new method of constructing the electron density distribution in a crystal on the basis of the Fourier coefficients of this distribution (the structure amplitudes). The method is based on the fact that the electron density at a given point in the crystal is proportional to the probability density for finding an electron at this point. They apply Jaynes' principle for determining the probability-density distribution and thereby the electron-density distribution. (2 refs.)

101503 On the possibility of determining the phases of structure amplitudes by an algebraic method. E.A.Soldadtov, E.A.Kuz'min, V.V.Ilyukhin, N.V.Belov (Physicotech. Res. Inst., N.I. Lobachevski State Univ., Gorki, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.908 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.644-5 (Nov. 1982).
The authors discuss an algebraic method for determining the phases of structural amplitudes and the basis of the existence of a linear relation between individual (normalised) structure amplitudes (squares of their absolute values). Comparing this method with the known statistical methods of determining phases and the tangent formula, they point out that this approach does not involve any probabilities, and this means that the correctness of the phase determination will not be affected (or at least to a much lesser extent and in a different manner) by the pseudosymmetry that reduces to dividing the structure into a substructure and a superstructure. (5 refs.)

61.10 X-RAY DETERMINATION OF STRUCTURES

(see also 61.80 Radiation damage and other irradiation effects; for specific determinations, see 61.55 to 61.80)

Interaction between components of polymer blends by scattering .... See Entry 101529

61.10D Theories of diffraction and scattering

101504 Huang diffuse scattering from interstitials in a general orthorhombic and tetragonal lattice. R.Khanna (Materials Sci. Lab., Reactor Res. Centre, Kalpakkam, India).
Pramana (India), vol.20, no.4, p.267-77 (April 1983).
Using the continuum theory of linear elasticity, Huang diffuse scattering (HDS) has been calculated from self-interstitials in a general orthorhombic and tetragonal lattice. Various defect configurations are represented according to the point group symmetry of the defect site. The contribution to HDS from all possible equivalent orientations (assumed to be equally populated) of the defect configuration is averaged. The limitations of HDS in discriminating between defect configurations having the same long-range symmetry are discussed, considering some special cases. (11 refs.)

101505 Diffuse X-ray scattering near Bragg peaks from point defects in a general lattice. R.Khanna (Materials Sci. Lab., Reactor Res. Centre, Kalpakkam, India).
Pramana (India), vol.20, no.4, p.279-86 (April 1983).
Using the continuum thoery of linear elasticity, diffuse X-ray scattering has been calculated in the immediate neighbourhood of Bragg peaks from point defects in a lattice containing more than one atom in the unit cell. General expressions are obtained for the Debye-Waller factor, Huang diffuse scattering and the asymmetric scattering due to the defect. For lattices with one atom per unit cell, these expressions reduce to the well-known formulae of diffuse scattering. (9 refs.)

61.10F Experimental techniques

(inc. apparatus, techniques and calculation methods for analyzing experimental results; see also 07.85 X-ray, gamma-ray instruments and techniques)

101506 About a feature of X-ray diffraction in imperfect crystals. P.H.Bezirganyan, V.G.Aslanyan (Dept. of Solid State Phys., Erevan State Univ., Grevan, USSR).
Phys. Status Solidi a (Germany), vol.78, no.1, p.157-61 (16 July 1983).
The influence of the surface and of the bulk defects upon the intensity of X-ray scattering is considered. It is shown that in particular cases the deformation of the crystal leads to a more efficient increase of diffracted waves than the attenuation of the waves propagating at an angle different from the strict Bragg angle. (6 refs.)

101507 A generalized probabilistic approach to special Fourier syntheses (β-synthesis). V.I.Bondar', V.G.Rau, V.V.Ilyukhin, N.V.Belov (P.I. Lebedev-Polyanskii State Pedagogical Inst., Vladimir, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.903-4 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.386-8 (Nov. 1982).
A probabilistic approach to the Patterson function was proposed and developed by Ilyukhin (1972) and has been used to appraise the discrimination of key peaks on the diagram of the vector system. The authors consider the technique of a generalized probabilistic treatment, capable not only of giving rough probabilistic characteristics of individual peaks (and even fragments) but also of solving the problem of choosing the method of interpreting a structure from experimental data and determining the possibilities of one or another Patterson or special, modified Fourier synthesis. (5 refs.)

X-ray diamond-anvil press for use at high temperatures .... See Entry 99246

61.12 NEUTRON DETERMINATION OF STRUCTURES

(for specific determinations, see 61.55 to 61.80)

Interaction between components of polymer blends by scattering .... See Entry 101529

Small angle neutron scattering complementing neutron radiography .... See Entry 103486

61.14 ELECTRON DETERMINATION OF STRUCTURES

(for specific determinations, see 61.55 to 61.80)

Scattering electrons in Budapest (and elsewhere) .... See Entry 98714

61.14D Theories of diffraction and scattering

101508 Diffraction contrast from partial dislocations in the two-beam dynamical theory. A.M.Arustamyan (Erevan State Univ., Erevan, USSR), F.N.Chukhovskii.
Phys. Status Solidi a (Germany), vol.78, no.1, p.K35-8 (16 July 1983).
The theory of electron diffraction contrast on the base of the S-matrix theory is extended to the case of the partial dislocation strain field. By definition a

partial dislocation has a stacking fault on one side of it and since the Burgers vector b_P is not a lattice vector, the product $\vec{g}b_P$ is not an integer. For example, in the FCC system $n=\vec{g}b_P$ takes values of 0, ±1/3, ±2/3, ±1, ±4/3, etc. It may be noted for an integer quantity n, that the defect will give an image similar to that produced by a perfect dislocation and the stacking fault on one side of it will be invisible. (7 refs.)

61.16 OTHER DETERMINATION OF STRUCTURES

(for specific determinations, see 61.55 to 61.80)

Scanning tunneling microscopy ....See Entry 99237

61.16D Electron microscopy determinations

101509 **High resolution electron microscopy.** D.J.Smith (High Resolution Electron Microscope, Univ. of Cambridge, Cambridge, England).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.463-77 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The author outlines some of the basic principles of high resolution electron microscopy (HREM), in particular noting some of the restrictions necessarily imposed upon both specimen and microscopist before useful information can be extracted from high-resolution electron micrographs. He summarises applications of the technique, highlighting some areas where the novel information provided by HREM is causing substantial revision of previous ideas about macroscopic properties. Finally, he discusses likely future developments which should broaden the appeal of the technique to any scientist interested in the structure of materials at the atomic level. (57 refs.)

The use of mini-lenses in the transmission electron microscope ....See Entry 99235

Mechanism of contamination build-up induced by fine electron probe irradiation ....See Entry 101801

61.20 CLASSICAL, SEMICLASSICAL, AND QUANTUM THEORIES OF LIQUID STRUCTURE

(for kinetic and transport theory, see 51.10; for electronic states, see 71.; for liquid helium, see 67.)

101510 **Parametrization of the radial distribution function and thermodynamic properties of the restricted primitive model of electrolyte solutions.** J.Sys, S.Labik, A.Malijevsky (Dept. of Phys. Chem., Inst. of Chem. Technol., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.7, p.763-71 (1983).
Monte Carlo simulations for the restricted primitive model of 1-1 aqueous electrolyte solutions were performed on a minicomputer. The calculations covered the concentration range from 0.1 to 3 mol./dm^3 and the ionic diameter varied from 2.0×10^{-10} to 4.75×10^{-10} m. On the basis of the Monte Carlo results a new analytical radial distribution function and excess internal energy parametrization were proposed for the restricted primitive model. (13 refs.)

101511 **Applications of picosecond and sub picosecond spectroscopy.** H.Graener, H.R.Telle, A.Laubereau (Phys. Inst., Univ. Bayreuth, Bayreuth, Germany).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.393-401 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Vibrational relaxation processes have received increasing interest in recent years. With ultrashort light pulses and novel experimental techniques the authors are in the position to study vibrational dynamics in the electronic ground state of simple liquids on the subpicosecond and picosecond time scale. The vibrational population lifetimes of (v=1) and (v=2) levels and the nonexponential dephasing in the subpicosecond time domain are considered. (13 refs.)

101512 **Dielectric friction and energy dissipation in polar fluids.** E.Nowak (Dept. of Chem., MIT, Cambridge, MA, USA).
J. Chem. Phys. (USA), vol.79, no.2, p.976-81 (15 July 1983).
The author considers a continuum model for dielectric friction on charged particles. Approximate results for friction coefficients can be derived in a convenient way by calculating the total energy dissipation in the system. This work is closely related to a theory of Hubbard and Onsager (1977); the author shows that these authors have neglected a contribution to the energy dissipation, which can be incorporated without major difficulties. In addition, he proposes a new type of electrohydrodynamic boundary condition which is a generalisation of the familiar hydrodynamic one. The general results are exemplified by studying simple models for moving or rotating ions and polar molecules. (15 refs.)

101513 **Corrections to the HNC equation for associating electrolytes.** R.Bacquet, P.J.Rossky (Dept. of Chem., Univ. of Texas, Austin, TX, USA).
J. Chem. Phys. (USA), vol.79, no.3, p.1419-26 (1 Aug. 1983).
The accuracy of the HNC approximation and modifications based on a simple approximation for the sum of bridge graphs has been studied for a charged soft sphere model for dilute aqueous 2-2 electrolytes. The accuracy is judged based on extensive Monte Carlo (MC) simulation for three representative concentrations: 0.005, 0.0625, and 0.2 M. The MC simulations find monotonically increasing like-charge correlation functions in agreement with the modified HNC results but in contrast with the HNC prediction of a local maximum at low concentration. Nevertheless, HNC provides the best overall quantitative match with MC except at very low concentration; at 5 mM the modifications are a significant improvement. For unlike charge correlations, there is good agreement among all methods; at the ionic contact peak, however, HNC underestimates the peak height and the modifications provide improved accuracy. (29 refs.)

101514 **Percolation behaviour of permeable and of adhesive spheres.** Y.C.Chiew, E.D.Glandt (Dept. of Chem. Engng., Univ. of Pennsylvania, Philadelphia, PA, USA).
J. Phys. A (GB), vol.16, no.11, p.2599-608 (1 Aug. 1983).
The pair-connectedness function and the average cluster size are determined for two different three-dimensional fluid systems using the Percus-Yevick (PY) approximation (1980). The permeable-sphere model of Blum and Stell (1980) provides a one-parameter bridge from the ideal gas (perfectly penetrable spheres) to the PY hard-sphere fluid. Two of such particles are considered to be 'bound' when their cores overlap. The percolation transition is located as a function of the interpenetrability of the particles, and is found to correspond to an average coordination number $\bar{z}=4$. Baxter's adhesive-sphere model (1968) is also investigated in the PY approximation and it is found that at the percolation transition the average coordination number is 2. The boundary between percolating and non-percolating homogeneous thermodynamic states is determined. (24 refs.)

101515 **Analytic studies of the hard dumbbell fluid. I. A RISA-like approximation.** G.P.Morriss (Res. School of Chem., Australian Nat. Univ., Canberra, Australia), P.T.Cummings.
Mol. Phys. (GB), vol.49, no.5, p.1103-20 (10 Aug. 1983).
A closed form analytic theory for the structure of the hard dumbbell fluid is introduced and evaluated. It is found to be comparable in accuracy to the reference interaction site approximation (RISA) of Chandler and Andersen (1972). (41 refs.)

101516 **The chemical potential in non-ideal liquid mixtures. Computer simulation and theory.** K.S.Shing (Dept. of Chem. Engng., Univ. of Southern California, Los Angeles, CA, USA), K.E.Gubbins.
Mol. Phys. (GB), vol.49, no.5, p.1121-38 (10 Aug. 1983).
The authors report Monte Carlo calculations for two non-ideal binary mixtures of Lennard-Jones fluids *A* and *B*. In the first the molecules have the same diameter but different well depths, $\epsilon_{AA}=2\epsilon_{BB}$. In the second the well depths are the same but the diameters differ, $(\sigma_{AA}/\sigma_{BB})^3=2.144$. The chemical potentials of both components are obtained over the entire range of compositions, using a modified test particle method called *f-g* sampling. The simulation data are used to test a variety of mixture theories based on both the *n*-fluid idea and on a perturbation expansion about a mixture of hard spheres. Of the *n*-fluid theories the van der Waals 1- and 2-fluid theories are best in general. However, none of the *n*-fluid theories give good results when the molecular size ratio parameter $(\sigma_{AB}/\sigma_{BB})^3$ differs from unity by more than about 30 or 40 per cent. When the molecules are appreciably different in size the Leonard-Henderson-Barker (LHB) and Lee-Levesque (LL) forms of hard sphere perturbation theory are both much better than the *n*-fluid theories, with the LL theory in closest agreement with the simulation results. (24 refs.)

101517 **Critical behaviour of monatomic and symmetric charged liquids in approximate theories of structure.** G.Senatore, M.P.Tosi, N.H.March (Theoretical Chem. Dept., Univ. of Oxford, Oxford, England).
Phys. & Chem. Liq. (GB), vol.13, no.1, p.55-64 (1983).
A **k** space analysis of the hypernetted chain (HNC) theory of a monatomic liquid is presented for *d* dimensions. Assuming the existence of a critical point, the total correlation function is shown to have long-range behaviour proportional to $r^{-2d/3}$ for short-range interactions. The case of a symmetric charged liquid is then considered in HNC theory and in another approximate treatment of higher-order correlation functions. The number-number structure factor as $k\rightarrow0$ can diverge in both approximate theories whereas the charge-charge structure factor exhibits Debye-Huckel behaviour. The critical ratio $(pV/RT)(n_c,T_c)$ is reduced from the superposition approximation value of 1/2 in the monatomic fluid, while in the charged fluid the 'correction' to 1/2 involves both number-number and charge-charge correlation functions. (14 refs.)

101518 **Nonequilibrium molecular dynamics via Gauss's principle of least constraint.** D.J.Evans (Res. School of Chem., Australian Nat. Univ., Canberra, Australia), W.G.Hoover, B.H.Failor, B.Moran, A.J.C.Ladd.
Phys. Rev. A (USA), vol.28, no.2, p.1016-21 (Aug. 1983).
Gauss's principle of least constraint is used to develop nonequilibrium molecular-dynamics algorithms for systems subject to constraints. The treatment not only includes 'nonholonomic' constraints—those involving velocities—but it also provides a basis for simulating nonequilibrium steady states. The authors describe two applications of this new use of Gauss's principle. The first of these examples, the isothermal molecular dynamics of a three-particle chain, can be treated analytically. The second, the steady-state diffusion of a Lennard-Jones liquid, near its triple point, is studied numerically. The measured diffusion coefficient agrees with the independent estimates from equilibrium fluctuation theory and from Hamiltonian external fields. (21 refs.)

101519 **Thermodynamics and structure of simple dense fluids.** S.K.Datta (Dept. of Phys., Jalpaiguri Government Engng. Coll., Jalpaiguri, India).
Pramana (India), vol.20, no.4, p.313-25 (April 1983).
The perturbation theory of Weeks, Chandler and Anderson (1971) (WCA) has been employed to calculate the free energy and compressibility factor of simple dense fluids characterised by a double Yukawa potential. The structure factor has been calculated in the random phase approximation together with the WCA prescription for the division of the pair potential. The calculated values are in excellent agreement with experimental results. (12 refs.)

101520 **Perturbation theory for equilibrium properties of a binary mixture of hard discs.** U.N.Singh (Dept. of Phys., RN Coll., Vaishali, India), S.K.Sinha.
Pramana (India), vol.20, no.4, p.327-37 (April 1983).
The radial distribution function (RDF) and thermodynamic properties of a two-dimensional hard-disc mixture are calculated by using the perturbation theory. Numerical results are given for the RDF, pressure and excess-free energy of the binary mixture of both additive and non-additive hard discs. It is found that the thermodynamic properties of the binary mixture of non-additive hard discs increase with Δ, the non-additive parameter. (22 refs.)

101521 **Kinetic description of Debye effect.** A.L.Virovlyanskii, A.N.Malakhov (Gor'ki State Univ., Gor'ki, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.9, p.710-15 (Sept. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.9, p.992-7 (Sept. 1982).
Deals with a flowing solution of a strong electrolyte. A self-consistent electric field is introduced for a description of the interaction of ions (just as in the theory of a collisionless plasma). An equation of kinetics is derived for calculating the electric field and the velocity distribution of ions, as well as their distribution in the coordinate space. This equation is used for describing the Debye effect. (9 refs.)

101522 **Stochastic dynamics of polymers.** W.F.van Gunsteren, H.J.C.Berendsen (Lab. of Phys. Chem., Univ. of Groningen, Groningen, Netherlands).
Physics of Superionic Conductors and Electrode Materials. Proceedings of a NATO Advanced Study Institute on the Physics of Superionics Conductors and Electrode Materials, Odense, Denmark, 4-22 Aug. 1980 (New York, USA: Plenum Press 1983), p.241-56
When simulating a molecular system by the method of stochastic dynamics (SD), less interesting degrees of freedom are ignored and their influence on the other degrees of freedom is approximated by a combination of mean force interactions, stochastic forces and frictional forces. When time and space correlations in the latter are neglected, SD reduces to its simplest form, Brownian dynamics (BD). A BD algorithm is derived and applied to liquid n-butane and n-decane, where one molecule is considered explicitly and the surrounding liquid is modelled stochastically. From a comparison of the results to those of molecular dynamics (MD) simulations of these liquids it is

concluded that the BD model yields a good approximation of the dynamics of n-alkanes in the liquid state. (23 refs.)

Structure and forces in simple liquid metals .... See Entry 101532

Computer simulation of molecular dynamics of anisotropic fluids .... See Entry 101546

Microemulsions and colloids .... See Entry 103593

61.25 STUDIES OF SPECIFIC LIQUID STRUCTURES

(see also 61.40 Amorphous and polymeric materials)

101523 A molecular dynamics simulation of rotational and vibrational relaxation in liquid HCl. D.Levesque, J.-J.Weis (Lab. de Phys. Theorique et Hautes Energies, Univ. de Paris XI, Orsay, France), D.W.Oxtoby.
J. Chem. Phys. (USA), vol.79, no.2, p.917-25 (15 July 1983).
The authors have carried out a molecular dynamics simulation of liquid HCl near its normal boiling point using the C^* potential of Klein and McDonald (1981). A wide variety of equilibrium and dynamical properties have been studied, ranging from partial structure factors to velocity, angular velocity and torque autocorrelation functions. Dipole moment and polarizability tensor correlation functions have been evaluated and compared with experimental data from dielectric relaxation and Raman line shape studies. Vibrational phase relaxation has been simulated; the authors show that HCl is an intermediate case between the rapid modulation and static broadening limits. The question of correlation between rotational and vibrational relaxation is discussed. (37 refs.)

101524 Comparison of simple potential functions for simulating liquid water. W.L.Jorgensen, J.Chandrasekhar, J.D.Madura (Dept. of Chem., Purdue Univ., West Lafayette, IN, USA), R.W.Impey, M.L.Klein.
J. Chem. Phys. (USA), vol.79, no.2, p.926-35 (15 July 1983).
Classical Monte Carlo simulations have been carried out for liquid water in the NPT ensemble at 25°C and 1 atm using six of the simpler intermolecular potential functions for the water dimer: Bernal-Fowler (BF), SPC, ST2, TIPS2, TIP3P, and TIP4P. Comparisons are made with experimental thermodynamic and structural data including the recent neutron diffraction results of Thiessen and Narten (1982). The computed densities and potential energies are in reasonable accord with experiment except for the original BF model, which yields an 18% overestimate of the density and poor structural results. The TIPS2 and TIP4P potentials yield oxygen-oxygen partial structure functions in good agreement with the neutron diffraction results. The accord with the experimental OH and HH partial structure functions is poorer; however, the computed results for these functions are similar for all the potential functions. Consequently, the discrepancy may be due to the correction terms needed in processing the neutron data or to an effect uniformly neglected in the computations. Comparisons are also made for self-diffusion coefficients obtained from molecular dynamics simulations. Overall, the SPC, ST2, TIPS2, and TIP4P models give reasonable structural and thermodynamic descriptions of liquid water and they should be useful in simulations of aqueous solutions. The simplicity of the SPC, TIPS2, and TIP4P functions is also attractive from a computational standpoint. (25 refs.)

101525 Structure and electronic properties of molten $TlAsSe_2$. T.Satow, K.Hoshino, O.Uemura (Dept. of Chem., Yamagata Univ., Yamagata, Japan).
J. Non-Cryst. Solids (Netherlands), vol.57, no.1, p.91-100 (Aug. 1983).
Radial distribution functions of $TlAsSe_2$ in both the amorphous and the liquid states were determined using X-ray and the neutron diffraction techniques. The electrical conductivity, the thermoelectric power and the magnetic susceptibility for liquid $TlAsSe_2$ were also measured over a wide temperature range from the melting point up to about 900°C. Radial distribution analysis suggested that the spiral chains consisting of As and Se atoms in the crystalline $TlAsSe_2$ are still present in both the amorphous and the liquid states. The electronic properties of the liquid $TlAsSe_2$ above 600°C indicate a strong temperature dependence. These experimental results are discussed by the use of the conventional theories often employed in disordered materials. (17 refs.)

101526 Coordination chemistry and ionic solvation in divalent metal halide aqueous solutions. P.V.Giaquinta, M.P.Tosi, N.H.March (Theoretical Chem. Dept., Univ. of Oxford, Oxford, England).
Phys. & Chem. Liq. (GB), vol.13, no.1, p.1-24 (1983).
A useful local picture of structure in divalent metal halide aqueous solutions is obtained from arguments drawn from coordination chemistry. The coordination chemistry of metal ions is examined and the crystal structures of hydrated salts discussed. Finally, the local coordination of metal ions in water is investigated. (36 refs.)

101527 Conformational transition in syndiotactic PMMA. VI. Mono- and dichlorobenzene. I.Katime, P.Gutierrez Cabanas, J.R.Ochoa, M.Garay, C.Ramiro Vera (Dept. de Quimica Fisica, Univ. del Pais Vasco, Bilbao, Spain).
Polymer (GB), vol.24, no.8, p.1015-17 (Aug. 1983).
The authors have studied the thermal behaviour of syndiotactic PMMA in several solvents by viscometry. A conformational change has been found in the temperature range 293-308K. (27 refs.)

101528 Molecular dynamics studies of molten NaI. III. Longitudinal and transverse currents. M.Dixon (Theoretical Phys. Div., AERE, Harwell, England).
Philos. Mag. B (GB), vol.48, no.1, p.13-29 (July 1983).
For pt.II see ibid., vol.47, p.531 (1981). Molecular dynamics simulations of molten NaI have been performed using rigid-ion and polarizable-ion models. The trajectories of the ions have been analysed to give the mass, charge and number currents. The frequency spectra of the current autocorrelation functions have been determined. The inelastic neutron scattering spectrum is reported. (13 refs.)

101529 Interaction between components of polymer blends by scattering. G.Hadziioannou (IBM Res. Labs., San Jose, CA, USA), J.Gilmer, R.S.Stein.
Polym. Bull. (Germany), vol.9, no.12, p.563-9 (May 1983).
The Flory interaction coefficient χ_{AB} of binary polymer blends of high concentration may be determined from the study of light, X-ray, or neutron scattering at $q=0$. Neutron scattering measurements are particularly effective for these measurements since scattering intensity may be enhanced through deuteration of one component. (26 refs.)

101530 Dimensions of poly(styrene) in the vicinity of the theta point. D.Nerger (Inst. fur Makromolekulare Chem. Univ. Freiburg, Freiburg, Germany), M.Eisele, K.Kajiwara.
Polym. Bull. (Germany), vol.10, no.3-4, p.182-6 (July 1983).
The decrease of the mean-square radius of gyration of a high molecular weight polystyrene dissolved in cyclohexane with decrease of temperatures to far below θ was observed by conventional light scattering techniques. The experiments were performed in the region of the coil-globule transition of the polymeric chain. The transition was reversible upon repeated heating and cooling of the sample. Aggregation occured at temperatures below the sharp decrease of the polymer dimensions. (11 refs.)

101531 Solution properties of poly(N-butyl methacrylamide). K.Ulbrich, L.Mrkvickova, M.Bohdanecky (Inst. of Macromolecular Chem., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Polym. Bull. (Germany), vol.10, no.3-4, p.191-5 (July 1983).
Dilute solutions of poly(N-butyl methacrylamide) in methanol, dimethylformamide, and cyclohexanone were investigated by light scattering, osmometry and viscometry. From the intrinsic viscosity data, the characteristic ratio, $C_\infty=9.9$, was estimated. This value is compared with those for other N-substituted polyacrylamides. The authors report on the solution properties of poly(N-butyl methacrylamide) (PBMAm) prepared by radical-initiated polymerization, namely, its solubility, determination of the molecular weight by light scattering and osmometry, correlation of the intrinsic viscosity with the molecular weight, and the configurational characteristics of the chain. (6 refs.)

Raman spectroscopic studies on the dynamics of a molecular 'probe' (methyl iodide) in hydrocarbon solvents .... See Entry 100403

Effects of protonation on the conformational characteristics and geometry of the rod-like benzobisoxazole polymers .... See Entry 100619

Pressure dependence of Newtonian viscosity .... See Entry 101164

Stochastic dynamics of polymers .... See Entry 101522

The structure of liquid crystalline aromatic copolyesters prepared from 4-hydroxybenzoic acid and 2-hydroxy-6-naphthoic acid .... See Entry 101555

Solvent induced crystallization of syndiotactic poly(methyl methacrylate). Relation to the formation of polymer aggregates in solution. [NMR and IR spectra] .... See Entry 101597

Phase transitions in polypeptide liquid crystals: a reentrant isotropic phase .... See Entry 101965

Phase studies of a liquid crystalline polymer: hydroxypropyl cellulose .... See Entry 101970

The calculation of molecular interaction in phosphoryl chloride .... See Entry 102001

Relationship between electrical conductivity, self-diffusion coefficients and ionic composition of alkali metal halide melts .... See Entry 102028

Kinematic viscosity of As_xSe_{1-x} glass forming liquids .... See Entry 102032

Temperature dependence of melt viscosity of polymers .... See Entry 102033

Influence of chain length on conformations of poly(ethylene glycol) chains grafted on silica [ESR observations] .... See Entry 102751

Nuclear magnetic relaxation of solvent nuclei in concentrated aqueous poly(methacrylic acid) solutions .... See Entry 102769

Molecular weight and temperature dependence of self-diffusion coefficients in polyethylene and polystyrene melts investigated using a modified NMR field-gradient technique .... See Entry 102777

Vibrational spectra and structure of stereoregular poly(methyl methacrylates) and of the stereocomplex .... See Entry 102885

EXAFS study of bromomanganate ions in molten salts .... See Entry 102995

Solvent structure effects on electron thermalization ranges in water-alcohol mixed solvents; preferred E_{Amax} values for $e^-{}_s$ in alchols .... See Entry 103541

Light-scattering studies of hydroxyethylcellulose in water/nonionic surfactant binary mixtures. Evidence for preferential solvation of polymer chains by surfactant micelles .... See Entry 103603

61.25M Liquid metals

101532 Structure and forces in simple liquid metals. I.Ebbsjo (Studvsik Sci. Res. Lab., Nykoping, Sweden), G.G.Robinson, N.H.March.
Phys. & Chem. Liq. (GB), vol.13, no.1, p.65-74 (1983).
Investigates the exact force equation for a classical monatomic liquid with pairwise interactions. This is handled by expanding the triplet correlation function $g^{(3)}$ in Legendre polynomials to yield $g'(r)+g(r)[\phi'(r)/k_BT]=(-4\pi\rho/3k_BT)\int s^2\phi'(s)Q_1(r,s)ds$, where $g(r)$ is the radial distribution function, $\phi(r)$ is the pair potential, ρ is the number density, while Q_1 is the $l=1$ term in the Legendre polynomial expansion of $g^{(3)}$. From molecular dynamics data for some simple liquids, the authors have calculated the left-hand-side of the equation. This has been used to draw some conclusions about the usefulness of the Kirkwood superposition approximation in extracting forces from structure. Used in the right way, the Kirkwood approximation yields a quantitative estimate of the three-body term in the force equation for Na, but is much less useful for argon. (12 refs.)

101533 Small *k*-behaviour of the structure factor of simple liquid metals and electron correlations. M.Silbert (Dept. of Phys., Ben Gurion Univ. of the Negev, Beer Sheva, Israel).
Phys. & Chem. Liq. (GB), vol.13, no.1, p.75-80 (1983).
Recent X-ray scattering data provides circumstantial evidence in support of the presence of a linear term in the small *k*-behaviour of the structure factor of simple liquid metals. The analysis of such data requires the liquid to be described as a binary mixture of electrons and ions, in which case qualitative arguments show that electron correlations are responsible for the above behaviour. (17 refs.)

101534 Structure factor of liquid alkali metals. H.B.Singh, A.Holz (Fachrichtung Theoretische Phys., Univ. des Saarlandes, Saarbrucken, Germany).
Phys. Rev. A (USA), vol.28, no.2, p.1108-13 (Aug. 1983).
Liquid alkali metals are treated as a system of charged hard spheres (CHS) in the background of interacting electrons. Such a system of CHS in a uniform background of electrons has been solved exactly by Palmer and Weeks (1973) in a mean spherical approximation. With the use of this model as a reference, the effect of responding electrons is taken into account in a linear-response approximation. The resulting expression for the structure factor involves the CHS diameter as the only free parameter and is very simple to compute. It reduces to the familiar Ashcroft-Lekner model (1966) when the charge on the hard spheres is taken to be zero. The results obtained for the static structure factor of all the alkali metals at different temperatures are in excellent agreement with the experimental data. (30 refs.)

101535 Determination of the pair potential and the ion-electron pseudopotential for aluminum from experimental structure-factor data for liquid aluminum. M.W.C.Dharma-wardana, G.C.Aers (Div. of Phys., Nat. Res. Council, Ottawa, Canada).
Phys. Rev. B (USA), vol.28, no.4, p.1701-10 (15 Aug. 1983).
A method of inverting a given structure factor $[S(k)]_{\text{expt}}$ of a liquid metal using a hypernetted-chain equation containing bridge-diagram contributions is

presented. Starting from a parametrized local pseudopotential and a parametrized model local field (or a theoretical local field), a pair potential is constructed. The $S(k)$ calculated from it is fitted to the given $[S(k)]_{\text{expt}}$. The method is first applied to a molecular-dynamics-generated $S(k)$ derived from an ab initio aluminum, potential and shown to yield the pair potential, the pseudopotential, and the charge density in excellent quantitative agreement with the original ab initio potential and other quantities. The method is then applied to the experimental $S(k)$ of aluminum from X-ray data at 943K. The Al-Al pair potential, Al-electron pseudopotential, and electron charge densities as well as the electron-gas response function (i.e. the model local field) are obtained selfconsistently, to within the accuracy of the experimental data. The calculated electrical resistivity is in excellent agreement with experiment. These investigations provide a comparative examination of the electron-gas local fields of Geldart-Taylor (1970), Vashista-Singwi (1972), Ichimaru-Utsumi (1981), and the density-functional local-density approximation. The hard-sphere parameter defining the bridge term is found to be essentially the same for the different ion-ion potentials determined from all but one of the different local fields, thus supporting the 'universality' hypothesis of Rosenfeld and Ashcroft (1979). (35 refs.)

101536 Stacking density of atoms in liquid metals. A.V.Vasiliadi.
Russ. Metall. (GB), no.4, p.62-3 (1981). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.4, p.71-2 (1981). [received: June 1983]
The values of the coefficient of stacking of atoms in liquid metals, used by a number of authors (0.45-0.48), are too low. It was found that the value is closer to 0.69-0.72. (4 refs.)

Mechanism of structural transformations in liquid metals ..... See Entry 101940

61.30 LIQUID CRYSTALS

(see also 64.70M Transitions in liquid crystals)

101537 Liquids with cubic orientational order—the cholesteric blue phase. S.Shtrikman (Dept. of Electronics, Weizmann Inst. of Sci., Rehovot, Israel).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.695 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Summary form only given. Using Landau theory, the author shows why three-dimensional orientational order emerges. Models are presented of this orientational order for various blue phases and the implication for the selection rules for Bragg reflection discussed. These turn out to be different from the classical crystallographic ones. The physical reason for this difference is explained and the role of polarization emphasized. Some properties of the blue phases, including optical activity, light scattering and phase diagrams in the temperature-chirality plane are discussed and compared with experiment. (no refs.)

101538 Electrohydrodynamic domain patterns in freely suspended layers of nematic liquid crystals with negative dielectric anisotropy. S.Faetti, L.Fronzoni, P.A.Rolla (Istituto di Fisica, Univ. di Pisa, Pisa, Italy).
J. Chem. Phys. (USA), vol.79, no.3, p.1427-33 (1 Aug. 1983).
The electrohydrodynamic domain patterns observed in freely suspended layers of nematic liquid crystals with negative dielectric anisotropy are investigated. Two different domain patterns, in low and high frequency electric fields, occur. Both the director lines and the hydrodynamic flow lines associated with these patterns are investigated in detail. The threshold voltage of the instability is measured as a function of thickness and distance between the electrodes. The experimental results agree with a two-dimensional theoretical approach based on the Carr-Helfrich's model. (29 refs.)

101539 A systematic density functional approach to the mean field theory of smectics. M.D.Lipkin, D.W.Oxtoby (James Franck Inst., Univ. of Chicago, Chicago, IL, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.1939-41 (15 Aug. 1983).
The authors present a systematic density functional approach to the mean field theory of the isotropic-nematic-smectic *A* transition. They show that their theory is a generalization of the McMillan theory of smectics (1971, 1972) and point out that an additional term arises in the free energy which was not present in the earlier work. Their approach provides a starting point for the investigation of chemical effects on liquid crystal phase transitions. (11 refs.)

101540 Small-angle Newton scattering from H_2O/D_2O solutions of a sodium alkylbenzenesulfonate having a branched alkyl group (neutron scattering). R.Triolo (Istituto di Chimica Fisica, Palermo, Italy), J.B.Hayter, L.J.Magid, J.S.Johnson,Jr..
J. Chem. Phys. (USA), vol.79, no.4, p.1977-80 (15 Aug. 1983).
Small-angle neutron scattering results from 0.055 *M* sodium *p*(1-penthylheptyl)benzenesulfonate solutions in D_2O-H_2O solutions of 57% to 100% volume percent D_2O are reported. Strong interaction peaks indicate interparticle ordering. Good fits to the results can be obtained taking account of hard-sphere and electrostatic repulsion with the mean spherical approximation. The model used is a spherical micelle, comprising a hydrocarbon core of 11.9 Å radius surrounded by a shell. The thickness of the shell derived from the results is 8.9 Å, implying a rough micellar surface. The measured geometry and charge are essentially independent of the contrast between the micelles and the solvent. (19 refs.)

101541 Remarks on the flow alignment of disc like nematics. T.Carlsson (Inst. of Theoretical Phys., Chalmers Univ. of Technol., Goteborg, Sweden).
J. Phys. (France), vol.44, no.8, p.909-11 (Aug. 1983).
The nature of the flow alignment of nematic liquid crystals is discussed within the hydrodynamic theory of Leslie, Ericksen and Parodi. It is shown that there is a limited range of angles for which flow alignment can occur. With this as a starting point the flow alignment of disc like nematics is discussed. It is proved that only one out of the two models of flow alignment recently discussed in the literature is consistent with hydrodynamic theory of nematics. (9 refs.)

101542 New contribution to spontaneous polarization of ferroelectric liquid crystals. E.P.Pozhidaev, L.A.Beresnev, L.M.Blinov, S.A.Pikin (Inst. of Crystallography, Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.2, p.88-92 (20 Jan. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.2, p.73-6 (20 Jan. 1983).
Experiments and theory have shown that a new component of spontaneous polarization exists in chiral smectics *C*, proportional to the cube of the angle of inclination of the molecules and characterized by a small relaxation time. (6 refs.)

101543 Stability of filaments of discotic liquid crystals. V.G.Kamenski, E.I.Kats (L.D. Landau Inst. of Theoretical Phys., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.5, p.261-4 (5 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.5, p.221-3 (5 March 1983).
The stability of a cylindrical specimen of a discotic liquid crystal is investigated. The critical value of the radius, beginning at which the cylindrical shape is stable, is found. For smaller radii, the maximum permissible length of the cylinder is determined. (6 refs.)

101544 Principal electro-hydrodynamic instability types in nematic liquid crystals. C.Rymarz.
J. Tech. Phys. (Poland), vol.23, no.2, p.103-10 (1982).
Fundamental problems connected with the study of threshold instabilities in nematic liquid crystals have been discussed briefly in the linear approximation, giving applicability ranges of the results hitherto obtained by disregarding the principle of conservation of moment of momentum. In addition the essential meaning of the simplifications introduced is pointed out, in which wave instability effects are neglected. The necessity of more rigorous application of the theory of equations with periodic coefficients to which reduce problems of alternating current instabilities is also emphasised. It is inferred that the study of instabilities in liquid crystals is very important from the heuristic and practical point of view, bearing in mind the fact that many liquid crystal substances have been detected in living organisms and are used for information displays. (12 refs.)

101545 Surface order in nematics. H.A.Van Sprang (Philips Res. Labs., Eindhoven, Netherlands).
Mol. Cryst. & Liq. Cryst. (GB), vol.97, no.1-4, p.255-61 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
Interfaces have been studied between a liquid crystal and either glass or an evaporated SiO_x (60°) layer. Experimental results are discussed from both residual birefringence measurements in the isotropic phase and studies of the influence on the director of an in-plane magnetic field at the phase transition from isotropic to nematic. These data show that on pyrex an ordered interfacial layer exists while on SiO_x (60°) a multidomain structure is present at the surface. Comparison with literature data from nematic phase experiments shows that additional experiments with the isotropic phase and at the phase transition are vital for an understanding of the interfacial phenomena leading to liquid crystal anchorage. (9 refs.)

101546 Computer simulation of molecular dynamics of anisotropic fluids. D.Decoster, E.Constant (Centre Hyperfrequences et Semiconducteurs, Univ. des Sci. et Tech. de Lille, Villeneuve D'Ascq, France), M.Constant.
Mol. Cryst. & Liq. Cryst. (GB), vol.97, no.1-4, p.263-76 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
Molecular dynamics calculations have been performed for fluid systems containing ellipsoidal particles which interact pair-wise with a modified Lennard-Jones potential. Assuming molecular parameters close to those of the CB7 compound, the authors have calculated both static and dynamic properties such as the internal energy, the entropy and specific heat changes at T_{NI}, the compressibility factor, the temperature dependence of the orientational order parameters, the reorientational angular momentum and velocity time-dependent self-correlation functions, and the diffusion coefficients in both the nematic and isotropic phases. The thermodynamical data show a transition between isotropic and nematic phases and the results obtained are in qualitative agreement with the experimental data. The influence of a decentered dipole along the molecular axis has been studied and partially bilayered smectic phases have been obtained. (22 refs.)

101547 Multiplexible liquid crystalline broad range systems. L.Pohl, B.Scheuble, G.Weber.
Mol. Cryst. & Liq. Cryst. (GB), vol.97, no.1-4, p.277-86 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
A sharp steepness, a low temperature dependence of the threshold, and a fast response time at low temperatures are preconditions for the multiplexibility of liquid crystals suitable for outdoor application. The steepness is efficiently improved if $K_3/K_1 \leq 1$. A temperature independent steepness and threshold can be realized if K_3/K_1 and $\Sigma K_1/\Delta\epsilon$ become constant. Response time is proportional to γ_1/K_1. Since viscous properties change by 1 to 2 of the tenth power more than elastic constants with temperature, a fast response behavior at low temperature is possible only by reducing the temperature dependence of the viscosity. Taking into account these preconditions, it is possible to develop nematic systems multiplexible up to 1:8 from −20°C to +60°C without temperature compensation of the driving voltage or with temperature compensation up to 1:16, having a total response time less than 1 s even below −20°C. (5 refs.)

101548 Thermotropic transition metal complexes discogens and their smectogenic intermediates. A.-M.Godquin-Giroud (Dept. de Recherche Fondamentale, CENG, Grenoble, France), J.Billard.
Mol. Cryst. & Liq. Cryst. (GB), vol.97, no.1-4, p.287-95 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
The series of the first thermotropic transition metal complexes discogens is completed: bis(*p*-*n*-alkylbenzoyl)methanato copper (II) including one derivative possessing two sorts of side chains. The symmetrical and unsymmetrical members of this series exhibit the same very organized discophase. The intermediates for the synthesis, the bis(*p*-*n*-alkylbenzoyl)methanes with two identical or different side chains, containing more than 18 carbon atoms exhibit the same very organized optically biaxial and positive smectic phase. The existence of another smectic phase stable at lower temperatures is established for a symmetrical term of this series. (25 refs.)

101549 Observations of electrically surface-induced regular arrays of focal conics in a homeotropic NPOB smectic A liquid crystal. H.P.Hinov, N.Shonova, K.Avramova (Inst. of Solid State Phys., Sofia, Bulgaria).
Mol. Cryst. & Liq. Cryst. (GB), vol.97, no.1-4, p.297-315 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
Regular arrays of confocal pairs of ellipse-hyperbola with Marignan-Malet-Parodi association were observed in the boundary regions of a smectic A NPOB liquid crystal after cooling of a homeotropic nematic layer subjected to the action of a transversal high-frequency electric field with a sufficient strength. These smectic A textures exist as a storage mode after the removal of the electric field. Their distribution and sizes depend on the surface energy which has been determined to be in the range of 5×10^{-3} erg/cm^2 for a clear or lecithin-coated glass plate. In hybrid-aligned planar-homeotropic smectic A layers under the same conditions simultaneously exist parabolic focals and edge-dislocations near the glass plate where the surface orientation is planar and regular arrays of confocal pairs of ellipse-hyperbola near the glass plate where the surface orientation is homeotropic. The regular arrays of confocal

domains might be used as diffraction gratings whereas the nonregular strong-scattering arrays obtained at lower electric fields might be used in the indicator technique. (37 refs.)

101550 Field-induced order in nematic liquid crystals. P.Palffy-Muhoray (Dept. of Phys., Univ. of British Columbia, Vancouver, BC, Canada), D.A.Dunmur.
Mol. Cryst. & Liq. Cryst. (GB), vol.97, no.1-4, p.337-49 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
The effect of an external magnetic field on the orientational order of a nematic liquid crystal has been examined using both Landau-de Gennes and Maier-Saupe theories. In the Maier-Saupe approach a rotationally invariant form of the pseudo-potential is introduced, which in the absence of an external field leads to three degenerate isomorphic solutions for the order parameter, corresponding to alignment along three principal axes; a similar result is obtainable from the Landau-de Gennes theory. Application of a magnetic field lifts the degeneracy of these solutions, and for materials having a positive diamagnetic susceptibility anisotropy, the uniaxial solution with alignment along the field direction is always energetically favorable. For materials with a negative susceptibility anisotropy, a biaxial solution minimizes the free energy at low temperatures, but on increasing the temperature there is a transition from a biaxial phase to an uniaxial phase. The field dependence of the transition temperatures is evaluated, and for positive materials there is a critical field, corresponding to a second order transition above which the nematic and isotropic phases are indistinguishable. A contrasting behavior is predicted for negative materials, and above a certain critical field the biaxial/uniaxial transition changes from first order to second order. For weakly ordered systems it is shown that the Landau-de Gennes expression for the free energy is identical to that obtained from the Maier-Saupe theory. However, for more ordered systems, the results of the two approaches differ, and in particular the Maier-Saupe theory predicts a susceptibility divergence temperature T^* which increases with applied field. (13 refs.)

101551 Induced smectic mesomorphism in binary mixtures of cholesteryl chloride and 4,4′-diheptyloxyazoxybenzene. K.A.Suresh (Raman Res. Inst., Bangalore, India).
Mol. Cryst. & Liq. Cryst. (GB), vol.97, no.1-4, p.417-21 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
The authors report occurrence in an ‘induced smectic A’ phase in binary mixtures of cholesteryl chloride (ChCl) and 4,4′-diheptyloxyazoxybenzene (HOAB). It is interesting to find that cholesteryl chloride, which is not as strongly polar as cyano- or nitro group containing aromatic nematogens, gives rise to the induced smectic phase. X-ray studies on ChCl, HOAB and their mixtures show that neither the pure compounds nor the mixtures have a bilayer arrangement of molecules. The interesting result is obtained that in a 12 mole pct ChCl in HOAB mixture, which exhibits a twisted smectic C phase and a skew-cybotactic cholesteric phase, the tilt angle varies with temperature, although in the corresponding smectic C and skew-cybotactic nematic phases of pure HOAB, the tilt angle is independent of temperature. (8 refs.)

101552 On the possibility of a smectic-A phase in paraffins. A.Holz (Fachrichtung Theoretische Phys., Univ. des Saarlandes, Saarbrucken, Germany).
Phys. Lett. A (Netherlands), vol 96A, no.9, p.475-9 (1 Aug. 1983).
It is proposed that for paraffins $(CH_2)_N$ and N not too large melting may not lead immediately to an isotropic fluid but first to a layered liquid state with smectic-A properties. (8 refs.)

101553 Relieving cholesteric frustration: the blue phase in a curved space. J.P.Sethna, D.C.Wright, N.D.Mermin (Lab. of Atomic & Solid State Phys., Cornell Univ., Ithaca, NY, USA).
Phys. Rev. Lett. (USA), vol.51, no.6, p.467-70 (8 Aug. 1983).
The problem of minimizing the full cholesteric free energy in flat space is difficult since the bending and bulk energies favor different forms of the order parameter. It is shown, however, that the problem can be solved exactly on the surface of a sphere in four-space, where the curvature relieves the strains induced by the ‘double twist’. The conventional Landau bulk free energy leads to a rigorously uniaxial structure. The model is also of interest as a simple and explicit example of the ideas underlying recent theories of glasses. (20 refs.)

101554 Field-induced first-order orientation transitions in ferroelectric liquid crystals. M.A.Handschy, N.A.Clark (Dept. of Phys., Univ. of Colorado, Boulder, CO, USA), S.T.Lagerwall.
Phys. Rev. Lett. (USA), vol.51, no.6, p.471-4 (8 Aug. 1983).
Two new effects specific to ferroelectric liquid crystals are described: (a) ferroelectric polar surface interactions and (2) spontaneous splay of the polarization. It is shown that a consequence of these effects is the possibility of first-order reorientation transitions induced by applied electric fields. (8 refs.)

101555 The structure of liquid crystalline aromatic copolyesters prepared from 4-hydroxybenzoic acid and 2-hydroxy-6-naphthoic acid. G.A.Gutierrez, R.A.Chivers, J.Blackwell (Dept. of Macromolecular Sci., Case Western Reserve Univ., Cleveland, OH, USA), J.B.Stamatoff, H.Yoon.
Polymer (GB), vol.24, no.8, p.937-43 (Aug. 1983).
X-ray methods have been used to investigate the structure of liquid crystalline copolyesters prepared from 4-hydroxybenzoic acid (HBA) and 2-hydroxy-6-naphthoic acid (HNA). Fibre diagrams and meridional diffractometer scans have been obtained for melt-spun specimens of five HBA/HNA ratios: 25/75, 30/70, 50/50, 58/42 and 75/25. The data indicate a high degree of axial orientation. The lateral packing is more irregular but the observation of some equatorial and off-equatorial Bragg reflections indicates the presence of some three-dimensional order. The patterns differ in the number and position of the meridional maxima, and these can be predicted accurately by a point model for aperiodic chains of totally random sequence. (12 refs.)

Dielectric anisotropy of nematic liquid crystals at centimeter wavelengths .... See Entry 99128

Molecular solutes in nematic liquid crystals: orientational order and electric field gradients .... See Entry 100415

Molecular properties of pentyl-cyano mesogens having different core structures .... See Entry 100597

Analysis of ultrasonic field images obtained in air by means of a liquid-crystal film .... See Entry 100995

Oscillatory and steady convection in a nematic liquid crystal .... See Entry 101215

Anisotropic propagation of ultrasound in the nematic phase of *N-p*-butoxybenzylidene-*p*-butylaniline with varying thermodynamic state parameters .... See Entry 101866

About the phase transition in the smectic A phase of a liquid crystal .... See Entry 101964

Phase transitions in polypeptide liquid crystals: a reentrant isotropic phase .... See Entry 101965

Scaled particle theory of a system of spherocylinders: extension of calculations to high pressures .... See Entry 101967

Nematic-isotropic transition in some lattice models for rigid cores having semiflexible tails: segmental Lennard-Jones interactions .... See Entry 101968

Phase studies of a liquid crystalline polymer: hydroxypropyl cellulose .... See Entry 101970

Density studies in *N*(*p*-*n*-heptyloxy benzylidene)*p*-*n*-butyl aniline across S_G-S_C, S_C-S_A, S_A-N and N-I phases .... See Entry 101971

On the solubilities of pleochroic dyes in liquid crystalline phases .... See Entry 101983

Unusual glassy smectic-G liquid crystal: heat capacity of N-p-n-pentyloxybenzylidene-p′-n-butylaniline between 11 and 393K .... See Entry 101995

Concentration dependence of diffusion in liquid crystals. A new experimental approach .... See Entry 102064

Inter and intramolecular contributions to the proton dipolar and rotating frame spin-lattice relaxation times in the nematic phase of the liquid crystal $5CB$-d_{11} .... See Entry 102771

Acoustooptical effect in a nematic liquid-crystal layer in an ultrasonic field .... See Entry 102852

Raman studies of $\langle P_2\rangle$ and $\langle P_4\rangle$ of some homologous nematic liquid crystals with small optical anisotropy .... See Entry 102876

Light scattering in nematic liquid crystals in non-equilibrium steady states .... See Entry 102899

61.40 AMORPHOUS AND POLYMERIC MATERIALS

(see also 64.70P Glass transitions 81.20P to 81.20T, and 81.60 Materials science)

101556 Amorphous metals: materials and applications. H.Warlimont (Vacuumschmelze GmbH, Hanau, Germany).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.281-91 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
A survey is given of the alloy design criteria, fundamental structure-property relations, present materials and main applications of amorphous metals. (10 refs.)

101557 Radial distribution analysis of amorphous carbon. C.A.Majid (Internat. Centre for Theoretical Phys., Trieste, Italy).
J. Non-Cryst. Solids (Netherlands), vol.57, no.1, p.137-45 (Aug. 1983).
The radial distribution analysis of amorphous carbon obtained from graphite is discussed. The various interatomic distances obtained were 1.44 Å, 2.57 Å and 3.8 Å. The coordination numbers for the first, second and third coordination spheres for this form of amorphous carbon were noted to be 3.15, 10.7 and 16.5 respectively. Values of the interatomic distances and the coordination numbers were found to lie between those for graphite and diamond. (34 refs.)

101558 Charged dangling bonds and crystallization in group IV semiconductors. P.J.Germain, M.A.Paesler, D.E.Sayers (Dept. of Phys., North Carolina State Univ., Raleigh, NC, USA), K.Zellama.
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.135-40
Crystallization of amorphous Ge (or Si) has been studied as a function of temperature and the flux of ionizing radiation (or doping). The crystallization growth rate v_g takes on the form $v_g=v_0 \exp(-E/kT)$ where v_0 is an increasing function of flux (or doping). The authors propose the following to explain these data: A concentration of mobile dangling bonds (DBs) exists in the bulk and near the amorphous-crystalline (a-c) interface. Ionization and doping induce transitions from the uncharged state D^0 to the charged states D^+ and D^-. The process controlling crystallization resulting in the above activation energy is discussed. Only certain sites on the a-side of the a-c interface are available for crystallization, and these sites are those which have captured DBs. The charged D^+ and D^- states have a larger capture cross section than the uncharged D^0 state. Increased concentrations of charged DBs results in an enhancement of the prefactor in the above equation. (22 refs.)

101559 Explosive crystallization in a-Ge and a-Si: a review. D.Bensahel, G.Auvert (CNET-CNS, Meylan, France).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.165-76
Self-sustained or explosive crystallization results on a-Si and a-Ge are reviewed and compared. CW laser experiments on a-Si allow to follow all the phenomena encountered, and to experimentally measure the crystallization front velocity. The published theories agree well with the experimental results on a-Si. Moreover, a-Ge presents the same behaviour as a-Si, but for a-Si, the high nucleation rate can induce a specific explosive growth. (31 refs.)

101560 Amorphous Si, crystallization and melting. J.M.Poate (Bell Labs., Murray Hill, NJ, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.263-71
Recent experiments dealing with the thermodynamics of crystallization and melting of amorphous Si are reviewed. Differential calorimetry measurements give the heat of crystallization of implanted, amorphous Si to be 11.3 ± 8 kJ/mole. Gibbs free energy calculation based on these measurements indicate that amorphous Si melts at a temperature of 1460K compared to the crystalline value of 1685K. Evidence for this reduced melting temperature also comes from rapid heating measurements using (a) structural information after solidification and (b) dynamic conductance measurements during the melt. Solid phase epitaxial regrowth experiments which apparently do not show such a depression in amorphous melting temperature are discussed. (17 refs.)

Structure and electronic properties of molten $TlAsSe_2$ .... See Entry 101525

Survey of the thermodynamics and kinetics of crystallization of Si and Ge .... See Entry 101611

Theory of strongly relaxed defects in crystalline and amorphous oxides .... See Entry 101693

Impurity redistribution in ion implanted Si after picosecond Nd laser pulse irradiation ....See Entry 101741

Amorphous phase trapping as a result of pulsed laser irradiation of silicon ....See Entry 101775

Visualization of temperature profiles in a-Si crystallized in the explosive mode by CW laser ....See Entry 101781

Formation of an amorphous alloy by solid-state reaction of the pure polycrystalline metals ....See Entry 102077

Structure and properties of evaporated amorphous films consisting of transition metal-metalloid alloys ....See Entry 102193

Strength and fracture of amorphous and partially crystallized selenium ....See Entry 103279

61.40D Glasses

101561 On the structure and properties of beryllium fluoride glasses containing CoF_2. W.Vogel, H.Reiss, J.Seifert (Dept. of Chem., Friedrich Schiller Univ. of Jena, Jena, Germany).
Glass Technol. (GB), vol.24, no.3, p.133-8 (June 1983). (Symposium on Halide and other Nonoxide Glasses, Cambridge, England, 23-26 March 1982).
Phase separation effects in binary CoF_2-BeF_2 glasses and ternary NaF-BeF_2-CoF_2 or KF-BeF_2-CoF_2 systems were studied and the distribution of Co ions was determined. The transmission in the visible and infrared region and also the magnetic moment in the temperature range 20-400°C showed that changes of colour are caused by changing absorption bands and not by changing coordination number. (14 refs.)

101562 The influence of fluorine upon the structural, chemical, and physical properties of phosphate glasses. J.J.Videau, J.Portier, B.Tanguy (Lab. de Chimie du Solide, CNRS, Talence, France).
Glass Technol. (GB), vol.24, no.3, p.171-2 (June 1983). (Symposium on Halide and other Nonoxide Glasses, Cambridge, England, 23-26 March 1982).
Owing to increased interest in fluoride and fluorophosphate glasses for their optical properties, it is interesting to understand the role of the fluorine ion when it is introduced into phosphate glasses. One series of fluorophosphate glasses studied were obtained by fluorination of $NaPO_3$ using NH_4HF_2 (I) and the other three were of the systems $NaPO_3$-AlF_3 (II), $NaPO_3$-FeF_3 (III), and $NaPO_3$-CaF_2-AlF_3 (IV). Structural studies were carried out using Raman spectroscopy, electron paramagnetic resonance and Mossbauer measurements. Structural models were proposed on the basis of these results. (6 refs.)

101563 Low temperature properties of metallic glasses. P.Doussineau (Lab. d'Ultrasons, Univ. Pierre et Marie Curie, Paris, France).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.269-79 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The low temperature properties ($T \lesssim 1K$) of metallic glasses are reviewed. They include specific heat, thermal conductivity, acoustic propagation mostly in superconducting glasses. They are well explained by the existence of low-energy excitations in form of tunneling two-level systems. (40 refs.)

101564 Statistical topology of glasses. N.Rivier (Blackett Lab., Imperial Coll., London, England).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.307-13 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The structure and properties of glasses are investigated from a topological viewpoint (the only geometry surviving the absence of metric and the triviality of the space group), with two main results: the overall homogeneity is a gauge symmetry and the only structurally stable constituents (in the elastic continuum limit) are odd lines or 2π-disclinations. The universal properties of glasses are immediate consequences of these results. Their structure corresponds to statistical equilibrium, i.e. to the most probable distribution of their constituents. Odd lines take up a semi-dilute distribution, and ideal space-filling cellular structures obey Lewis's law (1928). (20 refs.)

101565 Structural glasses and $Rb_{1-x}(NH_4)_xH_2PO_4$. E.Courtens (IBM Zurich Res. Lab., Ruschlikon, Switzerland).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.705-20 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Disordered or frustrated cooperative systems pose some major unsolved problems in solid-state physics. In magnetism, frustration can lead to condensation into spin glasses. Structurally frustrated systems are discussed, which lead to what is called by analogy 'structural glasses'. After a brief review of previous work, the author concentrates on the mixed system $Rb_{1-x}(NH_4)_xH_2PO_4$ in which ferroelectric and antiferroelectric tendencies compete. Dielectric, optical, structural, NMR, and thermal data are summarized which indicate a great resemblance to the spin glasses. A new aspect of the structural glasses are the large strictive effects which might help in producing and detecting real glass transitions. (53 refs.)

101566 Density fluctuation in a 'theorist's ideal glass'. Ryong-Joon Roe (Dept. of Materials Sci. & Metall. Engng., Univ. of Cincinnati, Cincinnati, OH, USA).
J. Chem. Phys. (USA), vol.79, no.2, p.936-8 (15 July 1983).
The density fluctuation in glassy materials can be considered to consist of dynamic and quasistatic contributions, the dynamic part being related to the compressibility of the glass determined on the same experimental time scale as the measurement of the density fluctuation. A justification for such an assumption, and a clarification of the meanings of the terms dynamic and quasistatic density fluctuation are obtained through the concept of 'theorist's ideal glass' which was originally described by Edwards for a canonical ensemble but now extended for a grand canonical ensemble. (13 refs.)

101567 Crystallization of the metallic glass $Fe_{80}B_{12}Si_8$. C.F.Chang, J.Marti (Corp. Res. & Dev., Allied Chem. Corp., Morristown, NJ, USA).
J. Mater. Sci. (GB), vol.18, no.8, p.2297-304 (Aug. 1983).
Crystallization of the metallic glass $Fe_{80}B_{12}Si_8$ has been studied by differential scanning calorimetry, X-ray diffraction and transmission electron microscopy. Samples were annealed isothermally for 15 to 1400 min between 633 and 753K. The crystalline phases observed are α(Fe,Si) and Fe_3B in sequence, with dendritic and cylindrical morphology, respectively. The distribution of α(Fe, Si) particles is rather uniform in the bulk but very non-uniform near both surfaces. The growth of these particles obeys a $t^{1/2}$ law and is diffusion controlled. (17 refs.)

101568 Silver sulfide based glasses. I. Glass forming regions, structure and ionic conduction of glasses in Ge_2-Ag_2S and GeS_2-Ag_2S-AgI systems. E.Robinel (Lab. d'Energetique Electrochimique, Saint-Martin d'Heres, France), B.Carette, M.Ribes.
J. Non-Cryst. Solids (Netherlands), vol.57, no.1, p.49-58 (Aug. 1983).
Ag_2S forms with GeS_2 stable glasses over a wide range of compositions (0-55% Ag_2S mol%). In the same system, more complex glasses obtained by dissolving silver iodide have been synthesized with up to 50 mol% AgI. Raman spectra are presented and a vibrational assignment in terms of bridging and nonbridging sulfur has been made. The electrical conductivity of these glasses has been measured over a temperature range (−50△C-+50°C) and for various compositions by the complex impedance diagram method. At 25°C, the coductivity reached a maximum value of $6 \times 10^{-3}\ \Omega^{-1}\ cm^{-1}$. Whatever the glass used, the same limit value of conductivity ($\sigma \simeq 10^{-2}\ \Omega^{-1}\ cm^{-1}$) and activation energy ($E_\sigma \approx 0.25$ eV) are obtained for the highest content of silver iodide. A conduction mechanism is proposed. (20 refs.)

101569 Molecular dynamics studies of the structure and atomic motion of BeF_2 glass. K.Hirao, N.Soga (Dept. of Industrial Chem., Kyoto Univ., Kyoto, Japan).
J. Non-Cryst. Solids (Netherlands), vol.57, no.1, p.109-17 (Aug. 1983).
Molecular dynamics calculations were performed on the glassy state of BeF_2, by assuming a pair potential of the Born-Mayer-Huggins type. From the pair correlation functions for the like- and unlike-charge pairs, the coordination number and the mean near-neighbor distance were obtained and compared with the published data of X-ray diffraction studies. With its use of computer-generated graphics, the characteristics of ionic motions were also examined. (11 refs.)

101570 Study of structural relaxation of $ni_{78}Si_8B_{14}$ metallic glass by electrical resistivity and thermal expansion. T.Komatsu, M.Takeuchi, K.Matusita, R.Yokota (Dept. of Materials Sci. & Technol., Technol. Univ. of Nagaoka, Nagaoka, Japan).
J. Non-Cryst. Solids (Netherlands), vol.57, no.1, p.129-36 (Aug. 1983).
Electrical resistivity and thermal expansion measurements were made to elucidate the structural relaxation of $Ni_{78}Si_8B_{14}$ metallic glass especially, the topological short range ordering. The decrease of resistivity and the increase of its temperature coefficient were observed, and these changes due to the structural relaxation were discussed on the basis of the extended Ziman theory for metallic glasses proposed by Nagel (1977). The densification of about 0.25% and the decrease of 4% in the thermal expansion coefficient were observed in the considerably relaxed sample. The topological short range ordering in $Ni_{78}Si_8B_{14}$ metallic glass occurs rapidly at the annealing temperature above 200°C. (23 refs.)

101571 Calorimetric study of crystalline in $(GeSe_2)_x(GeTe_4)_{1-x}$ glasses. S.Bordas, M.Geli, M.T.Clavaguera-Mora (Facultad de Ciencias, Univ. Autonoma de Barceolona, Barcelona, Spain), N.Clavaguera.
J. Non-Cryst. Solids (Netherlands), vol.57, no.1, p.195-8 (Aug. 1983).
Compositions of general formula $(GeS_2)_x(GeTe_4)_{1-x}$ are easy to obtain as glasses from quenching of the melt. The authors report a calorimetric study of the structural transformations characteristic of the glassy state and on their relation to the equilibrium phase diagram. DSC and DTA analyses were performed using a DSC II Perkin-Elmer and a TA 429 Netzsch Thermal Analyzer, respectively. (5 refs.)

101572 X-ray diffraction study of the structure of silicate glasses. I. Alkali metasilicate glasses. I.Yasui, H.Hasegawa, M.Imaoka (Inst. of Industrial Sci., Univ. of Tokyo, Tokyo, Japan).
Phys. & Chem. Glasses (GB), vol.24, no.3, p.65-71 (June 1983).
As one of a series of studies of silicate glasses, the structures of alkali metasilicate glasses were studied by X-ray diffraction. R_2O-SiO_2 (R=Li, Na, K, Cs) glasses were prepared and radial distribution functions were obtained from the X-ray measurement. Models were constructed and radial distribution functions were calculated by using the pair function method, which makes it possible to minimise the errors of overall analysis. The best models were selected by comparing the agreement between calculated and observed radial distribution functions. The structures of the alkali metasilicate glasses were found to consist of $(SiO_3)0_\infty$ straight chains, and the bending angles of the chains were mainly determined by a geometrical factor, i.e. the sizes of alkali ions and pockets between the chains. These analyses of alkali metasilicate glasses show that the intermediate range structural order (within a few angstroms) is quite high and a single model can explain the observed radial distribution functions. (17 refs.)

101573 X-ray diffraction study of the structure of silicate glasses. II. Alkali disilicate glasses. M.Imaoka, H.Hasegawa, I.Yasui (Inst. of Industrial Sci., Univ. of Tokyo, Tokyo, Japan).
Phys. & Chem. Glasses (GB), vol.24, no.3, p.72-8 (June 1983).
For pt.I see ibid., vol.24, no.3, p.65 (1983). The structures of two disilicate glases, $Na_2O.2SiO_2$ and $Li_2O.K_2O.4SiO_2$, have been determined by the pair function analysis of radial distribution curves obtained from X-ray diffraction data. Their structures are similar to the corresponding crystal structures and consist of sheets containng six-membered rings of SiO_4 tetrahedra. The two alkali ions are situated between the layers and are accommodated in the space formed by nonbridging oxygen atoms belonging to the two layers. In the mixed alkali glass, a bending of the layers makes different sizes of site available for the two types of alkali ion to occupy in accordance with their ionic sizes and this leads to a layer consisting of two types of chain each with one type of alkali ion.These structures are discussed in relation to ionic conductivity and the influence of the mixed alkali effect on ionic conductivity. The structures as described have been found to account successfully for these phenomena. (11 refs.)

101574 Elastic constants and structure of the vitreous system H_2O-P_2O_5. N.D.Patel, B.Bridge, D.N.Waters (Brunel Univ., Uxbridge, England).
Phys. & Chem. Glasses (GB), vol.25, no.5, p.122-9 (Oct. 1983).
The elastic moduli of the entire vitreous range of the system H_2O-P_2O_5 (0 to 50 mol.% H_2O) have been measured and the data used to suggest which of several alternatives (chain, molecular, three dimensional network, etc.) are the most likely structures for this glass system. Details are presented of thermal histories and the conditions required for the preparation of glasses in a form suitable for ultrasonic measurements. Possible methods for the assessment of water content are reviewed. In practice the use of proton nuclear magnetic resonance on solutions of the glasses in high purity deuterium oxide was found to be very successful. The ultrasonic method found suitable for the necessarily rapid yet accurate velocity measurements on these highly hygroscopic glasses is described. (10 refs.)

101575 Atomic structure of SiS_2 and $SiSe_2$ glasses. M.Tenhover, M.A.Hazle, R.K.Grasselli (Sohio Res. Center, Standard Oil Co., Warrensville Heights, OH, USA).
Phys. Rev. Lett. (USA), vol.51, no.5, p.404-6 (1 Aug. 1983).
The first study of the automatic structure of Si chalcogenide glasses is reported. The Raman spectra are remarkably simple and can be understood in terms of the vibrations of a bitetrahedral $Si_2(X_{1/2})_8$ (X=S,Se) unit. The

present results represent the most compelling evidence for medium-range order and a molecular-cluster description of a compound amorphous semiconductor. (9 refs.)

101576 On the annealing behaviour and crystallization of the amorphous alloy $Fe_{40}Ni_{40}P_{14}B_6$. R.Hohne, H.Borner, M.Krotzsch (Sektion Phys., Karl-Marx-Univ. Leipzig, Leipzig, Germany).
Phys. Status Solidi a (Germany), vol.78, no.1, p.211-16 (16 July 1983).
Samples of the amorphous system $Fe_{40}Ni_{40}P_{14}B_6$ are investigated in the as-quenched state as well as after heat treatments in the temperature range between 23 and 525°C. It is shown that the measurement of the field dependence of the damping of free torsional vibrations of a sample in a homogeneous magnetic field is a very sensitive method, yielding information about the quality of the amorphous alloys with respect to the existence of a second ferro- or ferrimagnetic phase or of crystalline grains, and the beginning of crystallization. By means of magnetic measurements and differential thermal analysis the existence of a second phase in the samples used could be detected. Both phases participate in the crystallization process. (14 refs.)

101577 Theory of doping in chalcogenide glasses. P.Nagy (Inst. of Phys., Acad. of Sci., Bratislava, Czechoslovakia).
Philos. Mag. B (GB), vol.48, no.1, p.47-54 (July 1983).
The concentration dependence of the Fermi energy and related quantities is investigated theoretically. Owing to the finite width of the gap states the Fermi energy changes relatively slowly with increasing concentration of ionized impurities. Acceptor-and donor-like impurities are found to alter the Fermi energy and the conductivity in different ways. (16 refs.)

101578 Theory of formation of metallic glasses. II. J.Hafner (Inst. fur Theoretische Phys., Tech. Univ. Wien, Wien, Austria).
Phys. Rev. B (USA), vol.28, no.4, p.1734-9 (15 Aug. 1983).
For pt.I see ibid., vol.21, no.2, p.406 (1980). Low-temperature limits for the metastability of the supercooled liquid state are derived from a thermodynamic perturbation calculation. Together with a previously published calculation of the energetics of solid and liquid alloy phases, this allows for an ab initio determination of the glass-forming ability of metallic alloys. (24 refs.)

101579 Preparation of fluoride glasses based on heavy metals. Optical transmission studies. G.Fonteneau, A.El Houari, J.Lucas (Univ. de Rennes-Beaulieu, Rennes, France).
Rev. Chim. Miner. (France), vol.20, no.3, p.321-8 (1983). In French.
Multicomponent glasses based on Th:Ba fluorides have been prepared in the quaternary system BaF_2-ThF_4-YF_3-ZnF_2. Their stabilization has been studied versus the percentage of BaF_2. These materials exhibit a very broad transmission plateau ranging from 0.3 μm to 8 μm. Very low intrinsic absorption values $\simeq 10^{-8}$ cm^{-1} are to be expected in the 3-4 μm region. (10 refs.)

101580 Disorderly crystal structures in transition metal rich-metalloid alloys: implications for glass formation. R.E.Watson (Phys. Dept., Brookhaven Nat. Lab., Upton, NY, USA), L.H.Bennett.
Scr. Metall. (USA), vol.17, no.7, p.827-32 (July 1983).
Easy glass formation usually occurs near eutectics where the glass forming temperature is close to the melting point. Glass formation is favored when the crystal structure(s) of the compounds are complicated. The purpose of the authors is to see what transition metal rich-metalloid compounds have complicated structures and what implications this might have for glass formation. (14 refs.)

101581 Correspondence between the results of structural and thermodynamic studies of vitreous silica. S.V.Nemilov (S.I. Vavilov State Optical Inst., Leningrad, USSR).
Sov. J. Glass Phys. & Chem. (USA), vol.8, no.4, p.255-62 (July-Aug. 1982). Translation of: *Fiz. & Khim. Stekla (USSR)*, vol.8, no.4, p.385-94 (July-Aug. 1982). [received: May 1983]
A general expression for the excess energy of vitreous silica relative to α-quartz has been obtained in the simplest approximation of the force field of the valence bonds. The excess energy is calculated on the basis of the distribution functions of the Si-O-Si valence angles found from the X-ray structural data, the most probable values of the Si-O distance, and the elastic deformation constant of the Si-O-Si angle determined from the Raman spectra. Using the published structural data, this energy is 1665 ± 700 cal/mole SiO_2 and in principle is in agreement with the value of the excess internal energy from the thermodynamic calculation (1720 ± 120 cal/mole SiO_2). The correspondence among the thermodynamic, X-ray structural, and spectroscopic results of the study of vitreous silica is shown. (17 refs.)

101582 Properties and structure of glasses in the SiO_2-TiO_2 system. G.A.Pavlova (State Sci.-Res. Inst. of Vitreous Silica, Leningrad, USSR).
Sov. J. Glass Phys. & Chem. (USA), vol.8, no.4, p.263-72 (July-Aug. 1982). Translation of: *Fiz. & Khim. Stekla (USSR)*, vol.8, no.4, p.395-405 (July-Aug. 1982). [received: May 1983]
It has been found that direct structural methods can be used to establish the fourfold coordination of Ti ions in binary titanosilicate glasses with the presence of predominant Ti-O-Si bonds. With an increase in the concentration of TiO_2 in the glasses there is a decrease in the charge density and an increase in the degree of hybridization of the wave functions of titanium and oxygen. The data on the change in the various physicochemical properties as a function of the concentration of TiO_2 and with a change in temperature are in good agreement with these structural features of titanosilicate glasses. When the concentration of TiO_2 is increased above 12 mass% in the glasses Ti-O-Ti bonds appear; this corresponds to the boundary of metastable liquid-phase separation and is accompanied by an inflection on the composition-property curves for a series of properties. This particular collection of the properties of titanosilicate glasses indicates their promise as exploitable materials. (69 refs.)

101583 ESR study of the change in the local structure of As_2Se_3 caused by the action of high pressure and by annealing. E.A.Zhilinskaya, V.N.Lazukin, I.V.Chepeleva, V.A.Shanditsev (Sci.-Res. Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
Sov. J. Glass Phys. & Chem. (USA), vol.8, no.4, p.273-7 (July-Aug. 1982). Translation of: *Fiz. & Khim. Stekla (USSR)*, vol.8, no.4, p.406-11 (July-Aug. 1982). [received: May 1983]
Residual local changes in glassy As_2Se_3 treated at a high pressure of 77 kbar have been observed. The high-pressure treatment of glassy As_2Se_3 containing impurity Cr leads to an increase in the splitting of the Cr^{3+}-ion levels in zero magnetic field as a result of the reduction in the distance between the Cr^{3+} ions and their surrounding ligands. The total elimination of the changes in the local structure caused by the high pressure is only possible as a result of annealing at temperatures close to T_g. (14 refs.)

101584 Phase changes in copper halide photochromic glasses. V.V.Golubkov, V.A.Tsekhomskii (I.V. Grebenshchikov Inst. of Silicate Chem., Acad. of Sci., USSR).
Sov. J. Glass Phys. & Chem. (USA), vol.8, no.4, p.280-4 (July-Aug. 1982). Translation of: *Fiz. & Khim. Stekla (USSR)*, vol.8, no.4, p.416-21 (July-Aug. 1982). [received: May 1983]
Using an SAS method the melting and crystallization temperatures of the light-sensitive phase of copper halide photochromic glasses have been determined. A temperature region where supercooling of the copper halide phase occurs and the dependence of the melting and crystallization temperatures of the regions of nonuniformity (microcrystals) on their size have been observed. Other components, obviously NaCl, are included in the composition of the light-sensitive phase as well as CuCl. (6 refs.)

101585 Effect of the third component on the technical and elastic properties of phosphorus-containing glasses. G.M.Orlova (A.A. Zhdanov Leningrad State Univ., Leningrad, USSR).
Sov. J. Glass Phys. & Chem. (USA), vol.8, no.4, p.296-9 (July-Aug. 1982). Translation of: *Fiz. & Khim. Stekla (USSR)*, vol.8, no.4, p.435-8 (July-Aug. 1982). [received: May 1983]
The effect of Tl, Ge, and Te on the thermal and elastic properties of phosphorus selenide glass has been studied. The addition of the third component helps to strengthen the framework of the phosphorus selenide glass, to increase the values of the activation energy of viscous flow and the ultrasonic propagation velocity and to reduce the adiabatic compressibility and lower the thermal-expansion coefficient. The interconnection between the character of the change in the concentration dependence of the thermal and elastic properties and the structure-chemical composition of the experimental glasses has been considered. (12 refs.)

101586 Effect of water on the crystallization of Li_2O-SiO_2 glasses and gels. Z.J.Huang, T.Yoko, K.Kamiya, S.Sakka (Dept. of Industrial Chem., Faculty of Engng., Mie Univ., Tsu-shi, Japan).
Yogyo-Kyokai-Shi (Japan), vol.91, no.5, p.215-21 (1983). In Japanese.
The crystallization process of Li_2O-SiO_2 glass and lithium silicate gel powders has been investigated by means of differential thermal analysis, X-ray diffraction and infrared spectroscopy. The former was prepared by melting and contained 0.004~0.177 wt.% water and the latter, by hydrolyzing metal alkoxide solutions. It is found that with increasing water content in the glass, the glass transition temperature and the rate of nucleation decrease, whereas the rate of crystal growth increases. It is also found that gels prepared from a metal alkoxide solution show a crystallization process different from glasses prepared by the conventional melting method; the crystalline phase precipitated from the former is metastable lithium metasilicate Li_2SiO_3 and that precipitated from the latter is stable lithium disilicate $Li_2Si_2O_5$. The glass prepared by melting the gel shows a crystallization process similar to glasses prepared by melting crystalline powders when their water contents are similar. (24 refs.)

101587 Thermal cycling and amorphous-crystalline transition in the amorphous Cu_{60}-Zr_{40} alloy system. M.A.Otooni (US Army Armament Res. & Dev. Command Dover, NJ, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.277-82
The transition behavior of the amorphous $Cu_{60}Zr_{40}$ alloy system during its transition to crystallinity by thermal cycling has been studied. A differential scanning calorimeter was used to record, in situ, the onset of thermal evolution of the sample during the course of transition. Analysis of DSC tracings reveal that transition occurs at a lower temperature than those transformed without thermal cycling. The amplitude of the exothermic rise decreases proportionally with increasing numbers of the thermal cycles. Details of the profile of the DSC tracing, i.e. the width of the exothermic rise and the presence of the secondary exotherm, are quite different from those transformed without thermal cycling. Preliminary high resolution electron microscopy of thermal cycled samples indicate random distribution of copper-rich precipitates at the early stages of cycling and their coalescence during the final stage of crystallization. For large number of cycles, however, the induced strains from thermal cycles contributes to the image contrast of the quenched solid thus allowing the assessment of the proposed atomic level stresses and strains, via technique of high resolution electron microscopy. (no refs.)

101588 Hydrogen solubility in $Pd_{100-x}Si_x$ metallic glasses and the phase diagram of Pd-Si-H glasses. R.S.Finocchiaro, C.L.Tsai, B.C.Giessen (Dept. of Chem., Northeastern Univ., Boston, MA, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.283-7
The hydrogen solubility of glassy $Pd_{100-x}Si_x$ alloys with $14 \leq x \leq 22$ has been measured in the temperature range of 10°C to 90°C and the hydrogen partial pressure range of 0 to 100 torr. The absorption of hydrogen in these glassy alloys is exothermic and Sieverts' law is not observed. An isothermal-isobaric ternary phase diagram showing the change of hydrogen solubility with silicon concentration is given. A preliminary analysis suggests that the hydrogen solubility is related to the atomic structure of the metallic glasses. (10 refs.)

101589 Metallic glass formation diagrams. B.C.Giessen, S.H.Whang (Dept. of Chem., Northeastern Univ., Boston, MA, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.289-94
The ability to predict ready glass formation (RGF) in binary alloy systems upon rapid cooling of the melt is of value both theoretically and practically. Two-dimensional maps show promise as a means of associating RGF with two system parameters which must have a combination of favorable values. Two types of glass formation diagrams are reviewed. One of these, the ΔH-r/R plot, is based on fundamental parameters which can, in principle, be derived from elemental quantities for each binary alloy system. The second type of diagram, the temperature-composition map, uses two equilibrium phase diagram features, namely reduced liquidus temperatures and reduced eutectic compositions to predict RGF. Both approaches are compared for binary alloys of Zr. The temperature-composition plot approach can be extended to predict qualitatively the RGF composition range of a given alloy system. (19 refs.)

Preparation of new fluoride glasses in ZrF_4-BaF_2-TlF system .... See Entry 100868

Amorphous metals: materials and applications .... See Entry 101556

Entropy of glassy and crystalline lithium acetate in relation to the Kauzmann paradox .... See Entry 102010

Connection between the excess thermodynamic functions of glassy As_2S_3 and As_2Se_3 at absolute zero and their structural features .... See Entry 102011

Surface compositional studies of heat reduced lead silicate glass .... See Entry 102130

X-ray spectral study of the surface of flat glass .... See Entry 102140

Small-angle neutron scattering study of anisotropic growth morphology and irreversible photodensification in *a*-$GeSe_3$ films ....See Entry 102204

Thermal conductivity of amorphous iron alloys at low temperatures ....See Entry 102346

Transport studies of S-Se amorphous semiconductors .... See Entry 102384

Magnetic resonance of the B_2O_3-Na_2O-MoO_3 vitreous system ....See Entry 102740

Observation of the methyl radical CH_3 in irradiated, high-purity synthetic fused silica ....See Entry 102750

Mossbauer and DTA studies of the crystallisation of borosilicate glasses ....See Entry 102789

IR-spectral study of vanadate vitreous systems .... See Entry 102871

X-ray diffraction analysis at high temperature on two ceramic systems ....See Entry 103141

The effect of Mo^{5+} ions (in the presence of Mo^{6+} ions) on the elastic moduli of molybdenum phosphate glasses ....See Entry 103195

Elastic properties of nongradient glasses and glasses synthesized by ion-exchange diffusion above and below the glass-transition temperature ....See Entry 103204

Properties of $Na_2O.3SiO_2$ glasses impregnated with ethyl alcohol ....See Entry 103280

The influence of structure on the corrosion of glassy copper-zirconium alloys ....See Entry 103371

61.40K Polymers, elastomers, and plastics

101590 Metal doped fluorocarbon polymer films prepared by plasma polymerisation using an RF planar magnetron target. H.Biederman, L.Holland (Lab. for Plasma Materials Processing, School of Math. & Phys. Sci., Univ. of Sussex, Brighton, England).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.497-503 (1 July 1983).
Fluorocarbon films have been prepared by plasma polymerisation of CF_4 using an RF planar magnetron with an aluminium target. More than one order of magnitude higher deposition rate has been achieved in comparison with an RF diode system operated under similar conditions of monomer pressure and flow rate and power input. A glow discharge in a CF_4[25%]-argon [75%] mixture was used to incorporate aluminium from a target electrode into the polymer films. The foregoing mixture and another based on CF_4 [87%]-argon [13%] were used in the RF discharge with a copper target. Some experiments with a gold target and pure CF_4 as the inlet gas were also made. The film structure was examined by [SEM] and [TEM] and characteristic micrographs are presented. The composition of the films was estimated from an AES study. The sheet resistivity of the metal/polymer film complexes was determined. (17 refs.)

101591 Polymer glasses: defects and plasticity on a molecular scale. B.Escaig (Lab. des Structures et Proprietes de l'Etat Solide, Univ. de Lille I, Villeneuve d'Ascq, France).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.293-305 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Discusses models of nonelastic deformation in glassy polymers. The physics of local defects in the chain arrangement is described together with predictions about flow parameters. It is shown that flow kinetics data give strong support to a localised dislocation loop mechanism as a realistic model to account for the mechanical behaviour of thermoplastics and thermoset resins. (22 refs.)

101592 Polymer physics: organization of macromolecules in the solid state. A.Keller (H.H. Wills Phys. Lab., Univ. of Bristol, Bristol, England).
Phys. Bl. (Germany), vol.39, no.7, p.178-80 (July 1983). In German.
The author provides a general introduction to polymer science with particular reference to the role of physics, aimed to give the background to those for whom the whole subject is an unfamiliar area. The second part deals with the states of organization in solid macromolecules. (no refs.)

101593 An application of Monte Carlo method to simulate disorders in polymer crystals. T.Yamamoto (Dept. of Phys., Yamaguchi Univ., Yamaguchi, Japan).
Polymer (GB), vol.24, no.8, p.943-8 (Aug. 1983).
The Monte Carlo method is applied to polymer crystals of idealized linear chain molecules of 30 carbon atoms, and the unharmonic, large-amplitude, oscillations and the subsequent conformational disorders of the chains are investigated. A crystalline field that confines the chain is treated by the molecular field approximation, and assumed to be cylindrical. A production type simulation is adopted taking into account rigorous statistical weights for each sample conformation. Both the rotational isomeric model and the continuous rotation model of chain conformation are considered. By averaging over 10^4-8×10^4 chains, mean-square end-to-end distance, fractions of gauche and trans states and a detailed distribution of internal rotation angle are obtained. (8 refs.)

101594 The morphology of poly(aryl-ether-ether-ketone). D.J.Blundell, B.N.Osborn (Petrochem. and Plastic Div., Imperial Chem. Industries plc, Cleveland, England).
Polymer (GB), vol.24, no.8, p.953-8 (Aug. 1983).
The morphology and related properties are described for the aromatic thermoplastic poly(aryl-ether-ether-ketone) (PEEK) $[C_6H_4\text{-}O\text{-}C_6H_4\text{-}O\text{-}C_6H_4\text{-}CO]_n$. Topics covered include crystallinity, crystallization and melting behaviour, lamellar thickness and spherulitic structure. The data are used to derive the following material parameters T_m=395°C, σ_e=49 erg cm^{-2}, σ_s=38 erg cm^{-} and ΔH_F=130 kJ kg^{-1}. PEEK is closely analogous to poly(ethylene terephthalate) in its crystallization behaviour except that the main transitions occur about 75°C higher. (8 refs.)

101595 The structure and elasticity of polyurethane networks. I. Model networks of poly(oxypropylene) triols and diisocyanate. M.Ilavsky, K.Dusek (Inst. of Macromolecular Chem., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Polymer (GB), vol.24, no.8, p.981-90 (Aug. 1983).
The equilibrium mechanical and optical behaviour of networks prepared from poly(oxypropylene) triols (PPT) and 4,4′-diphenylmethane diisocyanate (MDI) at various initial molar ratios of reactive groups, r_H=[OH]/[NCO], in the range $0.6<r_H<1.75$ have been investigated. A comparison between experimental and theoretical (based on the theory of branching processes) dependences of the equilibrium modulus, G_e, on r_H or on the sol content, w_s, led to the following conclusions: In the range $r_H\geq1$ the theory adequately describes experimental dependences, while in the range $r_H<1$ excess crosslinking takes place. In PPT networks with a higher molecular weight (M_n=2630), G_e is about twice the theoretical value for the front factor A=1. The difference between the experimental and theoretical moduli for A=1/3 may be adequately described by using W. Langley's concept (1968) of trapped entanglement contribution. (39 refs.)

101596 Influence of molar mass and catalysts on the kinetics of crystallization and on the orientation of poly(ethylene terephthalate). B.Gumther, H.G.Zachmann (Abteilung Angewandte Chem., Univ. Hamburg, Hamburg, Germany).
Polymer (GB), vol.24, no.8, p.1008-14 (Aug. 1983).
Poly(ethylene terephthalate) with different molar masses and different catalysts and additives (calcium acetate, manganese acetate, triphenylphosphate) was synthesized. The influence of the molar mass distribution, and of the additives used, on the rate of crystallization was studied. Also the dependence of the orientation obtained during drawing at elevated temperatures on the drawing conditions, on the average molar mass, and on the additives was investigated. It is shown that, under the same drawing conditions, an increase in molar mass leads to greater orientation. Also, at very small draw rates the orientation in the samples containing calcium acetate is greater than in those containing manganese acetate. (16 refs.)

101597 Solvent induced crystallization of syndiotactic poly(methyl methacrylate). Relation to the formation of polymer aggregates in solution. [NMR and IR spectra]. J.Spevacek, B.Schneider, J.Baldrian, J.Dybal, J.Stokr (Inst. of Macromolecular Chem., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Polym. Bull. (Germany), vol.9, no.10-11, p.495-501 (April 1983).
Solutions of syndiotactic (s) poly(methyl methacrylate) (PMMA) and samples of solid s-PMMA prepared from these solutions were studied by NMR and infrared (IR) spectroscopy and by wide-angle X-ray scattering (WAXS). IR spectra of s-PMMA films obtained from o-dichlorobenzene solutions by evaporation of solvent at room temperature have shown that the ordering of polymer chains which exists in aggregates of s-PMMA in o-dichlorobenzene is preserved in the solid state. s-PMMA prepared in this way is characterized as partly crystalline by WAXS. When o-dichlorobenzene is evaporated at elevated temperatures at which the aggregates of s-PMMA are decomposed, or if solid s-PMMA is obtained from solutions in which aggregation does not take place, the obtained solid polymer is amorphous. (10 refs.)

101598 Evidence of strain-induced phase separation in isopropyl azodicarboxylate modified polybutadiene. G.R.Hamed (Inst. of Polymer Sci., Univ. of Akron, Akron, OH, USA), C.-H.Shieh, D.N.Schulz.
Polym. Bull. (Germany), vol.9, no.10-11, p.525-32 (April 1983).
Polybutadiene (BR) has been modified by reaction with isopropyl azodicarboxylate (IAD). The reaction is quite efficient—resulting in a structure in which there are pendant hydrazoester groups dangling from the BR backbone. The cohesive strength and autohesion of BR are increased by the IAD modification. It is proposed that this polymer is capable of strain-induced phase separation (a mechanism of self-reinforcement). Evidence for this is the appearance of a new strain-induced thermal transition in the DSC scan of this material. (9 refs.)

101599 The rate of crystallization of poly(ethylene terephthalate) by differential scanning calorimetry. C.C.Lin (Dept. of Chem. Engng., New Jersey Inst. of Technol., Newark, NJ, USA).
Polym. Eng. & Sci. (USA), vol.23, no.3, p.113-16 (Feb. 1983). [received: July 1983]
The value of t_{max} in differential scanning calorimetry is correlated with the crystallization kinetics of poly(ethylene terephthalate) (PET). The Avrami exponent, n, obtained varies as a result of a change in slope of the curve at the point t_n, a secondary crystallization transition. The plot of t_n vs. t_{max} shows a linear relationship. The rate of crystallization depends upon both molecular weight and crystallization temperature. Under a nucleation controlling step, the plot of log t_{max} vs. $1/T^2\Delta T$ gives a linear relationship. Theoretical concepts of the treatments are discussed. (9 refs.)

101600 Physical properties of high-pressure ethylene vinylacetate copolymers and their saponified derivatives. R.J.Koopmans, R.Van Der Linden, E.F.Vansant (Dept. of Chem., Univ. of Antwerp, Wilrijk, Belgium).
Polym. Eng. & Sci. (USA), vol.23, no.6, p.306-17 (April 1983).
The physical properties of high-pressure ethylene vinylacetate (EVA) copolymers having an average melt index of 8.5 g/10 min and a mol.% of VA less than 20 are studied. A comparison is made with the properties of their saponified derivatives, the ethylene vinylalcohol (EVAl) co- and ethylene vinylalcohol vinylacetate (EVAlVA) terpolymers. A melt-index effect is noted. Density, thermal, and mechanical properties of EVA copolymers are determined by the degree of crystallinity, which depends on the mol.% VA and on the degree of alkyl shortchain branches. EVAlVa terpolymer properties depend on the residual mol.% VA. EVAl copolymers proved to have some properties similar to low-density polyethylene. The hydrogen-bonding effect via hydroxyl groups was negligible for this level of vinylalcohol incorporation. (27 refs.)

101601 Properties of polyisobutylene-polyurethane block copolymers. I. Macroglycols from ozonolysis of isobutylene-isoprene copolymer. T.A.Speckhard, G.Ver Strate, P.E.Gibson, S.L.Cooper (Dept. of Chem. Engng., Univ. of Wisconson, Madison, WI, USA).
Polym. Eng. & Sci. (USA), vol.23, no.6, p.337-49 (April 1983).
The properties of a series of polyisobutylene (PIB) based polyurethanes were studied and compared to those reported in the literature for polyether, polyester, and polybutadiene-based polyurethanes. Good phase separation was reflected in the invariance of the soft segment T_g with increasing hard segment content. Increasing hard segment content resulted in larger domains, higher modulus and lower ultimate elongation. The modulus above the soft segment T_g was higher than that previously reported for polyurethanes of similar hard segment content; improved phase separation and short contour lengths of the PIB chains were cited as possible causes of this behaviour. Stress-strain data indicated a change from isolated to interconnected domain morphology with increasing hard segment content. Preliminary environmental tests indicated that polyisobutylene based materials exhibit improved hydrolytic stability and reduced moisture permeability compared to polyether and polyester polyurethanes and greater oxidative stability compared to polybutadiene based materials. (52 refs.)

101602 Relation of low-frequency skeleton vibrations in glassy polymers with equilibrium rigidity of macromolecules. V.A.Bershtein, V.A.Ryzhov, S.I.Ganicheva, L.I.Ginzburg.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.7, p.1385-90 (July 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The influence of chemical crosslinks of chains on the far-infrared spectra has been studied for copolymers of styrene with divinylbenzene and methyl methacrylate with dimethacrylate ethylene glycol for a wide range of the concentration of the second comonomer (concentration of crosslinks). In crosslinked polymers the decrease of intensity of low-frequency vibrational motions of chains is observed. The character of the change of 225 and 245 cm^{-1} absorption bands related to skeleton vibrations points out their immediate relation with the equilibrium rigidity of macromolecules. The Kuhn segment corresponds to the characteristic motion unity. (27 refs.)

Conformational transition in syndiotactic PMMA. VI. Mono- and dichlorobenzene .... See Entry 101527

Interaction between components of polymer blends by scattering .... See Entry 101529

The structure of liquid crystalline aromatic copolyesters prepared from 4-hydroxybenzoic acid and 2-hydroxy-6-naphthoic acid .... See Entry 101555

Reduced van der Waals equation of state and critical properties of rubbers .... See Entry 101894

Phase studies of a liquid crystalline polymer: hydroxypropyl cellulose .... See Entry 101970

Comparative study of diluent effects on the glass transition of polyvinylchloride and phenolphthalein .... See Entry 101972

The effect of sequence distribution on glass transition of donor-acceptor copolymer systems .... See Entry 101973

Characteristics of polynorbornene and ethylene-propylene terpolymer blends .... See Entry 101974

Modeling of transport of small molecules in polymer blends: application of effective medium theory .... See Entry 102070

The diffusion of salt solutions into nylon-6 .... See Entry 102078

Influence of chain length on conformations of poly(ethylene glycol) chains grafted on silica [ESR observations] .... See Entry 102751

A ^{13}C-NMR study of the microstructure of polyphenylacetylenes prepared with $MoCl_5$ and WCl_6 .... See Entry 102761

^{13}C-NMR studies of thermally isomerized polyphenylacetylenes prepared with $MoCl_5$ and WCl_6 catalysts .... See Entry 102762

Molecular weight and temperature dependence of self-diffusion coefficients in polyethylene and polystyrene melts investigated using a modified NMR field-gradient technique .... See Entry 102777

Ferroelectric polymers .... See Entry 102827

Vibrational spectra and structure of stereoregular poly(methyl methacrylates) and of the stereocomplex .... See Entry 102885

Rheo-optical Fourier transform IR spectroscopy of polyurethane elastomers. I. Principle of the method and measurements at ambient temperature .... See Entry 102886

Rheo-optical fourier transform IR (FTIR) spectroscopy of polyurethane elastomers. II. Measurements at elevated temperature .... See Entry 102887

Rheo-optical Fourier transform IR (FTIR) spectroscopy of polyurethane elastomers. II. Investigation of NH-deuterated specimens .... See Entry 102888

Electrochemically prepared polythienylene films .... See Entry 103084

Annealing of ultra-oriented high density polyethylene extrudates .... See Entry 103186

Isochrone based mastercurves of viscoelastic functions .... See Entry 103196

Temperature dependence of the dynamic viscoelastic response of amorphous poly(diethylene glycol terephthalate) chains .... See Entry 103197

Polyisobutylene model elastomers prepared using demonstrably complete end-linking reactions. I. Elongation moduli of the trifunctional and tetrafunctional networks prepared from the linear polymers .... See Entry 103198

Characterization of elastomeric network structures using the effects of swelling on stress-strain isotherms and the extents of swelling at thermodynamic equilibrium .... See Entry 103239

Effect of the addition of EPM copolymers on the properties of high density polyethylene/isotactic polypropylene blends. II. Morphology and mechanical properties of extruded samples .... See Entry 103242

Thermo-oxidative ageing and its effect on the network structure and fracture mode of natural rubber vulcanizates .... See Entry 103353

Studies on whitening phenomena induced by some non-solvents on highly oriented glassy polymers .... See Entry 103357

Particle size from optical anisotropy effects in scattered light .... See Entry 103602

End group determination in hydroxyl-telechelic polyisobutylenes by infrared spectroscopy .... See Entry 103624

61.50 CRYSTALLINE STATE

(inc. molecular motions in solids; for magnetic structure and spin systems, see 75.25)

101603 A molecular dynamics calculation of the plastic phase of NaCN. M.Yvinec, R.M.Pick (Dept. de Recherches Phys., Univ. Pierre et Marie Curie, Paris, France).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.575-81 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
A large number of molecular crystals are actually known to present a high temperature disordered phase named 'plastic' which is an intermediate phase between the solid and the liquid states. In this plastic phase, the molecular centers of mass still form a regular lattice while the molecular orientations display some degree of disorder. The authors present a computer simulation which was primarily intended to provide a description of plastic molecular crystals. They have used the molecular dynamics technique for a two dimensional model which is an idealization of the sodium cyanide (NaCN). (7 refs.)

101604 Molecular dynamics on a parallel computer. G.S.Pawley, M.T.Dove (Dept. of Phys., Univ. of Edinburgh, Edinburgh, Scotland).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.583-92 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
For many years the computing capacity available to research science has grown at a rate of about ten times every five years. The major gain in capacity from now on will come from the use of parallel processors. Such computers are already proving ideal for certain molecular dynamics (and Monte Carlo) problems where the architecture of the computer is especially favourable. The architecture of the DAP is discussed, and it is shown that this favours lattice simulations rather than liquid simulations. Recent progress on the analysis of the dynamics of the plastic phase of SF_6 is reported, followed by results from a simulation of crystalline naphthalene, in which anharmonic properties have been analysed. (16 refs.)

101605 Neutron scattering study of the reorientational motions for NH_3 groups in $(NH_3(CH_2)_3NH_3)MnCl_4$. C.Sourisseau (Lab. de Spectrochimie Infrarouge et Raman, Thiais, France), G.Lucazeau, A.J.Dianoux.
J. Phys. (France), vol.44, no.8, p.967-74 (Aug. 1983).
Incoherent quasi-elastic neutron scattering experiments have been performed on oriented crystals, and on polycrystalline samples of $(NH_3(CH_2)_3NH_3)MnCl_4$ and $(NH_3(CD_2)_3NH_3)MnCl_4$ compounds in the 4-300K temperature range. Backscattering and time of light spectrometers were used; spectra were obtained using different resolutions (1-170 μeV) and a large range of momentum transfers (0.17-2.57 $Å^{-1}$). It is concluded that NH_3 groups reorientate below 300K; the experimental spectra have been satisfactorily fitted with a model of 2 $\pi/3$ jumps of the NH_3 groups, associated with a correlation time of 1×10^{-11} s at 300K and an activation energy roughly equal to 27 kJ/mol. Finally a comparison with literature data, mainly from NMR and Raman results, is presented. (19 refs.)

101606 Calculation of the molecular rotational potential from Bragg scattering data: the method and an application to $(NH_4)_2SnCl_6$. K.Vogt, W.Prandl (Inst. fur Kristallographie, Univ. Tubingen, Tubingen, Germany).
J. Phys. C (GB), vol.16, no.24, p.4753-68 (30 Aug. 1983).
The distribution of orientationally disordered rigid molecules is governed by the rotational potential. The authors present a procedure by which they derive the rotational potential from Bragg scattering. The analysis is applied to neutron diffraction data from $(NH_4)_2SnCl_6$ taken at $T=293$ and 140K, respectively. The new method gives a better fit to the data than the conventional crystal structure analysis. The computed rotational potential is temperature-independent at least between room temperature and 140K, and the rotational barriers are consistent with the observed activation energy. (29 refs.)

Novel example of simultaneous double N-inversion in the solid state .... See Entry 101679

Particular properties of $\Sigma=3^n$ boundaries in FCC polycrystals. I. Crystallographical parameters and grain boundary faceting during annealing .... See Entry 101718

Temperature dependence of the elastic constants in CsCN measured by Brillouin scattering .... See Entry 101835

Influence of crystalline perfection and surface species on the X-ray photoelectron spectra of natural and synthetic graphites .... See Entry 103027

61.50C Physics of crystal growth

(for techniques of crystal growth and film deposition, see 81.10 and 81.15; for epitaxy, thin films, see 68.55; for whiskers, see 68.70)

101607 Evidence for the growth mechanism of Cr_2O_3 at low oxygen potentials. H.Hindam (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA), D.P.Whittle.
J. Electrochem. Soc. (USA), vol.130, no.7, p.1519-23 (July 1983).
The growth rate of Cr_2O_3 on pure Cr, Ni-25, and 50% Cr and Co-25% Cr in flowing CO-CO_2 mixtures of effective oxygen pressures in the range 8.4×10^{-15}-8.3×10^{-9} atm at 1000°C has been measured. The parabolic growth constant is virtually independent of oxygen potential for both pure Cr and the alloys; for the alloys, it is about an order of magnitude smaller than for pure Cr. These results provide supportive evidence for Cr interstitials being the predominating mobile defect species in Cr_2O_3 under these conditions. (18 refs.)

101608 Application of the Wanklyn model to the BaO-BaF_2-B_2O_3-Y_2O_3-Fe_2O_3 flux system. P.Paroli (Istituto di Elettronica dello Stato Solido, CNR, Roma, Italy).
Mater. Res. Bull. (USA), vol.18, no.7, p.835-40 (July 1983).
Data on the BaO-$BaF_2B_2O_3$-Y_2O_3-Fe_2O_3 flux system are analyzed in terms of the model recently proposed by Wanklyn, Verified thus far for lead- and alkali-based fluxes. The model is found to hold, with the noticeable exception that in this particular case the basic oxide and the corresponding fluoride are not equivalent from the standpoint of phase equilibria: on the contrary, a BaF_2 addition makes 'ineffective' a small but definite fraction of the BaO present in the melt. (3 refs.)

101609 Simulation studies of the hydrodynamics in high-temperature solutions for crystal growth. III. Flow rates in the presence of free and forced convections proceeding in opposite directions. V.Nikolov, K.Iliev, P.Peshev (Inst. of General & Inorganic Chem., Bulgarian Acad. of Sciences, Sofia, Bulgaria).
Mater. Res. Bull. (USA), vol.18, no.7, p.889-96 (July 1983).
For pt.II see ibid., vol.18, p.9 (1983). An experimental simulation study has been carried out on the convection flow rate under the crystal during its growth from a high-temperature solution by the TSSG method or from a melt by the Czochralski method when periphery heating of the crucible is prevailing and simultaneous free and forced convections with opposite directions are present. It has been established that with increasing proportion of forced convection the resultant flow direction changes from downwards to upward. Immediately before the diection change, the flow is unstable with respect to time. The direction change has been found to occur at a definite ratio of the determination of the flow rate in the upflow region has been obtained. (10 refs.)

101610 On a particular type of twinning in the growth of rhenium single crystals. V.M.Romashov.
Russ. Metall. (GB), no.4, p.79-81 (1981). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.4, p.91-4 (1981). [received: June 1983]
By means of an X-ray technique, twinning of a particular type was detected in the initial zone of imperfect single crystals produced by electron-beam melting; the twinning plane (1012) coincides with the plane of the type (2130) of the second part of the twin. (3 refs.)

101611 Survey of the thermodynamics and kinetics of crystallization of Si and Ge. D.Turnbull (Div. of Appl. Sci., Harvard Univ., Cambridge, MA, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.131-4
The thermodynamic interrelations of the crystalline (c-sc), amorphous semiconducting (a-sc) and liquid metal (*l*m) states of Si and Ge, based on the existing thermal data, are reviewed. Then the kinetics of the interfacial processes in the growth of c-sc and a-sc into undercooled *l*m and the conditions for transition from c-sc to a-sc growth are discussed. (15 refs.)

Cohesive Properties of Semiconductors under Laser Irradiation. Proceedings of the NATO Advanced Study Institute .... See Entry 98653

Charged dangling bonds and crystallization in group IV semiconductors .... See Entry 101558

Explosive crystallization in a-Ge and a-Si: a review .... See Entry 101559

Amorphous Si, crystallization and melting .... See Entry 101560

Ising model simulations of impurity trapping in silicon .... See Entry 101740

Ultra-high speed solidification and crystal growth in transiently molten semiconductor layers .... See Entry 101774

Visualization of temperature profiles in a-Si crystallized in the explosive mode by CW laser .... See Entry 101781

Transient conductivity measurements in pulsed ion beam melted silicon .... See Entry 101823

Pressure effect on nucleation during crystallization from the melt of oligoesters of various molecular mass .... See Entry 101924

Transformation processes in deformed Al-30 wt.% Zn alloy containing metastable precipitates .... See Entry 101942

Segregation and crystallization phenomena in germanium ..... See Entry 101990

Tellurium as melting medium to prepare transition metal chalcogenides single crystals .... See Entry 103039

Growth reactions of potassium titanate fibers by slow-cooling calcination method .... See Entry 103043

On control of the composition of solid solutions of $Ga_{1-x}In_xSb$ and $Ga_{1-x}Al_xAs$ in the process of temperature-gradient zone refining .... See Entry 103044

Explosive recrystallization of ion implantation amorphous silicon layers .... See Entry 103047

61.50E Crystal symmetry; models and space groups, and crystalline systems and classes

101612 The invertibility of matter tensors. R.R.Birss (Dept. of Pure & Appl. Phys., Univ. of Salford, Salford, England).
J. Phys. C (GB), vol.16, no.24, p.L901-2 (30 Aug. 1983).
The conditions under which a matter, or property, tensor has an inverse are examined. It is shown that an inverse does not exist when the matter tensor connects two physical tensors with different numbers of independent components. When these numbers are the same, a sufficient condition for invertibility is identified in terms of positive definitiveness. (3 refs.)

101613 Simple criteria for the existence of Cochran cyclotomic sets. V.G.Rau, L.G.Parkhomov, V.V.Ilyukhin, N.V.Belov (P.I. Lebedev-Polyanskii State Pedogogical Inst., Vladimir, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.897-8 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.91-4 (Nov. 1982).
In two earlier papers (1982) the authors have shown that a necessary condition for the existence of Cochran cyclotomic sets of period $v=nd$ is that of solvability of $d+1$ equations in nonnegative integers $g_i \epsilon \{0,1\}$. Now they propose some simpler criteria, which it proved possible to derive only with the proof of some general theorems associated with the concept of a weighting cyclotomic set. (5 refs.)

101614 Additional symmetry with superposition of regular systems of points. E.A.Soldatov, E.A.Kuz'min, K.N.Akatova, V.V.Ilyukhin, N.V.Belov (Physicotech. Res. Inst., N.I. Lobachevski State Univ., Gorki, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.899-900 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.95-6 (Nov. 1982).
Investigations of pseudosymmetry are, as a rule, confined to the study of the pseudosymmetry of the individual regular systems. On the basis of the vector system of segments it becomes possible to investigate this complication within the more general framework of the pseudosymmetry of a superposition of regular systems. Using this concept, the authors assume that pseudosymmetry arises when two regular systems of one group become one regular system of another group. In terms of rhombi, this means that peaks of the interaction of the first group become peaks of the bundle of the second, which are found in certain Harker sections. This means that the regular systems are oriented in a particular way among themselves, so that the basis section is in a particular position. For example, for a pseudoplane the corresponding vector has two fixed coordinates, while for a pseudoaxis it has one. (4 refs.)

101615 Three types of one-dimensional disordering of close-packed martensite structures. E.A.Pilyankevich, A.I.Ustinov, K.V.Chuistov (Inst. of Metal Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.981-3 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.634-7 (Nov. 1982).
Determines the quantitative structural prerequisites for the qualitatively different diffraction patterns of one-dimensionally disordered crystals. On the basis of what was found, the one-dimensionally disordered crystals were classified into three groups, according to the similarity in the type of predominant stacking shift and according to the form of the diffraction pattern in the group. (8 refs.)

61.50J Crystal morphology and orientation

A structural description for the FCC→BCC martensitic transformation in terms of $\{011\}\ \langle 011\rangle_{fcc}$ simultaneous double shear. Relation with the atomic configuration in $\{3,15,10\}_{fcc}$ habit plane. .... See Entry 101956

61.50K Crystallographic aspects of polymorphic and order-disorder transformations

101616 Polymorphism and superconductivity of $LaIr_2Si_2$. H.F.Braun (Dept. de Phys. de la Matiere Condensee, Univ. de Geneve, Geneve, Switzerland), N.Engel, E.Parthe.
Phys. Rev. B (USA), vol.28, no.3, p.1389-95 (1 Aug. 1983).
$LaIr_2Si_2$ has a high-temperature form crystallizing in the primitive tetragonal $CaBe_2Ge_2$-type structure (space group $P4/nmm$; $a=4.191$ Å, $c=9.944$ Å), and a low-temperature form of the body-centered tetragonal $ThCr_2Si_2$ type (space group $I4/mmm$; $a=4.109$ Å, $c=10.299$ Å). Both structures are $BaAl_4$-type derivatives. The high-temperature modification may be quenched from above the transformation temperature of 1720°C and becomes superconducting at 1.6K, while the low-temperature modification is normal down to 1K. The structures of both modifications have been refined in single-crystal studies. The exceptional polymorphism of $LaIr_2Si_2$ is discussed, emphasizing structural relationships and the occurrence of superconductivity in the high-temperature modification. (18 refs.)

The synthesis and crystal structure of α-Ca_3UO_6 .... See Entry 101659

Neutron and X-ray diffraction study on polymorphism in lithium orthotantalate, Li_3TaO_4 .... See Entry 101663

Disordering kinetics in neutron and electron irradiated Fe-Co alloy .... See Entry 101800

Phase transitions and order parameters .... See Entry 101963

Evidence for grain boundary phase transition in a 2D bicrystal .... See Entry 102187

61.50L Crystal binding

101617 The effect of molecular excitation on crystal packing. 9-cyano-and 9,10-dimethylanthracene as excited guest/host and host/guest pairs. K.Norris, P.Gray, D.P.Craig, C.P.Mallett, B.R.Markey (Res. School of Chem., Australian Nat. Univ., Canberra, Australia).
Chem. Phys. (Netherlands), vol.79, no.1, p.9-19 (15 Aug. 1983).
The crystal packing of an electronically excited 9-cyanoanthracene (9-CNA) in host 9,10-dimethylanthracene (DMA), and the packing with roles of host and guest exchanged, are calculated using standard atom-atom potentials and a range of estimates of the changes in intermolecular forces in the molecular excited states. Exciplex formation is discussed in the two cases. Excited 9-CNA in DMA is stable to unsymmetrical displacement both in the unrelaxed and relaxed lattices. Excited DMA is unstable in a rigid 9-CNA lattice, being asymmetrically displaced towards one neighbour in the molecule stack; however, since the excitation of DMA is at higher energy than that of 9-CNA, the physically more realistic case is that of an excited 9-CNA molecule adjacent to the guest. Calculation shows that the excited molecule, in a rigid lattice, is unstable at its ground-state site, and that it will move to one of two potential minima closer to either the neighbour DMA or to the other neighbour (9-CNA). However, the simulation of long-time behaviour through calculation of changes in local molecular packing suggests no such instability. (26 refs.)

101618 Correlation of electron binding energy with the chemical shifts. K.S.Srivastava, A.Chaube, K.Sinha, A.Tandon, M.Husain (Phys. Dept., Lucknow Univ., Lucknow, India).
Indian J. Phys. Part B, vol.57B, no.1, p.71-5 (Feb. 1983).
Numerical order of the chemical shift of the X-ray absorption edges has been calculated by valence shell potential model (VSPM). A new expression for the charge parameters has been given. The calculated values of the chemical shifts correspond well with the experimentally observed values of the other workers. (16 refs.)

101619 Effects of a partial relaxation of the crystal lattice on the calculation of the electronic structure of CrF_6^{3-} in 'isolated-cluster' and 'shared-cluster' crystals. Z.Barandiaran, L.Pueyo (Dept. de Quimica-Fisica, Univ. de Oviedo, Oviedo, Spain).
J. Chem. Phys. (USA), vol.79, no.4, p.1926-32 (15 Aug. 1983).
The electronic structure of the CrF_6^{3-} in isolated-cluster crystals (K_2NaCrF_6, Rb_2NaCrF_6, Rb_2KCrF_6, and Cs_2KCrF_6) and in the shared-cluster system CrF_3 has been calculated in terms of an open-shell Hartree-Fock-Roothaan SCF methodology which includes the corresponding cluster-lattice interactions. These interactions have been calculated with different models of the crystal lattice. First, a rigid point-charge model has been used to compute the lattice potential. Then, this lattice representation has been partially relaxed in the sense that either the values of the point charges q(Cr), q(F) or the Cr-F internuclear distance or both are allowed to change in order to be consistent with the predictions of the cluster calculation. In CrF_3 the relaxation has been limited to the values of the point charges. In the isolated-cluster lattices it is extended to include the lattice value of the Cr-F distance. The results of these calculations have been analyzed with particular attention to the prediction of the equilibrium geometry and the electronic transition 10 Dq. The effect of the partial lattice relaxation on these two observables turns out to be rather significative in CrF_3 but uniformly small in the isolated-cluster lattices. The values of R_e and 10 Dq obtained in the best calculation on CrF_3 are in very good agreement with the experimental observations. (12 refs.)

101620 Madelung constants for layer compounds. T.H.Shen, W.Y.Liang (Cavendish Lab., Univ. Cambridge, Cambridge, England).
J. Phys. C (GB), vol.16, no.24, p.L883-8 (30 Aug. 1983).
Madelung constants have been calculated for layer compounds having octahedral and trigonal prismatic coordination structures, the value being 12.3 and 10.2 respectively. Applying the results to TaS_2, it was found that Ta ions carry a charge of about $1.2e$. (3 refs.)

101621 Universal features of bonding in metals. J.H.Rose (Ames Lab., Iowa State Univ., Ames, IA, USA), J.R.Smith, J.Ferrante.
Phys. Rev. B (USA), vol.28, no.4, p.1835-45 (15 Aug. 1983).
Binding-energy-distance relations for metallic systems are shown to exhibit a universal behavior under a simple two-parameter scaling. All currently available ab initio calculations for the cohesion and adhesion of metals, as well as the chemisorption of gas atoms on metal surfaces, are shown to be determined by this single relation. Further, the energetics of diatomic molecules are determined by the same relation, despite the existence of strong volume-dependent forces for metals. These findings suggest a commonality of metallic bonding and a close relationship between molecular and metallic bonding. The universal nature of binding-energy-distance relations implies relations between seemingly disparate physical phenomena. As an example the authors show that the surface-binding-energy relation can be approximately expressed in terms of the bulk quantities. This leads to an explanation of the well-known empirical result that the surface energy per surface atom is proportional to the cohesive energy per bulk atom. Also, a simple relationship between adsorbate-substrate vibrational stretch frequencies and their desorption energies follows from the universal relationship. (33 refs.)

101622 Parametrized density functionals in the phase theory in alloys of 3D-transition metals. V.Ja.Dvoretskiy, Yu.A.Khon (Inst. of Atmospheric Optics, Acad. of Sci., Tomsk, USSR).
Solid State Commun. (USA), vol.47, no.7, p.533-5 (Aug. 1983).
The calculation of the formation energies of a number of alloys of the 3d-transition metals as a function of concentration and long-range order parameter was made on the parametrized density functional formalism. The results obtained were in good agreement with experiment. It was shown that in the NiTi system a significant role is played by the ion component of binding energy, and in the FeCo system-by ferromagnetism. (14 refs.)

101623 Effective charges of the valence shells on atoms of A15 chemical compounds. B.N.Kodess, I.A.Massalimov (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
Solid State Commun. (USA), vol.47, no.7, p.545-7 (Aug. 1983).
X-ray diffraction data are used to calculate the charges of the valence shells of Si and V in V_3Si. The subsequent integration of the deformation density (ρ def $(\vec{r})=\rho$ exp $(\vec{r})-\rho$ at $(\vec{r})$) indicates that the charges on Si atoms decrease and on V atoms increase in comparison with the charges on free atoms. The magnitude of charge transfer is compared to the results of self-consistent band structure calculation. The observed increase of charge for atom V may be associated with the compression of the 3d-shells of V in V_3Si. (10 refs.)

101624 Electronic energy and short-range order in binary alloys. M.O.Robbins, L.M.Falicov (Dept. of Phys., Univ. of California, Berkeley, CA, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.63-6
An electronic theory for the total energy of binary alloys is presented. It treats the entire range of concentration and short-range order. The method is not ab initio, but requires only information about the pure elemental constituents of the alloy. Results for two very different metal series, monovalent metals and 4-d transition metals, are calculated and compared to experiment and other models. The model calculation allows us to examine the physical basis for experimental trends. (32 refs.)

101625 Lattice energy functions for predictions of structural properties of alloy phases. E.S.Machlin (Henry Krumb School of Mines, Columbia Univ., New York, NY, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.67-80
Lattice energy functions have been used to predict various properties. The energies and volumes of formation of alloy phases, as well as the relative stabilities of competing phases are provided by a model based on Mie-type interatomic potentials. The elastic constants of alloy phases are treated using a model sensitive to the quadrupole distortion of a repulsion spheroid. The properties of defects are treated using a model based on both a volume dependent contribution and an interatomic potential contribution to the lattice energy. Good predictability is obtained for all three types of lattice energy functions in their respective applications. (37 refs.)

101626 The atom as the building block in crystal: the use of electron charge-density data base for calculating structural properties of metals. G.L.Krasko (Dept. of Materials Sci. & Engng., MIT, Cambridge, MA, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.93-8
A new method of calculating structural properties of metals is suggested. The method utilizes the data of 'first principle' charge-density distributions in pure metals accumulated in recent years. If, for a metal, the solution to the Schrodinger equation within the automatic cell is known, the electron charge-density distribution in an arbitrary point of the crystal may be 'reconstructed' within the framework of a model. Using the density-functional formalism and the virial theorem, the total energy of the crystal may be found in terms of an effective interatomic potential. The latter may be used for the calculating of other structural properties, such as phonon spectra and elastic moduli. The extension of this method to alloys is briefly discussed. (12 refs.)

101627 Evaluation and meaning of ionic and dipolar lattice sums. E.R.Smith (Dept. of Math., Univ. of Melbourne, Parkville, Victoria, Australia), J.W.Perram.
Physics of Superionic Conductors and Electrode Materials. Proceedings of a NATO Advanced Study Institute on the Physics of Superionics Conductors and Electrode Materials, Odense, Denmark, 4-22 Aug. 1980 (New York, USA: Plenum Press 1983), p.41-55
The authors discuss the lattice sums which arise in simulations of ionic and dipolar systems using periodic boundary conditions. The lattice sums are conditionally but not absolutely convergent and so the order of summation must be given. They sum them by spherical shells and discuss the role of an 'external dielectric constant' ϵ', when the dielectric constant of a continuum outside the outermost shell becomes large. The lattice sums are converted into absolutely and rapidly convergent lattice sums and methods for rapid evaluation of these sums are discussed. The effect of ϵ' on the Hamiltonian is discussed. The effect of changes in ϵ' on the mean square dipole moment fluctuations is discussed and illustrated by reference to some Monte Carlo simulations of restricted primitive electrolyte. (20 refs.)

101628 Evaluation of lattice sums in disordered ionic systems. E.R.Smith (Dept. of Math., Univ. of Melbourne, Parkville, Victoria, Australia), J.W.Perram.
Physics of Superionic Conductors and Electrode Materials. Proceedings of a NATO Advanced Study Institute on the Physics of Superionics Conductors and Electrode Materials, Odense, Denmark, 4-22 Aug. 1980 (New York, USA: Plenum Press 1983), p.57-78
The potential energy of a crystal of point ions in an external field or the field set up by an impurity is written down and from it a set of equations for the distortion of the lattice caused by the field are derived. Since the distortions may often be small, it is clear that solutions of the linearised equations will be very useful. The linearised equations may be studied by Fourier transform techniques. These techniques require that lattice sums for ion-ion and ion-defect potentials be analysed with some care. The relevant sums are analysed, in a form which allows their use in some lattice distortion problems. (5 refs.)

101629 Some applications of conditionally convergent lattice sums. E.R.Smith (Dept. of Math., Univ. of Melbourne, Parkville, Victoria, Australia), J.W.Perram.
Physics of Superionic Conductors and Electrode Materials. Proceedings of a NATO Advanced Study Institute on the Physics of Superionics Conductors and Electrode Materials, Odense, Denmark, 4-22 Aug. 1980 (New York, USA: Plenum Press 1983), p.143-62
The authors use lattice sums to study two systems. The first is the simple cubic lattice, with unit lattice spacing with a polarisable point of polarisability α at each lattice site. For this system they consider first a plane slab of the material in an external electric field. The response of the system to a small external field gives the dielectric constant of the system. They also calculate the response of the polarisable points close to the surface of the plane slab. Next they consider the response of a large sphere of the material to a charge or fixed dipole at the centre of the sphere and find an asymptotic expression for the polarisation of points far from the 'defect'. These expansions also allow calculation of the dielectric constant. The second system studied is a plane slab of ionic crystal responding to an applied electric field. The authors show how to calculate the distortion of the crystal produced by the field and thus obtain the dielectric constant of the crystal. Results for the dielectric constant for a CsCl structure are given and show how the dielectric constant depends on the repulsive potential between the ions. (4 refs.)

101630 Boundary conditions in the simulation of ionic systems. S.W.de Leeuw (Theoretical Phys., Univ. of Oxford, Oxford, England).
Physics of Superionic Conductors and Electrode Materials. Proceedings of a NATO Advanced Study Institute on the Physics of Superionics Conductors and Electrode Materials, Odense, Denmark, 4-22 Aug. 1980 (New York, USA: Plenum Press 1983), p.163-76
The Hamiltonian of a periodic array of charges contains terms depending on the shape and the surroundings of the system. The effect of these terms on the properties of the system is considered and some relations are derived for the long wavelength behaviour of fluctuations in the system. A brief discussion of the dynamical properties of the system under different boundary conditions is given. (14 refs.)

101631 Introduction to Monte Carlo simulation techniques. D.Adams (Dept. of Chem., Univ. of Southampton, Southampton, England).
Physics of Superionic Conductors and Electrode Materials. Proceedings of a NATO Advanced Study Institute on the Physics of Superionics Conductors and Electrode Materials, Odense, Denmark, 4-22 Aug. 1980 (New York, USA: Plenum Press 1983), p.177-95
Starting from the assumption that matter consists of interfacing particles obeying classical mechanics, and using the postulates of statistical mechanics, one can model any specific material as a system of particles provided one knows what the interactions between the particles are. However, whatever interactions are chosen the integrals that it is necessary to solve are formidable. The authors present a standard numerical technique for solving multidimensional integrals when ordinary quadrature is impractical. Instead of trying to obtain values of the integrand at every point on a regular grid they find a very much smaller number of values scattered through the multidimensional volume of integration. This does not give a very accurate value of the integral, but provided that the sample points have been chosen without bias the answer obtained will also be unbiased. By taking more and more samples of the integrand the accuracy can be made as high as required. The simplest way of sampling to do this is to sample at randomly chosen points. This is Monte Carlo integration, the use of random numbers, of chance, to obtain a definite, correct (but necessarily approximate) value of an integral. (37 refs.)

101632 Molecular dynamics with constraints. H.J.C.Berendsen, W.F.van Gunsteren (Lab. of Physical Chem., Univ. of Groningen, Groningen, Netherlands).
Physics of Superionic Conductors and Electrode Materials. Proceedings of a NATO Advanced Study Institute on the Physics of Superionics Conductors and Electrode Materials, Odense, Denmark, 4-22 Aug. 1980 (New York, USA: Plenum Press 1983), p.221-40
A method is described to include constraints such as bond lengths and bond angles into molecular dynamics simulations, while retaining cartesian coordinates. The effects of constraints on physical behaviour and computational efficiency are evaluated. A Fortran subroutine (SHAKE) is appended. (18 refs.)

Cohesive Properties of Semiconductors under Laser Irradiation. Proceedings of the NATO Advanced Study Institute .... See Entry 98653

A general method for approximating the electronic correlation energy in molecules and solids .... See Entry 100268

Structural and electronic properties of small metal aggregates .... See Entry 101633

Bonding and structure of CoSi$_2$ and NiSi$_2$ .... See Entry 101664

Calculations of the binding of hydrogen to fixed interstitial impurities in nickel .... See Entry 101692

Cohesion, compound formation and phase diagrams from first principles .... See Entry 101913

Self-consistent Hellmann-Feynman theorem for tight-binding models .... See Entry 102224

Electronic structure of some binary uranium and thorium oxides and halides .... See Entry 102251

Multilayer lattice relaxation at metal surfaces: a total-energy minimization .... See Entry 102293

Hydrogen bonding and conformational effects on ^{13}C NMR chemical shifts of hydroxybenzaldehydes in the solid state .... See Entry 102767

A quantitative analysis of the ν_s(IR) bands of H-bonds. II. Adipic acid crystals .... See Entry 102862

On the nature of IR absorption peaks introduced by the absorbed hydrogen on Si surface .... See Entry 102893

61.55 SPECIFIC STRUCTURE OF ELEMENTS AND ALLOYS

61.55F Metallic elements

101633 Structural and electronic properties of small metal aggregates. J.Buttet, J.P.Borel (Inst. de Phys. Experimentale, Ecole Polytech. Federale de Lausanne, Lausanne, Switzerland).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.541-50 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The authors review the information obtained by electron microscopy and electron diffraction techniques on the structure of aggregates of diameter larger than $\sim$20 Å, and describe the results of simple models. They focus on very small alkali metal aggregates and compare some of the available experimental data with calculations of their structural and electronic properties. The evolution of the properties of alkali metal clusters as a function of size is certainly not representative of all metal aggregates. (49 refs.)

Static structure factor and electron-electron correlations in Be. A comparison of experiment with electron-gas theory .... See Entry 102285

61.55H Alloys

101634 Temperature dependence of the short range order parameters in Cu-15 at.% Al alloy. V.S.Zubchenko, M.P.Kulish, P.V.Petrenko, O.O.Tatarov.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.6, p.75-7 (1983). In Ukrainian.
A short-range ordering of the Cu-15 at.% alloy is studied within a wide temperature range (20-600°C) by the method of high-temperature X-ray diffraction. An increase in the short-range order degree with temperature is found. This is explained by existence of two ordering types in the alloy which are stable within different temperature ranges. (14 refs.)

101635 Effects of high dynamic pressures on the structure and mechanical properties of martensitic steels 38KhS and 30KhGSN2A. A.P.Bashchenko, A.O.Mettus, M.N.Spasskii, L.P.Orlenko (Inst. of Metallography & Phys. of Metals, Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1202-6 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of the various ways of applying high dynamic pressures (initiated by explosions) on the structure and mechanical properties of high-strength construction steels with the martensitic structure. Electron and optical microscopes were used to reveal a number of structural features of the martensite after the action of high dynamic pressures. The subsequent plastic

deformation of steels treated in this way was more homogeneous in the interior. It was found that the application of high dynamic pressures could result in a further increase in the hardness without deterioration in the plasticity and impact toughness. (6 refs.) *A.T.*

101636 Crystalline and magnetic structures in $REAl_xGa_{2-x}$ systems (RE=Nd, Er; $0 \leq x \leq 2$). I. Crystalline structures. O.E.Martin, K.Girgis (Inst. fur Kristallographie und Petrographie, Eidgenossische Tech. Hochschule, Zurich, Switzerland).
J. Magn. & Magn. Mater. (Netherlands), vol.37, no.3, p.228-30 (July 1983).
Part I describes results of crystalline structures found for the $NdAl_xGa_{2-x}$ and $ErAl_xGa_{2-x}$ pseudoternary solid solution systems ($0 \leq x \leq 2$). Characterization techniques include X-ray diffraction, electron microprobe analysis and DTA measurements. (6 refs.)

101637 Temperature dependence of lattice parameters and FCC/FCT/FCO transformations in some Mn-base metastable γ-phase alloys. K.Ito, M.Tsukishima, M.Kobayashi (Dept. of Materials Sci., Univ. of Tokyo, Tokyo, Japan).
Trans. Jpn. Inst. Met. (Japan), vol.24, no.7, p.487-90 (July 1983).
Lattice parameters of quenched $Mn_{1-x}Fe_x$ (X=0.27-0.31), $(Mn_{1-x}Fe_x)_{0.95}Cu_{0.05}$ (X=0.15-0.28), and $(Mn_{1-x}Co_x)_{0.95}Cu_{0.05}$ (X=0.05-0.19) alloys were measured at temperatures between 80 and 480K. The Mn-Fe and Mn-Fe-Cu alloys transformed from fcc to fct(c/a<1) structure on cooling below a critical temperature which was equal to or lower than the Neel temperature. With increasing cobalt concentration, the Mn-Co-Cu alloys underwent on cooling fcc/fct(c/a<1), fcc/fct(c/a<1)/fco, fcc/fct(c/a>1)/fco, and fcc/fct(c/a>1) transformations. These lattice change behaviours were compared with those of In-base alloys. (18 refs.)

Crystal structure and density data. I. Intermetallic compounds of titanium .... See Entry 98666

Effective charges of the valence shells on atoms of A15 chemical compounds .... See Entry 101623

Disordering kinetics in neutron and electron irradiated Fe-Co alloy .... See Entry 101800

The system copper-tellurium .... See Entry 101908

The Pd-Pt-H system: phase transformations at high pressure and superconductivity .... See Entry 102555

Neutron diffraction effects of distortion of the structure of Ni-67.7 at.% Fe alloy in a magnetically ordered state .... See Entry 102622

Crystal chemistry of metastable alloy phases .... See Entry 103122

X-ray diffraction investigation of the single-phase stage of precipitation of martensite .... See Entry 103156

61.60 SPECIFIC STRUCTURE OF INORGANIC COMPOUNDS

101638 Synthesis and study of the trivalent thallium chromate $Tl_2(CrO_4)_3$ and double chromates of formula type $M^IM^{III}(CrO_4)_2$, nH_2O ($M^I=Tl^+$, Ag^+; $M^{III}=Tl^+$, Bi^{3+}; n=0.1). A.Lecerf, Y.Cudennec, A.Riou, Y.Gerault (INSA, Rennes, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.14, p.1047-50 (18 April 1983). In French.
The trivalent thallium chromate $Tl_2(CrO_4)_3$ double chromates $AgTl(CrO_4)_2$, $AgTl(CrO_4)_2$, $1H_2O$ and $TlBi(CrO_4)_2$ α, β, γ, δ have been prepared. The crystal parameters of several phases have been determined with a single crystal. $Tl_2(CrO_4)_3$, $AgTl(CrO_4)_2$, $1H_2O$ and $TlBi(CrO_4)_2\alpha$ have an orthorhombic unit cell. $TlBi(CrO_4)_2$ γ and $TlBi(CrO_4)_2$ δ unit cell is monoclinic. (8 refs.)

101639 Crystallographic study of mixed oxides Sr_2MWO_6. G.Bouvier, P.Poix (Ecole Nat. Superieure de Chem., Strasbourg, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.15, p.1165-7 (25 April 1983). In French.
The crystallographic study of compounds Sr_2 MWO_6 (M=Mg, Ni, Co) establishes the cation distribution in the network and specifies for each compound the transition temperature quadratic+cubic. (4 refs.)

101640 Preparation and crystallographic characterization of two new hydrated trimetaphosphates: $Ca_3(P_3O_9)_2.10H_2O$ and $Cd_3(P_3O_9)_2.10H_2O$. N.El-Horr (CNRS, Beyrouth, Lebanon), A.Durif.
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.15, p.1185-7 (25 April 1983). In French.
$Ca_3(P_3O_9)_2.10H_2O$ and $Mn_3(P_3O_9)_2.10H_2O$ are monoclinic $P2_1/n$, Z=2 with the following unit cell dimensions a=9.332 (7), b=18.13 (1), c=7.841 (5) Å, β=106.69 (5)° for the calcium salt; a=9.219 (4), b=17.733 (8), c=7.644 (3) Å, β=107.37 (2)° for the manganese salt. Chemical preparations and the main crystallographic features are described for these two salts both isotypic with the corresponding cadmium salt: $Cd_3(P_3O_9)_2.10H_2O$. (7 refs.)

101641 Study by transmission electron microscopy of oxidation of zinc substituted magnetite in defective spinels. B.Gillot, R.Mohamed Benloucif, J.-C.Mutin, A.Rousset (Lab. sur la Reactivite de Solides, Faculte des Sci. Mirande, Dijon, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.19, p.1505-8 (30 May 1983). In French.
Defective phases γ derived from the cubic γ Fe_2O_3 phase through the simultaneous substitution of Fe^{3+} ions and vacancies by Zn^{2+} ions following the scheme: $2Fe^{3+}+\square \rightarrow 3Zn^{2+}$ have been investigated by transmission electron microscopy. These defective phases γ possess an ordered arrangement of cation vacancies with a period of 1/3 unit vector along [100] and [010] directions for the total composition $\gamma-({Zn_{0.18}}^{2+}{Fe_{2.54}}^{3+}\square_{0.28}){O_4}^{2-}$. (12 refs.)

101642 Structure of bis(*p*-bromophenyl)tellurium(IV)dichloride. R.K.Chadha, J.E.Drake, J.L.Hencher (Dept. of Chem., Univ. of Windsor, Windsor, Ontario, Canada).
Can. J. Chem. (Canada), vol.61, no.6, p.1222-5 (June 1983).
The X-ray crystal structure of bis(*p*-bromophenyl)tellurium(VI) dichloride has been determined: R=0.25. The crystals were triclinic, P1, a=8.000(7) Å, b=11.811(11) Å, c=7.978(6) Å, α=101.85(7)°, β=98.73(6)°, γ=80.95(7)°, and Z=2. The compound exhibits a γ-trigonal bipyramidal arrangement of ligands around tellurium with weak secondary interactions between tellurium and bromine atoms in adjacent molecules. (13 refs.)

101643 Observations on the structure, stability and transformations of the graphite: $SbCl_5$ intercalate. J.M.Thomas, R.Schlogl, W.Jones, P.Korgul (Dept. of Phys. Chem., Univ. of Cambridge, Cambridge, England).
Carbon (GB), vol.21, no.4, p.409-14 (1983).
Notwithstanding its stoichiometry, $C_{32}SbCl_{4.7}$, the richest intercalate of graphite: $SbCl_5$ that the authors have prepared, is a dilute first stage compound, in which each interlamellar space, though occupied, is undersaturated. A variety of anionic species reside in this space, including ${SbCl_6}^-$, ${SbCl_5}^{2-}$, $SbCl_3$ and some anions where there are bridging chlorine atoms. The guest species together form interpenetrating two-dimensional superlattices (±16.1° $\sqrt{39}.\sqrt{39}$ and ±19.1 $\sqrt{7}\sqrt{7}$), the identities of which were established by variable-temperature selected area electron diffraction. This technique also confirmed the presence of a rather unusual phase transition that takes place at *caa.* 210K. Electron-stimulated energy dispersive analytical studies of the changes that occur when the freshly prepared intercalate is exposed to air imply that de-intercalation is rapid and that the subsequent hydrolysis of released antimony halide is rate-determining. (18 refs.)

101644 Crystallographic polarity and etching of cadmium telluride. P.F.Fewster, P.A.C.Whiffin (Philips Res. Labs., Redhill, England).
J. Appl. Phys. (USA), vol.54, no.8, p.4668-70 (Aug. 1983).
This paper resolves the inconsistency in the literature on the determination of the polarity of CdTe and $Cd_xHg_{1-x}Te$ from their etching behavior. The etch (H_2O:H_2O_2:HF, 2:2:3 v/v) has been shown to reveal pits on the Cd (111) *A* face and not on the Te $(\bar{1}\bar{1}\bar{1})$ *B* face in contradiction to the previously published work of Warekois, Lavine, Mariano, and Gatos [J. Appl. Phys. 33, 690 (1962)] and Nakagawa, Maeda, and Takeuchi [Appl. Phys. Lett. 34, 574 (1979)]. This result agrees with the observations of Fewster, Cole, Willoughby, and Brown [J. Appl. Phys. 52, 4568 (1981)] for $Cd_xHg_{1-x}Te$ grown epitaxially on CdTe. (5 refs.)

101645 Structure and intermolecular excitations of β-N_2 at 400 MPa and 55K. B.M.Powell, G.Dolling, H.F.Nieman (Chalk River Nuclear Labs., Atomic Energy of Canada Ltd., Chalk River, Ontario, Canada).
J. Chem. Phys. (USA), vol.79, no.2, p.982-91 (15 July 1983).
Elastic and inelastic neutron scattering measurements have been made on a single crystal of β-N_2 at 55K and a pressure of 400 MPa. The integrated intensities of 34 Bragg reflections were measured and analysed in terms of symmetry-adapted harmonics. None of the coefficients of the higher-order harmonics could be determined and, within experimental error, the N_2 molecule is randomly oriented. No well-defined librational modes were observed and even translational acoustic phonons are broad. The line shapes of translational acoustic phonons propagating along the hexagonal axis are analysed in terms of both Gaussian and Lorentzian line shapes and in terms of the Michel-Naudts theory of rotation-translational interactions (1978). In terms of the latter theory, β-N_2 is in the slow relaxation regime and has a strong rotation-translation interaction. The temperature dependence observed for four of these line shapes suggests that the librational excitations are no longer overdamped at 46K. Values for three of the elastic constants were determined and are (in units of 10^9 N m^{-2}): $C_{11}=4.43\pm0.14$, $C_{33}=5.92\pm0.14$, and $C_{44}=0.61\pm0.02$. (25 refs.)

101646 A neutron powder diffraction study of α- and β-PbO_2 in the positive electrode material of lead-acid batteries. A.Santoro (NBS, Nat. Measurement Lab., Washington, DC, USA), P.D'Antonio, S.M.Caulder.
J. Electrochem. Soc. (USA), vol.130, no.7, p.1451-9 (July 1983).
A neutron powder diffraction study of α and β-PbO_2, both chemically prepared and electrochemically formed in cycled battery plates, was carried out to correlate the electrochemical activity of the lead-acid battery with the atomic arrangement of the electrode constituents. The results are consistent with the presence of hydrogen in the structure of β-PbO_2, but the departure of the occupancy factors from stoichiometric values are not large enough to unambiguously establish whether there are lead or oxygen deficiencies. If the Pb:O ratio corresponds to exact stoichiometry, any hydrogen which is present must be accompanied by a reduction of Pb^{+4}. There is a significant increase in the lattice parameter *a* of β-PbO_2 in cycled battery electrodes relative to the value found in chemically prepared β-PbO_2. No change in the *c* parameter, however, was detected. These dimensional changes are consistent with a configuration for hydrogen similar to that observed in the rutile-type structure of SnO_2, in which there are OH^- ions oriented perpendicular to the *c* axis. The profile parameters obtained in this analysis show that the crystallites of β-PbO_2 in the positive plate material of a battery cycled three times are smaller than those in the chemically prepared compound, while there are no significant differences between the latter and β-PbO_2 in the positive plate material of a battery cycled 36 times. The average structure of α-PbO_2 cannot be accurately determined by profile analysis, at the present time. The difficulties encountered in the refinement may be due to extensive defects, nonspherical crystallites of small size, and/or small departures of the structure from orthorhombic symmetry. (26 refs.)

101647 Characterization of the current-blackening phenomena in scandia stabilized zirconia using transmission electron microscopy. F.K.Moghadam, T.Yamashita, D.A.Stevenson (Dept. of Materials Sci. & Engng., Stanford Univ., Stanford, CA, USA).
J. Mater. Sci. (GB), vol.18, no.8, p.2255-9 (Aug. 1983).
The nature of blackening of 8 mol.% Sc_2O_3-ZrO_2, caused by imposing high current densities on this material at 800°C and P_0, $<10^{-7}$ atm, has been investigated by transmission electron microscopy. The material studied was in the form of hot pressed polycrystalline discs with equiaxed grains 2 to 4 μm in size with a cubic fluorite structure. The current-blackened samples contained numerous polycrystalline aggregates, with crystallites 10 to 20 nm in size, and they were usually found at the grain boundaries. The lattice parameter of the phase is virtually identical to that of the original cubic-fluorite matrix phase. The electron diffraction pattern showed, however, weak reflections forbidden by the FCC symmetry of the parent phase. These reflections can only be indexed as primitive cubic, and it is proposed that grain boundary phase consists partly of non-stoichiometric zirconium suboxides (ZrO_{2-x}). The analysis of energy dispersive X-ray spectrum and electron diffraction patterns of the polycrystalline phase shows no evidence of the presence of metallic zirconium, as has been postulated previously. (18 refs.)

101648 High resolution X-ray diffraction of fully and partially magnesium stabilized beta″-alumina ceramics. F.Harbach (Brown, Boveri and Cie AG, Heidelberg, Germany).
J. Mater. Sci. (GB), vol.18, no.8, p.2437-52 (Aug. 1983).
The dependence of the unit cell size of β″-Al_2O_3 on its sodium and magnesium content has been stated in the past in a contradictory manner. This situation is clarified on the basis of high resolution Guinier photographs of the X-ray diffraction of fully stabilized ternary β″-Al_2O_3 ceramics with compositions of $Na_{1+z}Mg_zAl_{11-z}O_{17}$. The lattice constant a_0 increases with increasing z over the range of 0.5 to 0.8. In contrast, the height H of the conduction slab decreases with increasing z. Both values level off at $z \geq 0.8$. This behaviour is discussed using simple models. The X-ray diffraction patterns of β″-Al_2O_3 ceramics can show considerable splittings of reflections with high Miller indices/for compositions which do not correspond to the above formula. These splittings can be attributed to the simultaneous presence of two different β″$-Al_2O_3$ component phases-a fully and a partially magnesium stabilized one. The excess sodium of the partially stabilized component phase is shown to be charge compensated by interstitial oxygen ions in the conduction slab. (27 refs.)

101649 $K_4Mo_8{}^{V}P_{12}O_{52}$, a tunnel structure characterized by an unusual valence of molybdenum. A.Leclaire, J.-C.Monier, B.Raveau (Lab. de Cristallographie, Phys. et Chimie du Solide, Univ. de Caen, Caen, France).
J. Solid State Chem. (USA), vol.48, no.2, p.147-53 (1 July 1983).
A new phosphate of molybdenum (V) $K_4Mo_8{}^{V}P_{12}O_{52}$ has been isolated and its structure solved from a single crystal X-ray diffraction study. It crystallizes in a monoclinic cell, space group $C2/c$, with the parameters $a=10.7433(16)$ Å, $b=14.0839(9)$ Å, $c=8.8519(7)$ Å, and $\beta=126.42(1)°$. After refinement of the different parameters, the reliability factors were lowered to $R=0.026$ and $R_w=0.029$. The framework '$Mo_8P_{12}O_{52}$' can be described as corner-shaping PO_4 tetrahedra, P_2O_7 groups, and MoO_6 octahedra. Although the 'O_6' octahedron surrounding the molybdenum ion is almost regular, the metal ion is strongly off center so that its coordination is better described as a MoO_5 pyramid. This particular coordination, which characterizes Mo(V), is discussed. (23 refs.)

101650 Investigation of the structural description of the endothermic decompositions of solid 1 to solid 2+gas. III. Case of reaction $BaC_2O_4,2H_2O$ to BaC_2O_4,H_2O+H_2O: comparison of crystal structures of the two hydrates and X-ray analysis of the pseudomorphs. M.Ben Amor, J.C.Mutin (Lab. de Recherches sur la Reactivite des Solides, Faculte des Sci. Mirande, Dijon, France), A.Aubry, A.Courtois.
J. Solid State Chem. (USA), vol.48, no.2, p.215-30 (1 July 1983).
For pt.II see ibid., vol.38, p.394 (1981). The topological analysis of the crystal structure of initial and final phases of the dehydration $BaC_2O_4,2H_2O \rightarrow BaC_2O_4,H_2O+H_2O$ shows that the structural transformation may proceed by small and cooperative movements in the dihydrate's ions. Only one type of such movements may be described by this approach. However, the X-ray analysis of BaC_2O_4, $2H_2O$ crystals partially transformed into BaC_2O_4, H_2O reveals several relationships of nonequivalent orientation between the crystal lattice of the two solid phases. The possible significance of the peculiarities of the reticular orientations is discussed. (16 refs.)

101651 Investigation of the structural description of the endothermic decompositions solid 1 to solid 2+gas. IV. Core of reaction $BaC_2O_4,2H_2O$ to BaC_2O_4,H_2O+H_2O characteristics of structural rearrangement. M.Ben Amor, J.C.Mutin (Lab. de Recherches sur la Reactivite des Solides, Faculte des Sci. Mirande, Dijon, France), A.Aubry, A.Courtois.
J. Solid State Chem. (USA), vol.48, no.2, p.231-41 (1 July 1983). In French.
For pt.III see ibid., vol.48, p.215 (1983). The X-ray analysis of $BaC_2O_4,2H_2O$ crystals partially transformed into BaC_2O_4,H_2O leads to the specific reticular orientation relationships of the dehydration $BaC_2O_4,2H_2O \rightarrow BaC_2O_4,H_2O+H_2O$. Their interpretation has been made by a plane-by-plane comparison of the dihydrate crystal structure with the monohydrate. The principal features of the ionic movements are described; they differ from those which are expected from a simple topological comparison of the structures. With the assumption of a displacive transformation, coherent or semicoherent interfaces seem to be built up from all invariant plane families, as deduced from the X-ray analysis. (8 refs.)

101652 Crystal chemistry of $Tl_6{}^{III}Te^{VI}O_{12}$ and $Tl_6{}^{I}Te^{VI}O_6E_6$: an example of original stoichiochemical activity of the electronic pair $6s^2(E)$ in thallium(I). B.Frit (Lab. de Chimie Minerale Structurale, UER des Sci., Limoges, France), G.Roult, J.Galy.
J. Solid State Chem. (USA), vol.48, no.2, p.246-55 (1 July 1983).
Both crystal structures of Tl_6TeO_{12} and $Tl_6TeO_6E_6$ compounds have been determined, the former by X-ray single crystal techniques, the latter by powder neutron diffraction techniques. They crystallize in the trigonal system, space group $R\bar{3}$, the corresponding hexagonal cell parameters are $a=9.645(2)$ Å, $c=9.421(2)$ Å, and $a=9.5722(3)$ Å, $c=9.3494(4)$ Å, respectively, with $Z=3$. In both compounds tellurium(VI) is octahedrally coordinated to oxygen atoms with Te-O distances of 1.936 Å for the Tl(III)-containing compound, i.e. Tl_6TeO_{12}, and 1.946 Å for Tl_6TeO_6 (Tl(I)). Tl(III) is surrounded by seven oxygen atoms sitting at the summits of a distorted monocapped trigonal prism. Tl(I) is linked to three oxygen atoms, forming a distorted TlO_3 pyramid. The lone pairs brought by Tl(I) are in the positions precedingly occupied by oxygen atoms in the crystal structure of Tl_6TeO_{12}. This is an outstanding example of the crystallochemical role of the lone pairs E which act like oxygen atoms, making $Tl_6{}^{I}Te^{VI}O_6E_6$ isostructural with $Tl^{III}Te^{VI}O_{12}$. Structural relationships with fluorite type network are discussed. (21 refs.)

101653 On chalcogenide-iodates of antimony SbXI (X=Si, Se, Te): structure and Mossbauer spectra of ^{121}Sb. A.Ibanez, J.-C.Jumas, J.Olivier-Fourcade, E.Philippot, M.Maurin (Lab. de Chimie Mineralke C, Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
J. Solid State Chem. (USA), vol.48, no.2, p.272-83 (1 July 1983). In French.
The crystal structure of $SbXI$ (X=Se, Te) compounds has been determined by means of three-dimensional intensity data. The crystal structure of SbSeI, orthorhombic, space group Pnma with $a=8.698(2)$, $b=4.127(1)$, $c=10.412(2)$ Å, was refined at several temperatures (180K, $R=0.021$; 293K, $R=0.020$; 320K, $R=0.023$) in correlation with the paraelectric structure or SbSI stable above 293K. The crystal structure of SbTeI, triclinic, space group $P\bar{1}$, with $a=7.570(3)$, $b=7.159(3)$, $c=4.228(3)$ Å, $\alpha=107.22(5)$, $\beta=106.18(4)$, $\gamma=77.19(3)°$ has been determined by symbolic addition method and refined to a final R value of 0.035. These structures are built up from infinite weakly linked ribbons $(SbX_2)_n$ of trigonal SbX_3 with Sb-X bonds of 2.605(1), 2.795(1) Å (X=Se), and 2.829(1), 2.953(1), 2.955(1) Å (X=Te). The nature of Sb-X and Sb-I bonds is discussed in terms of the S, Se, Te substitution. Antimony-121 Mossbauer spectra have been recorded at liquid helium temperature. The data are discussed with regard to the stereochimical activity of the antimony (III) lone pair of electrons. For SbTeI the Mossbauer parameters are interpreted in terms of direct population of conductance bands by nonbonding electron pairs. (38 refs.)

101654 Preparation and properties of WP_4. N.Kinomura, K.Terao, S.Kikkawa, M.Koizumi (Inst. of Sci. & Industrial Res., Osaka Univ., Osaka, Japan).
J. Solid State Chem. (USA), vol.48, no.2, p.306-7 (1 July 1983).
Mixtures of tungsten and red phosphorous having various mixing ratios were reacted at 1000°C for 1 hr under 3 GPa in a cubic type high pressure vessel. An unknown phase was observed when the starting composition of P/W was more than 2. It was contaminated with WP_2 when $P/W<4$ and with black phosphorous when $P/W>4$. X-ray powder diffraction data are presented. Black single crystals with metallic cluster and with irregular shapes were obtained when the starting mixture of composition $P/W=4$ was held at 1000°C for 1 hr and slowly cooled to 600°C over 6 hr and then quenched to room temperature under high pressure of 3 GPa. (12 refs.)

101655 The structures of lithium inserted metal oxides: $Li_2FeV_3O_8$. R.J.Cava, A.Santoro, D.W.Murphy, S.Zahurak, R.S.Roth (Bell Labs., Murray Hill, NJ, USA).
J. Solid State Chem. (USA), vol.48, no.3, p.309-17 (15 July 1983).
Neutron diffraction powder profile analysis has been used to determine the structure of $Li_2FeV_3O_8$. The compound is prepared from FeV_3O_8, which has the $VO_2(B)$ structure type, by a lithium insertion reaction employing n-BuLi. Only minimal distortion of the host lattice occurs on Li insertion. The Li ions occupy five coordinate square pyramidal sites with an average Li-O bond distance of 2.04 Å. These five coordinate sites occur commonly in the capped perovskite cavities of crystallographic shear structures based on ReO_3. (14 refs.)

101656 Crystal structure of the 6H $BaCrO_3$ polytype. B.L.Chamberland (Dept. of Chem., Univ. of Connecticut, Storrs, CT, USA).
J. Solid State Chem. (USA), vol.48, no.3, p.318-22 (15 July 1983).
A product from the reaction between CrO_2 and Ba_2CrO_4 at 900°C under 60-65 kbar was found to be the six-layer polytype of $BaCrO_3$ from powder diffraction studies. A hexagonal black crystal obtained from this reaction was isolated for single crystal studies and structure determination. The crystal was found to possess a six-layer stacking sequence of BaO_3 layers with space group $P6_3/mmc$ and had unit cell parameters $a=5.629(2)$, $c=13.698(6)$ Å, and $Z=6$. The structure was determined from 936 independent reflections of which 693 were considered observed. Averaging equivalent reflections yielded 163 unique, observed reflections. Refinement of the structure by least-squares methods gave a conventional R value of 4.8% ($R_W=6.2\%$). The structure consists of a six-layer stacking sequence of close-packed BaO_3 layers containing tetravalent chromium in all the octahedral oxygen interstices. The compound was found to be isostructural with previously reported $BaMO_3$ phases. (18 refs.)

101657 Preparation and characterization of the system $BaBr_xCl_{2-x}$: The structure of BaBrCl. S.A.Hodorowicz, E.K.Hodorowicz, H.A.Eick (Dept. of Chem., Michigan State Univ., East Lansing, MI, USA).
J. Solid State Chem. (USA), vol.48, no.3, p.351-6 (15 July 1983).
The variations in the lattice parameters in the $BaBr_xCl_{2-x}$ system have been determined for the composition range $2.0>x>0.0$. All phases exhibit the $PbCl_2$-type orthorhombic structure and are assignable to space group $Pnma$. The crystallographic parameters of BaBrCl were determined by the Rietveld method from a line profile analysis of a digitized powder X-ray diffraction pattern. The anions are ordered with the bromide ion occupying the square pyramidal hole, and the chloride ion the smaller tetrahedral hole. Atomic coordinates are presented. (17 refs.)

101658 Channel structures based on octahedral frameworks: The crystal structure of $TlTi_5Se_8$, TlV_5Se_8, and $TlCr_5Se_8$ and its relationships to $TlCr_3S_5$, hollandites, and psilomelane. K.Klepp (Inst. fur Anorganische Chem., Tech. Hochschule Aachen, Aachen, Germany), H.Boller.
J. Solid State Chem. (USA), vol.48, no.3, p.388-95 (15 July 1983).
$TlTi_5Se_8$, TlV_5Se_8, and $TlCr_5Se_8$ are monoclinic compounds with space group C2/m which crystallise with the TlV_5Se_8 structure type. The lattice constants of these three compounds are reported using X-ray diffraction methods and least squares refinements. A unified scheme is developed for the TlV_5S_8, $TlCr_3S_5$, hallandite, and psilomelane structures on the basis of ideal close packing. (17 refs.)

101659 The synthesis and crystal structure of α-Ca_3UO_6. J.Holc, L.Golic (J. Stefan Inst., E. Kardelj Univ., Ljubljana, Yugoslavia).
J. Solid State Chem. (USA), vol.48, no.3, p.396-400 (15 July 1983).
Single crystals of α-Ca_3UO_6 were grown from a UO_3-$CaCl_2$-CaO melt by the slow cooling method from 950°C. The crystal structure was determined by means of X-ray diffraction with $R=0.032$ and $R_W=0.019$. The structure of α-Ca_3UO_6 is of Mg_3TeO_6 type. α-Ca_3UO_6 is rhombohedral with $a=6.729(1)$ Å, $\alpha=90.30$ (1)°, $Z=2$, $D_c=4.955$ g/cm^3, $D_m=4.79$ g/cm^3, space group $R3$. Uranium and calcium atoms are six-coordinated. At 1200°C rhombohedral α-Ca_3UO_6 irreversibly transforms to monoclinic β-Ca_3UO_6. (16 refs.)

101660 The crystal structure of $RbHSeO_4$: A neutron diffraction study of the paraelectric phase. I.Brach, D.J.Jones, J.Roziere (Lab. des Acides Mineraux, Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
J. Solid State Chem. (USA), vol.48, no.3, p.401-6 (15 July 1983).
The structure of the paraelectric phase of $RbHSeO_4$ has been determined at 387K by neutron diffraction. The structure consists of chains of hydrogen bonded SeO_4 groups extending along the crystallographic b axis. Two different hydrogen bonds have been characterized, with O-O distances of 2.524(4) and 2.583(3) Å. In the shorter O-H-O hydrogen bond the hydrogen atom is disordered, suggesting that the ordering of hydrogen participates directly in the phase transition to the ferroelectric phase. (10 refs.)

101661 The structure of a cubic hydrogen rhenium bronze, $H_{1.36}ReO_3$. P.G.Dickens, M.T.Weller (Inorganic Chem. Lab., Oxford Univ., Oxford, England).
J. Solid State Chem. (USA), vol.48, no.3, p.407-11 (15 July 1983).
The structure of $D_{1.36}ReO_3$ has been determined by a room temperature powder neutron diffraction study. The unit cell is body centered cubic (space group $Im3$) and contains eight formula weights ($a=7.497 \pm 0.001$ Å). A least squares method based on peak intensities was used to refine the structure. The rhenium atoms lie on the special perovskite sites and are surrounded by distorted octahedra of oxygen atoms which are displaced towards the vacant perovskite A sites. The deuterium atoms are statistically distributed over 72 possible sites in the unit cell, as OD bonds. (12 refs.)

101662 · Evidence for a new eight atom B anion in $Tl_4[B_8O_{12}(OH)_4]H_2O$. M.Touboul, C.Bois (Lab. de Chimie Structurale des Materiaux, Univ. Pierre et Marie Curie, Paris, France), D.Amoussou.
J. Solid State Chem. (USA), vol.48, no.3, p.412-19 (15 July 1983). In French.
The structure solution of an hydrated thallium diborate previously formulated $Tl_2B_4O_7.2H_2O$ has led to the correct formula $Tl_4[B_8O_{12}(OH)_4]H_2O$. This compound is triclinic with $a=7.221(4)$ Å, $b=9.494(4)$ Å, $c=15.592(8)$ Å, $\alpha=114.86°(4)$, $\beta=90.25°(7)$, $\gamma=99.70°(4)$, $Z=2$, space group $P\bar{1}$. Independent reflections numbering 1594 were used in the solution and refinement of the structure to $R=0.039$ ($R_W=0.042$). The structure contains a new unit $[B_8O_{12}(OH)_4]^{4-}$, formed by four $BO_4(T)$ tetrahedra and four $BO_3(\Delta)$ triangles. In the Christ and Clark classification for borates (1977), the structural formula should be written $[B_7O_{10}(OH)_3.OBO(OH)]^{4-}$. A fundamental building block with seven boron atoms is found for the first time; the correspondent fully hydrated polyanion is $[B_7O_9(OH)_7]^{4-}$; the shorthand notation is $7{:}3\Delta+4T$. The units $[B_7O_{10}(OH)_3.OBO(OH)]^{4-}$ or $7{:}(3\Delta+4T)+\Delta$ are linked together to form an infinite chain. Tl^+ and H_2O are located between the chains. (20 refs.)

101663 Neutron and X-ray diffraction study on polymorphism in lithium orthotantalate, Li_3TaO_4. M.Zocchi, M.Gatti (Dipartimento di Chimica Industriale, Politecnico di Milano, Milan, Italy), A.Santoro, R.S.Roth.
J. Solid State Chem. (USA), vol.48, no.3, p.420-30 (15 July 1983).
The structures of the low- and high-temperature modifications of lithium orthotantalate, Li_3TaO_4, have been determined by neutron and X-ray diffraction methods. The low-temperature, or β, phase has symmetry $C2/c$ and lattice parameters $a_l=8.500(3)$, $b_l=8.500(3)$, $c_l=9.344(3)$ Å, and $\beta=117.05(2)°$. The high-temperature, or α, phase has symmetry $P2$ and lattice parameters $a_h=6.018(1)$, $b_h=5.995(1)$, $c_h=12.865(2)$ Å, and $\beta_h=103.53(2)°$. Both structures are ordered. The β-phase has a rock salt-type

structure with a 3:1 ordering of the Li^+ and Ta^{5+} ions. Its structure can be generated from the low-temperature modification by means of a complex pattern of shifts of the Ta^{5+} ions. (10 refs.)

101664 Bonding and structure of $CoSi_2$ and $NiSi_2$. J.Tersoff, D.R.Hamann (Bell Labs., Murray Hill, NJ, USA).
Phys. Rev. B (USA), vol.28, no.2, p.1168-70 (15 July 1983).
Self-consistent calculations of the electronic structure of $CoSi_2$ and $NiSi_2$ give insight into the nature of the bonding and suggest an explanation of the unique structure of these two compounds. A quasigap separates bonding and antibonding states. For $CoSi_2$ and $NiSi_2$, E_F falls in or near the quasigap. The Si atoms exhibit sp^3 hybridization, absent in many other silicides. Ionicity is negligible. Bonding is well described by a directed valence-orbital picture, except for free-electron (interstitial) character at higher energies. (9 refs.)

101665 Isomorphism among commensurate and incommensurate high-temperature phases of A_2BO_4 compounds. F.Tuinstra, A.J.van den Berg (Lab. of Appl. Phys., Delft Univ. of Technol., Delft, Netherlands).
Phase Transitions (GB), vol.3, no.4, p.275-82 (1983).
The incommensurate and commensurate superstructures of K_2MoO_4, Rb_2WO_4 and K_2WO_4 are shown to have orthorhombic symmetry rather than the hexagonal symmetry, reported earlier. The structures belong essentially to the β-K_2SO_4 type. The β-K_2SO_4 structure can be regarded as a commensurate superstructure of the α-K_2SO_4 structure by doubling of the unit cell. In this sense β-K_2SO_4 and K_2MoO_4 have the same average structures. Rb_2WO_4 displays a lock-in transition at 681K where the incommensurate distortion wave vector jumps from an incommensurate value to the value 0.5 which results in the β-K_2SO_4 type. The distortion wave vectors of the other compounds range from 0.25 to 0.5. (8 refs.)

101666 PNb_2S_{10} a new two-dimensional sulfide. Synthesis and structural characterization. R.Brec, P.Grenouilleau, M.Evain, J.Rouxel (Lab. de Chimie des Solides, UER de Chimie, Nantes, France).
Rev. Chim. Miner. (France), vol.20, no.3, p.295-304 (1983).
The new layered sulfide PNb_2S_{10} is obtained by high temperature synthesis from the elements. It crystallizes in the orthorhombic symmetry, with the parameters $a=13.739(2)$ Å, $b=12.950(1)$ Å and $c=7.211(1)$ Å, space group $P2_12_12$, Z=4 and V=1283(1) $Å^3$. The structure is built up from distorted bicapped trigonal prisms $[NbS_8]$ sharing a rectangular face to constitute $[Nb_2S_{12}]$ units (average $d_{Nb\text{-}S}=2.547$ Å). These units are bonded through the S-S prism edges and through one of the bicapping sulfur atom to make infinite $[Nb_2S_9]$ chains linked together on each side by tetrahedral $[PS_4]$ groups (average $d_{P\text{-}S}=2.051$ Å). Between the two-dimensional planes thus obtained, only van der Waals' gaps are found. Both well characterized $(S_2{}^{-II})$ and S^{-II} anionic species are present in the structure, along with niobium-niobium pairing ($d_{Nb^{IV}\text{-}Nb^{IV}}=2.869(1)$ Å). PNb_2S_{10} who's developed formula is $P_2{}^VNb_4{}^{IV}S_6{}^{-II}(S_2{}^{-II})_7$ is a diamagnetic insulator. (10 refs.)

101667 Crystal structure of MSb_3F_{10} (M=NH_4, Rb, Tl). B.Ducourant, R.Fourcade, G.Mascherpa (Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
Rev. Chim. Miner. (France), vol.20, no.3, p.314-20 (1983). In French.
The crystal structure of $NH_4Sb_3F_{10}$ has been solved on single crystal $P2_1/c$ space group (R=0.07 for 1934 reflections). The structure consist of $(Sb_3F_{10})_x{}^{x-}$ layers. One can see a $Sb_2F_7{}^-$ linked with a SbF_3 unit. This kind of arrangement is quite different from the one observed in $NaSb_3F_{10}$ where exists a true $Sb_3F_{10}{}^-$ ion. (15 refs.)

101668 Study of $BaAl_4S_7$ and $BaGa_4S_7$. B.Eisenmann, M.Jakowski, H.Schafer (Eduard-Zintl-Inst., Tech. Hochschule Darmstadt, Darmstadt, Germany).
Rev. Chim. Miner. (France), vol.20, no.3, p.329-37 (1983). In German.
The new isotypic compounds $BaAl_4S_7$ and $BaGa_4S_7$ crystallize in the orthorhombic system, space group $Pmn2_1$ with the lattice constants $BaAl_4S_7$: $a=14.814\pm0.004$ Å, $b=6.218\pm0.002$ Å, $c=5.891\pm0.002$ Å; $BaGa_4S_7$: $a=14.774\pm0.004$ Å, $b=6.237\pm0.002$ Å, $c=5.934\pm0.002$ Å. AlS_4-and GaS_4-tetrahedra respectively are connected by common corners to a framework with two negative charges per formula unit resulting from the (8-N)-rule by using the number of bonds of the constituent atoms. (31 refs.)

101669 Crystallochemistry of $GaPO_4$, $AlAsO_4$ and $GaAsO_4$ phases. Comparison with α-quartz type structure. A.Goiffon, G.Bayle, R.Astier, J.-C.Jumas, M.Maurin, E.Philippot (Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
Rev. Chim. Miner. (France), vol.20, no.3, p.338-50 (1983). In French.
Quartz α type $GaPO_4$, $AlAsO_4$ and $GaAsO_4$ have been synthetised and their structures have been refined at room temperature and at 173K. Between these two temperatures, the structures are completely rigid. Distortions of tetrahedral sites have been evaluated. The comparison of these three compounds with isotype phases of known structures (SiO_2, GeO_2, $AlPO_4$, $FePO_4$) shows a regular evolution of these distortions with the atomic size and the c/a ratio. (22 refs.)

101670 New fluorides of tetravalent cerium, praseodymium and terbium. K.Feldner, R.Hoppe (Inst. fur Anorganische und Analytische Chem., Justus Liebig-Univ. Giessen, Giessen, Germany).
Rev. Chim. Miner. (France), vol.20, no.3, p.351-67 (1983). In German.
The authors have prepared 22 fluorides containing Ce^{4+}, Pr^{4+} and Tb^{4+}, most of these for the first time; e.g. Cs_3CeF_7 ($a=9.94_9$ Å), Rb_3CeF_7 (9.53_7 Å), Cs_3PrF_7 (9.91_3 Å), Rb_3PrF_7 (9.51_1 Å), K_3PrF_7 (HPM:9.11 Å), Cs_3TbF_7 (9.80_1 Å), Rb_3TbF_7 (9.39_6 Å) and K_3TbF_7 (9.07_9 Å) as well as mixed fluorides like $CsRbKTbF_7$ (9.39_6 Å). All fluorides are colourless and of the $(NH_4)_3ZrF_7$-type of structure. They report the Raman Spectra of all samples. As the first fluorides of the type $A^{II}RE^{IV}F_6$ (RE=Pr, Tb) they obtained $BaPrF_6$ ($a=8.02_4$ Å, $b=11.58_0$ Å, $c=5.61_6$ Å) and $SrTbF_6$ ($a=7.69_5$ Å, $b=11.01_5$ Å, $c=5.39_7$ Å), both colourless, $RbPaF_6$-type of structure as well as $SrPrF_6$ ($a=7.09_4$ Å, $c=7.29_8$ Å), colourless, to understand as $Sr_{0.5}Pr_{0.5}F_3$ with LaF_3-type of structure, and $BaTbF_6$ of unknown structure. (32 refs.)

101671 Crystal structure of $PbZr_6F_{22}O_2$, Structural relations with KY_3F_{10}, KH_0F_7, CsU_6F_{25} and fluoride types. J.-P.Laval, B.Frit (Lab. de Chimie Minerale Structurale, UER des Sci., Limoges, France).
Rev. Chim. Miner. (France), vol.20, no.3, p.368-84 (1983). In French.
$PbZr_6F_{22}O_2$ crystallizes with hexagonal symmetry and unit-cell parameters $a=12.997(6)$ Å, $c=15.008(7)$ Å (space-group $P6_3/mcm$; Z=6). Its structure has been solved and refined to a conventional R=0.028 for 395 independent reflexions recorded on an automatic three-circle diffractometer, but on the basis of a reduced cell with parameters $a=7.504(4)$ Å, $c=15.008(7)$ Å and space group $P6_3/mmc$ (Z=2). It is an original three-dimensional framework of ZrF_7O square antiprisms with mainly two kinds of cavities. The first cuboctahedral ones contain one extra fluorine atom; the second ones more voluminous and complex contain [12+6]-coordinated Pb atoms. The structural characteristics of the $Zr_6F_{31}O_6$ clusters of the quite similar Zr_6F_{37} and $(Ca, Y)_6F_{37}$ ones found respectively in the $Na_7Zr_6F_{31}$ and $Ca_{14}Y_5F_{43}$ (tveitite) structures, or of its U_6F_{38} homologues in CsU_6F_{25} structure, as well as the structural relationships with structures like KY_3F_{10}, βKYb_3F_{10}, KHo_2F_7 or CsU_6F_{25} and αKTh_6F_{25} have been analysed and detailed. Oxygen atoms have been shown to be strictly localised within the anionic sublattice and their structural role has been emphasized. (22 refs.)

101672 Composition of the general formula $Na_xLn_{1/3}Nb_{1-x}Ti_xO_3(0\leq x\leq2/3)$. Correlation between structural evolution and photoelectric properties. G.Le Flem, D.Conte, G.Campet, J.Claverie (Univ. de Bordeaux I, Talence, France).
Rev. Chim. Miner. (France), vol.20, no.3, p.411-20 (1983). In French.
A crystal chemical study of materials with general formula $Na_xLn_{1/3}Nb_{1-x}Ti_xO_3$(Ln=La, Nd)$(0\leq x\leq2/3)$ shows in each system the existence of three new phases related to the perovskite type. The comparison between the photoelectrochemical properties of $Nd_{1/3}NbO_3$ and of $Na_{2/3}Nd_{1/3}Nb_{1/3}Ti_{2/3}O_3$ leads to a relatively accurate description of the bonding evolution due to sodium insertion. (12 refs.)

101673 Crystal structure of $Cs_4P_4O_8S_4$. V.V.Ilyukhin, V.R.Kalinin, T.B.Kuvshinova, I.V.Tananaev (N.S. Kurnakov Inst. of General & Inorganic Chem., Acad. of Sci., Moscow, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.85-8 (Nov. 1982).
The crystal structure of $Cs_4P_4O_8S_4$ was studied using paper chromatography, chemical, X-ray phase, and differential thermal analyses, and IR spectroscopy. In order to decipher the crystal structure the authors used 2200 nonzero reflections $F_{hkl}{}^2$ $[I>3\sigma(I)]$, from which they constructed the three-dimensional Patterson function P(uvw). (5 refs.)

101674 Crystal structure of the α'-modification of dicalcium silicate $Ca(Ca,Sr)SiO_4$. A.M.Il'inets, N.N.Nevskii, V.V.Ilyukhin, M.Ya.Bikbau, N.V.Belov (A.V. Shubnikov Inst. of Crystallography, Acad. of Sci., Moscow, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.906-7 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.641-4 (Nov. 1982).
The experimental data—660 $I(hkl)>3\sigma(I)$—were obtained from a spherical specimen with the parameters $a=20.871(2)$, b=9.496(1), c=5.600(1) Å, $\alpha=\beta=\gamma=90°$ (MoKα radiation, $\sin\theta/\lambda\leq0.7$ $Å^{-1}$). Analysis of the systematic extinctions indicated two possible space groups: $Pna2_1$ and $Pnma$. The Patterson function was found by the method of symmetrization within the framework of the first group. A series of electron-density synthesis $\rho(xyz)$ enabled 21 atoms to be located in an independent part of the unit cell. (9 refs.)

101675 Interrelation of crystal structure with physical properties in complex perovskite-type oxides. S.Nomura, K.Uchino (Tokyo Kogyo Univ., Tokyo, Japan).
Solid State Phys. (Japan), vol.18, no.2, p.71-86 (Feb. 1983). In Japanese.
In examining crystal formation mechanisms of oxides of complex perovskite ionic pairing both lawful and unlawful and the elucidation of the latter by X-ray and electron beam analysis are treated. The morphotropic phase boundary and its dependence on temperature is examined. Electronic conductivity of a complex perovskite with diffuse phase changes and dependence of conductivity on structural rules are studied. Magnetic properties and optical properties, and their coupling phenomena such as ferroelectromagnetic and electrostrictive effects are reviewed. (84 refs.) *M.O.*

101676 Neutron scattering study of brominated $(SN)_x$. L.Pintschovius, M.Kobbelt (Inst. fur Angewandte Kernphys. I, Kernforschungszentrum Karlsruhe, Karlsruhe, Germany).
Synth. Met. (Switzerland), vol.6, no.1, p.25-9 (June 1983).
Single crystals of brominated $(SN)_x$ have been ivestigated by means of elastic and inelastic neutron scattering. The results indicate that bromine is regularly incorporated into the outer parts of the $(SN)_x$ fibers, whereas the inner parts remain unchanged. (8 refs.)

101677 X-ray study of the layer structure of graphite-antimony chloride intercalation compounds. M.H.Boca (Dept. of Electrical Engng., Univ. of Kentucky, Lexington, KY, USA), M.L.Saylors, D.S.Smith, P.C.Eklund.
Synth. Met. (Switzerland), vol.6, no.1, p.39-51 (June 1983).
Presents the results of an X-ray diffraction study of stages 1, 2 and 3 graphite-antimony chloride intercalation compounds. Integrated intensity data on the $(00l)$ diffraction peaks were analyzed in terms of a centrosymmetric structural model involving periodic stacking of atomic layers of carbon, antimony and chlorine. The results of the X-ray data analyses are found to be in good agreement with recent (^{121}Sb) Mossbauer results which report large concentrations of both trivalent (Sb^{3+}) and pentavelent (Sb^{5+}) antimony in the intercalate layers. The X-ray derived stoichiometries were found to be $C_{13.2}SbCl_{4.8}$, $B_{26.9}SbCl_{5.0}$, and $C_{47}SbCl_{5.7}$ for the stage 1, 2, and 3 compounds, respectively. The authors are unable to distinguish separate contributions to a central Sb^{5+} layer from $SbCl_5$ and $SbCl_6$ molecules. The authors find the Sb^{3+} layers located at $z=\pm0.07$ Å relative to an Sb^{5+} mirror plane $(z=0)$ in the center of the intercalate layer. These locations for the Sb^{3+} layers suggest that $SbCl_3$ molecules are oriented in a configuration in which each $SbCl_3$ molecule bridges the space between bounding carbon layers. The Cl^- layers $(z=\pm1.40$ Å) were found to contact the bounding carbon layers. (27 refs.)

101678 Structures and magnetic properties of rare earth compounds in the melilite group. Y.Ochi, H.Morikawa, F.Marumo (Res. Lab. of Engng. Materials, Tokyo Inst. of Technol., Yokohama-shi, Japan), H.Nozaki.
Yogyo-Kyokai-Shi (Japan), vol.91, no.5, p.229-35 (1983). In Japanese.
A series of new rare earth compounds $Ln_2GeBe_2O_7$ (Ln=Y, La, Pr, Sm, Gd, Dy and Er) have been synthesized. With Cu Kα radiations, 1701 powder X-ray diffraction data were collected for each of these compounds by a step scan method with a step interval of 0.05° in 2θ, and the structure analysis of the compounds was carried out by the powder pattern fitting method. Atomic coordinates and isotropic temperature factors were determined by using the least-squares program PFLS-M. The crystals have tetragonal melilite structures composed of layers of GeO_4 and BeO_4 tetrahedra parallel to (001) and rare earth ions connecting the layers along the c-axis. The c-value decreased with decrease in the ionic radius of the rare earth ions between the layers, showing a typical lanthanoid contraction. The a-axis which is parallel to layers also contacted, since the size of the Be_2O_7 double pyramids became smaller with decreasing ionic radius of the rare earth ions. Comparing eight-fold coordination sites at interlayers in the present compounds with other melilites, the former was less distorted than the latter. Though the rare earth compounds usually show the magnetic transitions at low temperatures, the present compounds showed paramagnetism down to 4.8K. (23 refs.)

Crystal structure and density data. II. Titanium halides and chalcogenides .... See Entry 98667

Polymorphism and superconductivity of $LaIr_2Si_2$ .... See Entry 101616

The $TlCl/PbCl_2$ system .... See Entry 101906

SnS_2-Tl_2S section of the thallium-tin-sulphur system .... See Entry 101910

X-ray study of the thermal expansion in $CuAlS_2$, and $CuGaS_2$, and $CuInS_2$ compounds over the temperature range from 90 to 650K ....See Entry 102023

Relations between crystal structures and ionic conductivity ...See Entry 102052

Electrical conductivity of doped poly(1-methyl 2,5-pyrrolylene) ....See Entry 102368

Magnetic properties and structural chemistry of ternary silicides (RE, Th, U)Ru_2Si_2 (RE=rare earth) ....See Entry 102618

Magnetic properties of the $Cr_{7-x}Fe_xTe_8$ (x=0 to 3) system .See Entry 102659

ESR of Mn^{2+} ions in ZnP_2 and structural correlations ....See Entry 102730

Reconsidering the existence of cubic sublimated P_4S_{10} ....See Entry 102891

Spectroscopic properties of some Eu^{3+} doped scheelite-related rare earth sesquimolybdates and sesquitungstates ....See Entry 102903

Synthesis of a new ramsdellite-like phase of approximate composition, $Li_2MgSn_3O_8$ ....See Entry 103045

$V_{3.2}W_{1.8}O_{13}$ and studies of the V_2O_5-WO_3-VO_2 ternary system ....See Entry 103127

Effect of the conditions of synthesis and heat-treatment regime on the magnetic properties of iron sulfides with a Curie temperature of 570°C ....See Entry 104341

61.65 SPECIFIC STRUCTURE OF ORGANIC COMPOUNDS

101679 Novel example of simultaneous double N-inversion in the solid state. M.Kaftory (Dept. of Chem., Technion-Israel Inst. of Technol., Haifa, Israel).
J. Am. Chem. Soc. (USA), vol.105, no.12, p.3832-6 (15 June 1983).
Two configurational isomers (endo and exo) of the mono-adduct and one isomer (endo, endo) of the bis-adduct of 11-cyano-1,6-methano[10]annulene with 4-methyl-1,2,4-triazoline-3,5-dione have been isolated and their crystal structures determined by X-ray diffraction methods. The thermodynamically less stable isomer (exo) is transformed to the endo isomer upon heating a solid sample to ca. 175°C. This process was detected by high-temperature diffraction methods. The change of configuration is explained by a simultaneous double N-inversion with a doubly planar transition state. (18 refs.)

101680 Crystal and molecular structure of biacetyl (2,3-butanedione), $(H_3CCO)_2$, at −12 and −100°C. K.Eriks, T.D.Hayden (Dept. of Chem., Boston Univ., Boston, MA, USA), S.Hsi Yang, I.Y.Chan.
J. Am. Chem. Soc. (USA), vol.105, no.12, p.3940-2 (15 June 1983).
The crystal structure of solid biacetyl has been determined at −12 and −100°C. Crystals are monoclinic, space group $P2_1/n$, with unit cell parameters a=7.514 (29) Å, b=5.249 (22) Å, c=6.552 (21) Å, and β=116.1 (3)° at −12°C and a=7.384 (35) Å, b=5.205 (27) Å, c=6.533 (28) Å, and β=117.4 (4)° at −100°C, Z=2, d(calcd)=1.232 g cm^{-3} at −12°C, d(calcd)=1.280 g cm^{-3} at −100°C. Data were collected on a Nicolet $P2_1$ diffractometer and refined by least-squares methods to R=0.048 at −12°C and R=0.081 at −100°C. There is no phase transition between −12 and −100°C. The biacetyl molecule has the trans configuration and molecular symmetry $\bar{1}$. The most important distances are C=O=1.20 (6) Å, C-C(methyl)=1.476 (6) Å, and C-C(central)=1.540 (6) Å. The high value for the central C-C distance is discussed. The six non-hydrogen atoms are coplanar. (26 refs.)

101681 Tetramethyldithiadiselenafulvalene (TMDTDSF): properties of its hexafluorophosphate salt and alloys with tetramethyltetraselenafulvalene. F.Wudl, W.M.Walsh,Jr., J.J.Hauser, F.J.DiSalvo, D.Nalewajek, L.W.Rupp,Jr., J.V.Waszczak, R.J.Felder (Bell Labs., Murray Hill, NJ, USA), T.O.Poehler, P.M.Chaikin, R.Lacoe.
J. Chem. Phys. (USA), vol.79, no.2, p.1004-12 (15 July 1983).
Preparation and some properties of tetramethyldithiadiselenafulvalene (TMDTDSF) are described. It forms the expected $(donor)_2$ X salts. Properties of the PF_6^- salt are described as well as properties of alloys of the title compound with tetramethyltetraselenafulvalene (TMTSF). $(TMDTDSF)_2PF_6$ is a relatively poor conductor even though it is isomorphous with the high-pressure superconductor $(TMTSF)_2PF_6$. The profound difference in properties between these two solids is ascribed to disorder in the arrangement of sulfur and selenium atoms along the donor stacks in $(TMDTDSF)_2PF_6$. Alloying very small amounts of TMDTDSF into $(TMTSF)_2PF_6$ causes the metal-to-insulator transition temperature (T_{MI}) to move up smoothly from 11K for pure $(TMTSF)_2PF_6$ to ~200K for pure $(TMDTDSF)_2PF_6$ due to increasing disorder as TMDTDSF is incorporated. (21 refs.)

101682 Crystal structure of solid bromoform. R.Myers, B.H.Torrie (Guelph-Waterloo Program for Graduate Work in Phys., Univ. of Waterloo, Waterloo, Ontario, Canada), B.M.Powell.
J. Chem. Phys. (USA), vol.79, no.3, p.1495-504 (1 Aug. 1983).
The crystal structures of the three solid phases of deuterated bromoform have been determined using the neutron powder profile refinement technique. At 273K, there are two molecules per unit cell in a hexagonal structure with space group $P\bar{3}$. The molecules are statistically disordered to give a pseudo-symmetry with space group $P6_3/m$. Rapid cooling of the sample freezes out the dynamic disorder and results in a metastable structure with trigonal space group $P3$, in which a given molecule is surrounded by molecules of the opposite orientation with C-D bonds in the c direction. This structure can be viewed as being made up of molecular bilayers parallel to the basal phase with the deuterium atoms in the interior of a bilayer. The transformation from this metastable trigonal phase to the stable phase at low temperatures involves mainly a translational motion of one bilayer with respect to the neighboring bilayers. Assuming threefold molecular symmetry, this structure has been determined at 14 and 220K. It is found to be triclinic (space group $P\bar{1}$) with two molecules per unit cell. (14 refs.)

101683 Crystal structure and electronic states of dithieno[3,2-*b*:2′,3′-*d*]thiophene. F.Bertinelli, P.Palmieri, C.Stremmenos (Istituto di Chimica Fisica e Spettroscopia, Bologna, Italy), G.Pelizzi, C.Tallani.
J. Phys. Chem. (USA), vol.87, no.13, p.2317-22 (23 June 1983).
A structural, spectroscopic, and theoretical study on the electron donor dithieno[3,2-*d*:2′,3′-*d*]thiophene (DTT) crystal is presented. The crystals are monoclinic (space group $P2_1/n$) with four molecules per unit cell; atomic coordinates, bond lengths, angles, and the orientation of the optical indicatrix with respect to crystallographic axes are reported. The polarized UV absorption spectra of the single crystal, the electronic structure, and the symmetries of the first excited molecular singlet states are discussed, the observed transitions being compared with the results of an extended ab initio SCF/CI computation using the STO/3G expansion of atomic orbitals. Evidence of a strong 3^1A_1-1^3B_2 spin-orbit interaction leading to an efficient intersystem crossing to the first excited triplet state is deduced from the emission spectra. (14 refs.)

101684 Lattice parameters, thermal expansion coefficients, and vacancy density in solid CD_4. A.I.Prokhvatilov, A.P.Isakina (Phys.-Tech. Inst. of Low Temperatures, Acad. of Sci., Kharkov, Ukrainian SSR).
Phys. Status Solidi a (Germany), vol.78, no.1, p.147-55 (16 July 1983).
X-ray measurements of lattice parameters of deuteromethane are carried out in the range 5 to 89.5K. The density, molar volumes, and thermal expansion coefficients are found, as well as magnitudes of volume changes at phase transitions and melting. The constant-volume heat capacity, Gruneisen constants, adiabatic and isothermal compressibilities are calculated. Comparing the X-ray and the extrapolated dilatometric thermal expansion coefficients, the density, volume and formation enthalpy of thermal equilibrium vacancies are estimated. The values obtained are compared with those observed in methane and solid noble gases. (24 refs.)

101685 Crystal and molecular structure of 1,6,9,12,17,20-hexaoxacyclodocosane-2,5,13,16-tetra-one. S.T.Malinovskii, Yu.A.Simonov, N.G.Luk'yanenko, V.A.Shapkin, T.L.Malinovskii (Inst. of Appl. Phys., Acad. of Sci., Kishinev, Moldavian SSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.895-6 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.88-91 (Nov. 1982).
The authors study the structure of the twenty-two membered macrocycle 1,6,9,12,17,20-hexaoxacyclodocosane-2,5,13,16-tetra-one. For the investigation they chose a colorless single crystal of prismatic habit with dimensions 0.4×0.5×1.2 mm. The experimental data were obtained on a computer (M-600)-controlled DAR-UMB diffractometer in CuKα radiation by the combined ω-$\theta/2\theta$ method. For the calculation they used 1526 reflections with $I \geq 3\sigma(I)$. The structure was solved by direct methods using the YANX program. (9 refs.)

101686 Crystal and molecular structure of dioximeacetone thiosemicarbazone. B.Ya.Antosyak, V.N.Biyushkin, T.I.Malinovskii, N.I.Belicheuk (Inst. of Appl. Phys. & Inst. of Chem., Acad. of Sci., Kishinev, Moldavian SSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.901-3 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.382-5 (Nov. 1982).
The authors have carried out an X-ray diffraction investigation of dioximeacetone thiosemicarbazone, of composition $C_4H_7N_5O_2S$. The crystals were pale yellow, needle-shaped, and of rhombic syngony. The crystal characteristics were: a=11.429(6), b=16.583(6), c=4.307(5) Å; space group $P2_12_12_1$; Z=4; d_{calc}=1.55 $g.cm^{-3}$, μ (CuKα)=34.7 cm^{-1}. Intensities of 813 independent reflections with $I>2\sigma$ were measured on the DAR-UMB diffractometer. The structure was solved by the heavy-atom method and refined by the least-squares method in the isotropic approximation to R=0.088. (1 ref.)

61.70 DEFECTS IN CRYSTALS

(see also 61.80 Radiation damage, 62. Mechanical and acoustic properties, 71.55 Impurity and defect levels, 76.30M EPR of colour centres and other defects, 78.50 Impurity and defect absorption in solids, 81.40 Treatment of materials)

101687 Fresnel fringe contrast of faceted voids within gem-quality diamond. J.L.Hutchison, L.A.Bursill (Dept. of Metall. & Sci. of Materials, Univ. of Oxford, Oxford, England).
J. Microsc. (GB), vol.131, pt.1, p.63-6 (July 1983).
The topology of faceted void-like defects ('voidites') in gem-quality type Ia diamonds has been revealed by high resolution phase-contrast electron microscopy. Interpretation of the images in terms of a Fresnel contrast mechanism allows the defects to be identified as octahedral in shape. Image contrast is sensitive to defocus and other parameters, and Fresnel fringe interference effects may generate 'superlattice'-like contrast. (6 refs.)

101688 Lattice relaxation, radiative and non-radiative deexcitation at localized defects. J.M.Langer (Inst. of Phys., Polish Acad. of Sci., Warsaw, Poland).
Radiat. Eff. (GB), vol.72, no.1-4, p.55-72 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
The influence of defect-lattice coupling on energy structure and recombination processes at localized defects is discussed. The emphasis is put on those processes in which the charge state of the defect changes. Among the topics discussed are: extrinsic self-trapping, negative U defects, metastable defect states, multiphonon recombination and recombination induced defect reactions. (59 refs.)

Quantitative modelling of swelling in M316 steel ....See Entry 101754

Double gauge theory of stresses and defects ....See Entry 101843

Homogeneity of semi-insulating GaAs substrates for GaAs IC ....See Entry 101991

Effects of oxygen content on pressure-induced superconductivity in $EuMo_6S_8$ ....See Entry 102554

Progress in the analysis of defect structures with ENDOR spectroscopy ....See Entry 102778

The influence of radiation defects on the nonlinear properties of TGS in the neighbourhood of the temperature of ferroelectric transition .See Entry 102828

Positrons and solid state physics ....See Entry 102989

61.70B Interstitials and vacancies

(exc. colour centres)

101689 X-ray and dilatometric investigation of defect structure in strontium chloride. G.Daniel, J.Nolting (Inst. fur Phys. Chem., Univ. Gottingen, Gottingen, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.7, p.562-6 (July 1983). In German.
$SrCl_2$ crystallizes in the fluorite structure and shows, like all materials with this structure, anomalous properties with regard to thermodynamic as well as to transport phenomena. In a temperature region starting about 200K below the melting point (1146K) a pronounced maximum of c_p is found, which is identified with a Schottky anomaly. Most significant are the increasing values of ionic conductivity with rising temperature. They mostly exceed those of a typical ionic melt. The degree of the 'molten' anion lattice and the distinct places of the defect ions are not clarified until now. The temperature of transition at the maximum of the expansion coefficient value at T=1000K has been determined by dilatometric measurements. The existence of predominant Frenkel disorder has been demonstrated by comparing X-ray and dilatometric measurements. The ratio of ionic radii relative to the configuration in the fluorite structure has been determined from the lattice parameter and the crystal structure. The enthalpy of formation of Frenkel disorder has been calculated from dilatometric measurements as $\Delta H_f=(248\pm8)$ kJ mol. (29 refs.)

101690 Threshold energy surface and Frenkel pair resistivity for Cu. W.E.King, K.L.Merkle (Argonne Nat. Lab., Argonne, IL, USA), M.Meshii.
J. Nucl. Mater. (Netherlands), vol.117, p.12-25 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
In-situ electrical resistivity damage-rate measurements in the high voltage electron microscope have been used to study electron irradiation induced defect production in copper single crystals at $T<10K$. Analysis of the directional and energy dependence yields a threshold energy surface that is significantly different from those of previous investigations: two pockets of low threshold energy centered at ⟨100⟩ and ⟨110⟩ surrounded by regions of much higher threshold energy. The corresponding damage function exhibits a plateau at 0.6 Frenkel pairs. The present results imply a Frenkel pair resistivity for Cu of $(2.75_{-0.2}^{+0.6})\times10^{-4}\ \Omega$ cm. (26 refs.)

101691 Structure of small defects in nonstoichiometric WO_{3-x}. L.A.Bursill (School of Phys., Univ. of Melbourne, Parkville, Victoria, Australia).
J. Solid State Chem. (USA), vol.48, no.2, p.256-71 (1 July 1983).
Structural models are derived for the hitherto 'unresolved' small defects which should occur in the nonstoichiometric phase WO_{3-x}. The mechanisms of aggregation or interaction of these small defects to produce extended defect structures (i.e. crystallographic shear plane and pentagonal and/or hexagonal tungsten bronze-type columns) are discussed next. Linear defects, consisting of two pairs of edge-shared octahedra, are proposed. These readily explain the large number of electron microscope observations of precipitation and dissolution phenomena reported for reduced WO_{3-x} and doped tungsten trioxide specimens. (31 refs.)

101692 Calculations of the binding of hydrogen to fixed interstitial impurities in nickel. M.S.Daw, C.L.Bisson, W.D.Wilson (Sandia Nat. Labs., Livermore, CA, USA).
Metall. Trans. A (USA), vol.14A, no.7, p.1257-60 (July 1983).
The authors have calculated the binding energy of hydrogen to inert, fixed interstitial impurity atoms He, Ne, Ar, Kr and Xe and also the chemically active impurities C, O, and Ni using local density functional theory including lattice relaxation. (11 refs.)

101693 Theory of strongly relaxed defects in crystalline and amorphous oxides. W.B.Fowler (Dept. of Phys., Lehigh Univ., Bethlehem, PA, USA).
Radiat. Eff. (GB), vol.72, no.1-4, p.27-38 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
Large, asymmetric atomic relaxations have been shown to play a crucial role in the structure and properties of several point defects in oxide materials. Examples include trapped hole centers in alkaline-earth oxides and E_1' and E_4' oxygen-vacancy centers and peroxy-radical defects in silicon dioxide. Schirmer's 'bound small polaron' model (1974, 1976), applied in particular to the alkaline-earth oxide defects, and model treatments of the E_1' center in SiO_2 by Yip, Griscom and Fowler (1974) clearly illustrate the important spectroscopic consequences of such atomic relaxations. In fact, such effects has been incorporated in Luty's classic model of the Type II F_A center in alkali halides. Edwards and Fowler (1982) have applied MNDO and MINDO/3 quantum-chemistry approaches to the E_1', E_4', and peroxy radical defects in SiO_2. These calculations generally corroborate suggested models and bear as well on possible creation mechanisms. Large relaxation effects are likely to be important in many other defects in oxide materials. (73 refs.)

101694 Study of defect formation in irradiated KL and KI(Pb) by Raman scattering and optical absorption techniques. J.D.Comins, A.M.T.Allen, P.J.Ford, D.A.Matthews (Dept. of Phys., Univ. of the Witwatersrand, Johannesburg, S Africa).
Radiat. Eff. (GB), vol.72, no.1-4, p.107-14 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
Studies of the growth of halogen molecular complexes induced in KI and KI(Pb) have been made by Raman scattering and optical absorption techniques. Their behaviour is consistent with the ideas of halogen cluster development resulting from the sequential trapping of halogen interstitials. Comparison of the results with recently published studies of KI and KI(Ca) shows that the defects responsible for the Raman scattering (I_3^- and higher order interstitial complexes) have the same basic nature independent of the presence of nearby impurities. Evidence that lead impurities stablize halogen interstitials is presented. (12 refs.)

Huang diffuse scattering from interstitials in a general orthorhombic and tetragonal lattice .... See Entry 101504

Diffuse X-ray scattering near Bragg peaks from point defects in a general lattice .... See Entry 101505

Evidence for the growth mechanism of Cr_2O_3 at low oxygen potentials .... See Entry 101607

Study by transmission electron microscopy of oxidation of zinc substituted magnetite in defective spinels .... See Entry 101641

Lattice parameters, thermal expansion coefficients, and vacancy density in solid CD_4 .... See Entry 101684

M-center growth in alkali halides: computer simulation .... See Entry 101701

F^+ centre in (Ca-Sr) carbonated hydroxyapatites .... See Entry 101702

The theory of dynamic sink strengths .... See Entry 101704

Iron-ion—implantation effects in MgO crystals .... See Entry 101730

Impurity-vacancy dipoles in cadmium-doped silver bromide crystals .... See Entry 101743

Influence of the variation of the association energy on the equilibrium concentration of dipole aggregates in ionic crystals .... See Entry 101744

Effect of X-irradiation on impurity-vacancy dipoles in lead and calcium-doped NaCl .... See Entry 101746

Uniformly valid asymptotic solutions of chemical rate equations for irradiation-produced point defects .... See Entry 101747

Experimental determination of the energy dependence of defect production .... See Entry 101748

Molecular dynamics simulation of low energy displacement cascades in Cu .... See Entry 101749

Computer simulation of defect behavior under fusion irradiation environments .... See Entry 101750

Defect production in simulated cascades: cascade quenching and short-term annealing .... See Entry 101751

Helium partitioning between voids and dislocations .... See Entry 101755

Theory of helium transport and clustering in materials under irradiation .... See Entry 101756

Theory of pulsed irradiation microstructures .... See Entry 101757

Search for vacancies in laser annealed silicon .... See Entry 101787

Creation of quasistable lattice defects by electronic excitation in SiO_2 .... See Entry 101798

Impact of the injected interstitial on the correlation of charged particle and neutron-induced radiation damage .... See Entry 101805

Effects of pulsed dual-ion irradiation on phase transformations and microstructure in Ti-modified austenitic alloy .... See Entry 101809

Effect of impurities on the diffusion-controlled creep activation energy in MgO .... See Entry 101848

Determination of vibronic parameters for GR1 centre in diamond by an optimisation technique .... See Entry 101873

The intralayer order-disorder transition in monoclinic $Cr_{3\pm x}Se_4$ .... See Entry 101949

One-dimensional-particle kinetics in a multicomponent alloy. The asymptotic time dependence of the mean-square displacement .... See Entry 102040

The migration energy of point defects in $Cd_{0.2}Hg_{0.8}Te$ .... See Entry 102045

Ionic conductivity of Li_4SiO_4 solid solutions in the system Li_2O-Al_2O_3-SiO_2 .... See Entry 102048

Evidence of divacancies in the diffusion of In in GaSb .... See Entry 102066

Atomic transport in dilute alloys containing interstitial defects .... See Entry 102074

Cation valencies and surface segregation in copper ferrites under X-ray photoelectron spectroscopy conditions .... See Entry 102131

Observation of voids in thin silver films by TEM .... See Entry 102202

Defect control during epitaxial regrowth by rapid thermal annealing .... See Entry 102216

Comment on the model of the Mg centres in NaCl crystals .. See Entry 102302

Deformation-induced point defects in germanium .... See Entry 102311

Electrical and optical properties of RF-SP a-Ge:O:(H) deposited from GeO_2 .... See Entry 102382

Hyperfine interactions from EPR of iron in silicon .... See Entry 102738

Defect characterization in III-V compounds by ESR .... See Entry 102746

Interstitial Tl^0 atoms in alkali halides: ESR study of a ⟨111⟩-oriented Tl_2^+ center .... See Entry 102748

Muon trapping and Knight shift at a dilute structural defect in zinc .... See Entry 102795

Raman scattering of pure, singly- and doubly perturbed interstitial hydrogen atom centers in alkali halides .... See Entry 102889

Spectroscopic properties of some Eu^{3+} doped scheelite-related rare earth sesquimolybdates and sesquitungstates .... See Entry 102903

Luminescence of rare earth activated polymorphous perovskites $Sr_2Sr_{1/4}Gd_{1/2}\square_{1/4}WO_6(=Sr_8SrGd_2\square W_4O_{24})$ .... See Entry 102931

Development and application of growth models for grain boundary allotriomorphs of a stoichiometric compound in ternary systems ...... See Entry 103106

Effects of surface and thickness of specimens on the aging in Al-Zn alloys .... See Entry 103168

61.70D Colour centres

101695 High resolution laser spectroscopy of colour centres. R.M.Macfarlane, R.T.Harley, R.M.Shelby (IBM Res. Lab., San Jose, CA, USA).
Radiat. Eff. (GB), vol.72, no.1-4, p.1-11 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
The application of narrow band dye lasers to high resolution spectroscopy within the inhomogeneously broadened zero-phonon lines of colour centres is reviewed. Most work so far has centred on the use of holeburning which is exhibited by the majority of centres examined. This technique has been used to make detailed Stark and Zeeman effect measurements. In addition, optical coherent transients have been used to determine dephasing times and the results of optical phase switching and free decay experiments are discussed. (22 refs.)

101696 Magnetic properties of optically excited states of colour centres. M.Glasbeek (Lab. for Phys. Chem., Amsterdam, Netherlands).
Radiat. Eff. (GB), vol.72, no.1-4, p.13-25 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
A review is given of recent developments in the study of magnetic (localized) photo-excitations in ionic solids. Emphasis is on the three topics: (i) the importance of magnetic properties in the structural characterization of defects; (ii) photo-chemical reactions as revealed from magnetic interactions in point defects and (iii) energy and phase relaxation dynamics in photo-excited colour centres as probed from magnetic transients. The author focuses on defects photo-excited to phosphorescent triplet states. In discussing a number of dynamical processes, some attention is given to the application of (optical-microwave) coherence spectroscopy which holds considerable promise for future work. (28 refs.)

101697 Picosecond measurement of relaxation in color centers. L.F.Mollenauer, J.M.Wiesenfeld (Bell Telephone Labs., Holmdel, NJ, USA), E.P.Ippen.
Radiat. Eff. (GB), vol.72, no.1-4, p.73-9 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
Describes techniques for the direct measurement of configurational relaxation times in color centers. The first such measurements, on the F_A(II) center in KCl:Li, yield a zero-temperature lifetime of 13 psec. Measured temperature dependence of the lifetime indicates that the relaxation is dominated by a phonon mode of energy ~47 cm^{-1}. The possibility of extending the measurements to other centers is discussed. (17 refs.)

101698 Bound triplet state of the F′ center in NaI. G.Baldacchini, G.P.Gallerano (ENEA, Roma, Italy), U.M.Grassano, F.Luty.
Radiat. Eff. (GB), vol.72, no.1-4, p.153-9 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
The astonishing feature that the F′ band in NaI is located on the high energy side (2.4 eV) of the F band (2.1 eV) indicates an unusually deep-lying F′ singlet ground state and suggests the possible existence of a bound triplet state in this material. Absorption measurements during the $F\rightarrow F'$ conversion show indeed the appearance of a weak band of large width (~0.5 eV) around 1.45 eV, conversion show indeed the appearance of a weak band of large width (~0.5 eV) around 1.45 eV, which decays spontaneously in the dark with a liftime of 540 sec. Its formation is found to be enhanced in high

magnetic fields when the F$\rightarrow$(F′ singlet) conversion is suppressed due to spin polarization of the F electrons. The authors interpret this band to be caused by a bound metastable triplet state of the two F′ electrons, with the 1.45 eV optical excitation leading into the conduction band. (7 refs.)

101699 M_A-type centers in alkaline-earth doped KCl. L.Bosi (Istituto di Fisica Politecnico di Milano, Milano, Italy).
Radiat. Eff. (GB), vol.72, no.1-4, p.167-70 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
The authors present: a critical analysis of the results known in literature on the absorption and emission properties of the Z_4-center in divalent doped KCl crystals; evidence, by lifetime measurements, of the existence of an M_A-type center, whose absorption band strongly overlaps that of the Z_4-center; a discussion of the radiative lifetime values obtained by the author for the excited state of the M_A- and M_A-type centers and the unperturbed M-center; discussion on the correctness of the models for the Z_4-center, supported by indirect proof of the Briginets model (Z_4-center analog of the N_1-center in undoped alkali halides) has been achieved. (18 refs.)

101700 The spin-lattice relaxation and spin-orbit interaction of F center in the relaxed excited state. H.Ohkura, K.Iwahana, K.Tara, M.Hirata, Y.Mori (Dept. of Appl. Phys., Osaka City Univ., Osaka, Japan).
Radiat. Eff. (GB), vol.72, no.1-4, p.171-5 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
The spin-orbit interaction constant λ_{RES} in the relaxed excited state of an F center (RES) and the temperature dependence of spin-lattice relaxation time in the RES have been determined via the study of magnetic circular polarization of F center emission (MCP). An essential factor for this determination lies in the experimental estimation of the proportionality constant F_p between the paramagnetic component of MCP and spin polarization in the RES. The values of F_p and λ_{RES} disagree with those proposed previously. The origin of the discrepancy is discussed. (15 refs.)

101701 M-center growth in alkali halides: computer simulation. M.Aguilar, F.Jaque, F.Agullo-Lopez (Univ. Autonoma de Madrid, Madrid, Spain).
Radiat. Eff. (GB), vol.72, no.1-4, p.193-200 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
The heterogeneous interstitial nucleation model previously proposed to explain F-center growth curves in irradiated alkali halides has been extended to account for M-center kinetics. The interstitials produced during the primary irradiation event are assumed to be trapped at impurities and interstitial clusters or recombine with F and M centers. For M-center formation two cases have been considered: (a) diffusion and aggregation of F centers, and (b) statistical generation and pairing of F centers. Process (b) is the only one consistent with the quadratic relationship between M and F center concentrations. However, to account for the F/M ratios experimentally observed as well as for the role of dose-rate, a modified statistical model involving random creation and association of F^+-F pairs has been shown to be adequate. (11 refs.)

101702 F^+ centre in (Ca-Sr) carbonated hydroxyapatites. G.Bacquet (Lab. de Phys. des Solides, CNRS, Toulouse, France), M.Sbit, M.Vignoles, G.Bonel.
Radiat. Eff. (GB), vol.72, no.1-4, p.299-302 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
Powdered samples of synthetic carbonated hydroxyapatites with variable amounts of strontium substituting for calcium, obtained by precipitation, were studied by ESR at the X-band frequencies after heating at 400°C for 24 h, X-irradiation and annealing at 150°C for 30 min. The F^+ centre spectrum exhibiting orthorhombic symmetry was recorded between RT and 120K, with $\langle g \rangle \simeq 2$. When the amount of carbonate inside the samples increases, the spectral intensity has the same behaviour as that of the quantity of O^{2-} vacancies calculated from the results of chemical analysis. The results are a confirmation of the existence of two different mechanisms of charge compensation when ${CO_3}^{2-}$ substitutes for ${PO_4}^{3-}$, and they also show that Sr ions are not located in cation sites adjacent to carbonate ions. (5 refs.)

Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals' .... See Entry 98642

Change of state of colour centres in alloyed sodium chloride crystals .... See Entry 99222

A new nonlinear *Q*-switch element—LiF:F_2^- crystal .... See Entry 100864

Effect of X-irradiation on impurity-vacancy dipoles in lead and calcium-doped NaCl .... See Entry 101746

F and photochromic centers in $LiYF_4$:Nd crystals .... See Entry 101794

Creation of quasistable lattice defects by electronic excitation in SiO_2 .... See Entry 101798

Recent studies of radiation induced F-center and colloid particle formation in synthetic NaCl and natural rock salt .... See Entry 101799

Negative photoplastic effect due to the relaxed excited state of the F-center in alkali halides .... See Entry 101846

The F^+ centre in lithium oxide .... See Entry 102307

Impurity-ligand effects on the magneto-optically measured spin-orbit splitting of trapped electron centres .... See Entry 102334

Photochromic reactions involving Cr ions and defects in magnesium oxide .... See Entry 102731

Interstitial Tl^0 atoms in alkali halides: ESR study of a $\langle 111 \rangle$-oriented ${Tl_2}^+$ center .... See Entry 102748

Triple resonance investigation of F centres in BaFCl .... See Entry 102779

Optical detection of electron spin resonances via magnetic circular polarization of F-center emission .... See Entry 102781

Magneto-optical studies of atomic thallium centers in KCl: Magnetic circular dichroism tagged by spin resonance .... See Entry 102855

Raman scattering induced by V centers and their aggregates in alkali halides .... See Entry 102890

Photochemical conversion and optical absorption spectra of V centers in coloured KI crystals .... See Entry 102917

Vibrational fluorescence of CN^- defects in KCl excited by coupling to optically pumped *F* centers .... See Entry 102940

Emission of F centres in alkali halides under hydrostatic pressure .... See Entry 102948

Optical properties of F_A and $(F_2)_A$ centres in doped KI .... See Entry 102949

Low energy photoluminescence of pure and doped LiF .... See Entry 102950

The resonant secondary emission of the F center in alkali halides .... See Entry 102951

Thermoluminescence of X- or γ-irradiated KI and KI(Ca^{2+}) crystals .... See Entry 102966

Investigations of mechanically induced excited states on cleavage planes of ionic crystals. II. Investigations of the mechanisms of electron emission from cleaved alkali halide crystals and of the influence of surface charges .... See Entry 103037

Ab initio study of the symmetric reaction path of H_2 with a surface *V* center in magnesium oxide .... See Entry 103587

61.70E Other point defects

Determination of the threshold-displacement energy in α-Al_2O_3 by high-voltage electron microscopy .... See Entry 101795

Defect characterization in III-V compounds by ESR .... See Entry 102746

61.70G Dislocations: theory

101703 Model of acoustic emission from accelerated dislocations. M.Jaszczewski (Inst. of Nuclear Phys., Cracow, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.1, p.69-75 (July 1983).
A model of acoustic emission signals generated by nonuniform motion of dislocations is presented. The acceleration of dislocations is given by the Dirac δ-function. Detection system influence on acoustic emission signal is taken into account and the Laplace transform is applied to solve it in agreement with the causality requirement. It is shown that for a wide range of the values for the total length of dislocations and for the sudden change of their velocities the analyzed model can explain the observed pulses of acoustic emission. (7 refs.)

101704 The theory of dynamic sink strengths. H.Rauh, R.Bullough, M.H.Wood (Theoretical Phys. Div., AERE, Harwell, England).
Proc. R. Soc. London Ser. A (GB), vol.388, no.1795, p.311-33 (8 Aug. 1983).
Dynamic sink strengths for the void, dislocation and thin foil surfaces are derived using a cellular model. These can be used in the chemical rate theory analysis of non-steady irradiation damage. In particular, appropriate dynamic sink strengths to model a steady state pulsing regime, such as is expected to prevail in the fusion reactor, are obtained. The transient nature of these sink strengths indicates the importance of the relative mobilities of the interstitials and vacancies and can, in fact, lead to the new phenomenon of a dynamic preference for vacancies, even for a sink that has a static preference for interstitials. The general dynamical features are found to depend also on both the irradiation mode and on the morphology of the particular sink. The present results indicate that for steady-state pulsing conditions it is usually acceptable to replace the dynamic sink strengths in rate theory calculations, by the corresponding steady state sink strengths appropriate to continuous irradiation. However, the dynamic sink strengths do appear to be required for the study of damage during the initial transient under continuous irradiation conditions. (11 refs.)

101705 Disclinations in solids. A.E.Romanov, V.I.Vladimirov (A.F. Ioffe Physico-Tech. Inst., Acad. of Sci., Leningrad, USSR).
Phys. Status Solidi a (Germany), vol.78, no.1, p.11-34 (16 July 1983).
An attempt has been made to embrace a wide class of problems on theoretical study and experimental proofs of the existence of disclinations in solids and about their role in various physical processes. The main attention is given to the progress in the disclination theory of strength and plasticity as the most promising direction in studying the behaviour of strongly deformed materials and constructing a physical theory of mechanical treatment of metals and alloys. Another important question fully represented is the analysis of the disclination elastic fields—the starting point in considering the properties of disclinations in different substances. (200 refs.)

Diffraction contrast from partial dislocations in the two-beam dynamical theory .... See Entry 101508

Non-equilibrium state and recovery of grain boundary structure. II. Energetic analysis .... See Entry 101717

On the relation between the plastic strain rate of a crystal and microscopic characteristics of dislocation motion .... See Entry 101844

Melting of two-dimensional solids .... See Entry 101918

61.70J Etch pits, decoration, transmission electron-microscopy and other direct observations of dislocations

101706 Electron-microscopic investigation of α-planar defects formed by boron in alloys of refractory metals with the BCC lattice. I.I.Novikov, R.M.Sofronova, V.I.Chervinskii (A.A. Baikov Inst. of Metall., Acad. of Sci., Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1179-86 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
Planar α-type defects loaded in $\{100\}$ planes in Mo-0.003% B-0.003% C-0.09% Zr and Cr-0.04% B (wt.%) alloys were investigated by the average contrast method developed earlier by two of the present authors [R.M. Sofronova and V.I. Chervinskii, Phys. Status Solidi A 66, 103 (1981)]. The displacement vectors $\langle d\ 0\ 1/2 \rangle$ and $\langle 2d\ 0\ 0 \rangle$, where $d \approx 1/6$ is the component normal to the defect plane, were determined by the precipitation of the B atoms in the form of single and double layers. The Burgers vector of the surrounding dislocations was $\mathbf{b}=\mathbf{R}$. Models of defects based on the hard sphere approximation indicated that they probably represented an intermediate stage in the growth of borides. (11 refs.) *A.T.*

101707 Dislocation motion in a dispersion hardened Al-Zn-Mg alloy and its plastic properties. U.Messerschmidt (Inst. fur Festkorperphys. und Elektronenmikroskopie, Akad. der Wissenschaften, Halle, Germany), F.Appel, M.Bartsch, R.Gerlach.
Phys. Status Solidi a (Germany), vol.78, no.1, p.93-102 (16 July 1983).
Al-Zn-Mg specimens are annealed to contain η' precipitates. They are deformed inside the high-voltage electron microscope and in a macroscopic compression machine. Under stress the dislocations strongly bow out between localized obstacles. The respective stress corresponds to about two thirds of the yield stress. Other contributions are due to the long-range dislocation interactions and, perhaps, the induced Snoek effect. The alloy deforms predominantly in an athermal mode. (22 refs.)

101708 Dislocation structures and subgrain boundaries in Al_3Zr. E.K.Polychroniadis, O.Delavignette (Materials Sci. Dept., CEN/SCK, Mol, Belgium).
Phys. Status Solidi a (Germany), vol.78, no.1, p.287-301 (16 July 1983).
The dislocation dissociation in the DO_{23} structure of Al_3Zr is performed by a contrast experiment in TEM and confirmed by a precision analysis of low angle grain boundary characteristics. In particular, the precision determination of the angle of rotation at subgrain boundaries allows a determination of amplitudes of Burgers vectors. The type of dissociation is interpreted in terms of the characteristics of the ordered lattice. (2 refs.)

101709 Dislocations in germanium: Effects of plasma hydrogenation. S.J.Pearton, J.M.Kahn (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Phys. Status Solidi a (Germany), vol.78, no.1, p.K65-9 (16 July 1983).
The authors investigate the effects on electrical activity of exposing undeformed, ultra-pure germanium samples containing $\approx 10^4$ cm^{-2} dislocations to various plasmas. The samples used were cut perpendicular to the axis of crystal growth, either [113] or [100], and the dislocations counted by using the preferential etch treatments. The reduction in electrical activity was measured using a DLTS study. (10 refs.)

101710 Nature of defects in heavily Te-doped GaAs. D.L.Williamson, M.Kowalchik (SERI, Golden, CO, USA), A.Rocher, P.Gibart.
Rev. Phys. Appl. (France), vol.18, no.8, p.475-8 (Aug. 1983).
Heavily Te-doped GaAs has been studied by ^{125}Te Mossbauer spectroscopy and transmission electron microscopy (TEM). It is shown that for N_D-$N_A > 10^{19}$ cm^{-3}, microprecipitates are observed along dislocation loops on TEM micrographs whereas a quadrupole split second site appears in Mossbauer spectra. Both features are consistent with the existence of microprecipitates of gallium telluride, Ga_2Te_3. (10 refs.)

Flame annealing of ion implanted silicon ....See Entry 101736

Effects of pulsed dual-ion irradiation on phase transformations and microstructure in Ti-modified austenitic alloy ....See Entry 101809

Depth dependent damage profile in stainless steel irradiated with He-ions ....See Entry 101810

Oxygen implantation in GaAs: damage studies ....See Entry 101818

Acoustic emission in the interaction of iron and its alloys with surface-active melts ....See Entry 101869

Studies of two-dimensional lattices using ferrofluid ....See Entry 102126

Defect control during epitaxial regrowth by rapid thermal annealing ....See Entry 102216

Hydride precipitation in α/β zirconium alloys ....See Entry 103150

Microstructural mechanism for the anomalous tensile behaviour of aluminum-killed steel prestrained in plane strain tension ....See Entry 103224

Forming conditions and geometric variety of etch pits. II. Rectangular and triangular etch pits ....See Entry 103382

61.70L Slip, creep, internal friction and other indirect evidence of dislocations

(see also 62.20H Creep, 62.40 Internal friction)

101711 Glide mechanisms in BCC crystals: an investigation of the case of α-iron through multislip and latent hardening tests. P.Franciosi (Lab. PMTM, Univ. Paris-Nord, Villetaneuse, France).
Acta Metall. (USA), vol.31, no.9, p.1331-42 (Sept. 1983).
Multislip and latent hardening tensile tests are performed on α-iron single crystals at room temperature, in order to check the assumption of crystallographic glide restricted to the $\{110\}$ planes and the $\{112\}$ asymmetric planes. The evidence of a macroscopic glide either following higher indexed planes or the maximum resolved shear stress plane (referred as 'noncrystallographic glide') is interpreted, through a theoretical approach of multislip situations—in terms of mechanics of continuous media and of plasticity theory—as colinear glide on a $\{110\}$-$\{112\}$ neighbouring planes pair. The observed hardening behaviour allows to interpret the influence of the axis orientation on the preferred slip mode. The latent hardening tests are performed according to the assumption of glide on $\{110\}$ and $\{112\}$ planes. The experimental results are not consistent with a description of plastic flow resulting from four noncrystallographic slip systems only defined by the $\langle 111\rangle$ slip direction. A hardening law, previously derived from tests on FCC crystals, is extended in the simplest way in order to analyze the latent hardening tests results and to represent the main features of the observed plastic behaviour of the α-iron crystals. (22 refs.)

101712 Dislocation wall and cell structures and long-range internal stresses in deformed metal crystals. H.Mughrabi (Max-Planck-Inst. fur Metallforschung, Stuttgart, Germany).
Acta Metall. (USA), vol.31, no.9, p.1367-79 (Sept. 1983).
Long-range internal stresses in deformed metals have traditionally been associated primarily with the existence of dislocation pile-ups. Recent experimental work has shown, however, that long-range internal stresses prevail also in crystals containing dislocation wall or cell structures which have so far been considered as energetically favourable dislocation patterns of negligible internal stress. These experimental results are interpreted in terms of a simple model in which the crystal is considered as a composite consisting of hard dislocation walls of high local dislocation density which are separated by soft regions of low local dislocation density. The model is developed for single-slip and multiple-slip deformation. The considerations show that, in crystals in which a heterogeneous dislocation distribution develops during deformation, substantial long-range internal stresses arise unavoidably as a natural consequence of the compatibility requirements in the stress-applied state. A discussion of the microscopic glide processes makes it evident that, in addition to the dislocations located in the walls and in the regions separating them, so-called 'interface dislocations' must be considered also. (73 refs.)

101713 The stresses of planar dislocation multipoles in plastically deformed Cu-Al crystals. N.R.Comins (Nat. Inst. for Materials Res., CSIR, Pretoria, S Africa), P.J.Jackson.
S. Afr. J. Phys. (S. Africa), vol.6, no.1, p.7-11 (1983).
Realistic calculations are presented of the stresses on secondary glide systems inside planar dislocation multipoles. The stresses are much larger than the yield stress, but they are too localized to cause secondary slip. It is suggested that dislocation grids observed in the later stages of deformation are produced when multipoles become plastically relaxed as a result of the superposition of internal stresses. (17 refs.)

Disclinations in solids ....See Entry 101705

Negative photoplastic effect due to the relaxed excited state of the F-center in alkali halides ....See Entry 101846

The influence of the crack tip stress field on the nucleation and growth of voids ....See Entry 101853

Deformation-induced point defects in germanium ....See Entry 102311

Strain aging of Ti-6242 at hot-working temperatures ....See Entry 103184

Temperature- and strain-rate dependence of the flow stress of ultrapure niobium single crystals in cyclic deformation ....See Entry 103207

The effect of grain size on deformation twinning in a textured zinc alloy ....See Entry 103217

Superplastic flow and failure at 773K in the aluminium-calcium eutectic alloy ....See Entry 103218

Cyclic softening and thermally activated deformation of titanium and zirconium ....See Entry 103226

Some surprising features of the plastic deformation of body-centered cubic metals and alloys ....See Entry 103227

Effect of structural transformations in the cast conditions on the high-temperature ductility of nickel alloys ....See Entry 103244

Deformation properties of high purity α-Fe single crystals ... See Entry 103246

Influence of ultrasonic action on the bending deformation of D16 and V95 alloy plates ....See Entry 103250

Changes in the structure and mechanical properties of 25Kh2MFA steel under the effect of programmed increasing load and irradiation ......See Entry 103252

The transition from stage I to stage II fatigue crack propagation in copper single crystals cycled at constant strain amplitudes ....See Entry 103303

Deformation and fracture of strongly textured Ti alloy sheets in uniaxial tension ....See Entry 103306

Stretch forming and fracture of strongly textured Ti alloy sheets ....See Entry 103307

Low cycle fatigue of Ti-Mn alloys: microstructural aspects of fatigue track growth ....See Entry 103316

Load fixture for uniform plastic deformation of single crystals ....See Entry 103440

61.70N Grain and twin boundaries

101714 Grain boundary motion in vanadium. A.Juhasz, I.Fozy, P.Tasnadi, I.Kovacs (Inst. for General Phys., Roland Eotvos Univ., Budapest, Hungary), I.Vitanyi.
Acta Phys. Acad. Sci. Hung. (Hungary), vol.53, no.3-4, p.455-68 (1982). [received: Aug. 1983] (CRYOSEM '81. Second International Seminar on Low Temperature Physics, Visegrad, Hungary, 8-10 Oct. 1981).
Grain boundary motion has been investigated 'in situ' in 99.9% purity V sheets in a microscope. The individual grain boundary motion has been followed by the grooves etched thermally on the surface of the sample. The velocity of individual grain boundaries has been measured and compared to the average velocity determined from the normal gain growth law. An analysis of the relation between the velocity of curved boundaries and their curvature is given. The results obtained prove that in the applied experimental circumstances the driving force of the grain boundary motion is the surface energy of the boundaries. Finally, a simple geometrical model is given for explaining the spasmodic migration of the boundaries joined to the surface, as well as the observed sudden breaking of certain grains. (27 refs.)

101715 Inheritance of twin boundaries as a mechanism of the shape memory. G.E.Brainin, A.E.Volkov, V.A.Likhachev (A.A. Zhdanov State Univ., Leningrad, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1045-50 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A crystal-geometric analysis is made of the 'inheritance' of twin boundaries in a martensitic phase during the reverse martensitic transition. It is shown that in the course of such a transition there may be some disaccommodation at the boundaries of 'inherited' martensite twins and this effect can increase considerably the elastic energy of the system. A physical mechanism is proposed for the shape memory. This mechanism makes it possible to calculate the deformation in the course of recovery of the shape, reactive stresses, elastic energy, and mechanical work on the basis of the crystallographic features of twinning and martensitic transitions in specific alloys. (6 refs.) *A.T.*

101716 Conductivity and 'negative *U*' for ionic grain boundaries. D.M.Duffy (Dept. of Phys., Univ. of Reading, Reading, England), A.M.Stoneham.
J. Phys. C (GB), vol.16, no.21, p.4087-92 (30 July 1983).
The authors show that charge-transfer excitations (like $2M^{2+} \rightarrow M^{+} + M^{3+}$) can be lowered greatly in energy near grain boundaries, where sites are no longer equivalent. In special cases the excitations may be exothermic ('negative-*U*' behaviour); likely cases include (320) and (122) grain boundaries in FeO. Consequences include effects on conductivity, segregation of impurities with different valence, and on other charge-state-dependent properties. (17 refs.)

101717 Non-equilibrium state and recovery of grain boundary structure. II. Energetic analysis. R.Z.Valiev, V.Yu.Gertsman, O.A.Kaibyshev (Aviation Inst., Ufa, USSR).
Phys. Status Solidi a (Germany), vol.78, no.1, p.177-86 (16 July 1983).
For pt.I see ibid., vol.77, p.97 (1983). The energy of grain boundary (GB) with non-equilibrium structure caused by trapped lattice dislocations (TLD's) and TLD dissociation products—extrinsic grain boundary dislocations (EGBDs)—are estimated. The process of GB structure recovery, i.e. transition of non-equilibrium GB structure into equilibrium state, is analysed on the basis of the model of TLD dissociation into EGBD's and EGBD uniform distribution in GB. A process of this type appears to be energetically favoured for GB's of any type. The kinetics of the recovery of GB structure which is of diffusional character is considered. The differences in TLD stability in various GB's are caused by kinetic reasons. In the process of TLD absorption GB's possess non-stationary structure, which is of great importance for GB behaviour during deformational processes. (29 refs.)

101718 Particular properties of $\Sigma = 3^n$ boundaries in FCC polycrystals. I. Crystallographical parameters and grain boundary faceting during annealing. G.D.Sukhomlin (All-Union Sci. Res. Tube Inst., Dnepropetrovsk, USSR), A.V.Andreeva.
Phys. Status Solidi a (Germany), vol.78, no.1, p.333-41 (16 July 1983).
The crystallographic parameters and faceting during annealing of $\Sigma = 9$; 27; 81; 243 special grain boundaries in stainless steel and copper are investigated by the TEM technique. The preferential facet orientation parallel to closely packed $\{Okl\}$ planes of CSL is supposed to be due to a special feature of the $\Sigma = 3^n$ boundary formation, which is realized by multiple interaction of $\Sigma = 3$ twin boundaries. A strong agreement is observed between the experimental rotation angles and theoretical ones. It is concluded that $\Sigma = 3^n$ boundaries

may serve as standards for further investigations of grain boundaries in polycrystalline materials. (13 refs.)

101719 Microtwins in $LiNbO_3$ crystals observed by high-voltage and high-resolution electron microscopy. L.Malicsko (Res. Lab. of Crystals Phys., Hungarian Acad. of Sci., Budapest, Hungary), R.Scholz.
Phys. Status Solidi a (Germany), vol.78, no.1, p.K1-4 (16 July 1983).
Twin stacks were observed by HVEM and HREM in $LiNbO_3$ crystals, thus enabling their reliable characterization. The twin stacks were found preferentially in strongly non-stoichiometric, red-brown samples. This fact supports the formation of twin stacks to be closely connected with stoichiometric deviations in $LiNbO_3$, especially with oxygen deficiencies. The deviations found in the form and in the orientation of the twin boundaries within the twin stacks allow one to assume that the twin stacks are grown-in defects. (16 refs.)

101720 Conditions of formation and growth of mechanical twins at the tip of a dynamic crack. A.P.Korolev, V.A.Fedorov, Yu.I.Tyalin (Tambov Chem. Engng. Inst., Tambov, USSR).
Strength Mater. (USA), vol.14, no.6, p.824-8 (June 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.6, p.93-7 (June 1982).
An analysis is made of the physical conditions of formation and growth of accompanying twins at the tip of a rapidly developing crack using as an example Fe+3.25% Si. It should be noted that the analysis is not a strict calculation of the quantitative characteristics of formation and propagation of accompanying twins. Its results present a concept of the condition of their formation and growth at the tip of rapid rupture. (10 refs.)

101721 Measurement of grain boundary parameters by laser-spot photoconductivity. E.Poon, H.L.Evans, W.Hwang, R.M.Osgood,Jr., E.S.Yang (Dept. of Electrical Engng., Columbia Univ., New York, NY, USA).
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.103-8
An experimental technique has been developed to study the electrical properties of semiconductor grain boundaries (GBs) by a focused laser beam. The laser beam is trained on a GB while the photoconductivity of the sample is measured. Both the steady-state and transient signals are recorded as functions of temperature. From these data, the authors obtain well-defined GB parameters, including the barrier height, interface charge density, trap energy and thermal capture cross-section. This technique allows them to examine localized regions of individual GBs in a semiconductor with multiple grains. (8 refs.)

On a particular type of twinning in the growth of rhenium single crystals ....See Entry 101610

Characterization of the current-blackening phenomena in scandia stabilized zirconia using transmission electron microscopy ....See Entry 101647

Dislocation structures and subgrain boundaries in Al_3Zr ....See Entry 101708

High resolution electron-microscope studies on a quenched $(Ni_{0.5}Cr_{0.5})_7Nb_6$ alloy ....See Entry 101722

Baroplastic effect in superplasticity ....See Entry 101847

Star patterns and dissociation of interfaces without spontaneous strain compatibility between orientation domains in ferroelastic crystals. Case of a monoclinic rare earth sesquioxide ....See Entry 101992

Grain boundary strength of molybdenum bicrystals with a ⟨110⟩ twist boundary ....See Entry 102185

Grain boundary fracture in molybdenum bicrystals with a ⟨110⟩ symmetric tilt boundary ....See Entry 102186

Evidence for grain boundary phase transition in a 2D bicrystal ....See Entry 102187

Magnetic field and strain dependences of the tin whiskers resistance ....See Entry 102356

Influence of carbon and hydrogen segregation on the electrical properties of grain boundaries in polycrystalline silicon sheets ....See Entry 102423

Grain boundary phenomena in n-type CdTe films grown by hot wall vacuum evaporation ....See Entry 102533

Influence of carbon addition on the electrical and structural properties of phosphorus and boron doped silicon layers ....See Entry 102536

Development and application of growth models for grain boundary allotriomorphs of a stoichiometric compound in ternary systems ......See Entry 103106

X-ray diffraction investigation of the single-phase stage of precipitation of martensite ....See Entry 103156

On the kinetics of discontinuous precipitation in Cu-Mg alloys ....See Entry 103158

Discontinuous γ' coarsening in a Ni-Al-Mo base superalloy . See Entry 103161

Effects of surface and thickness of specimens on the aging in Al-Zn alloys ....See Entry 103168

Development of the recrystallization texture in tensile deformed aluminium single crystals. I HVEM observations ....See Entry 103170

Orientation relationships in the secondary recrystallization of pure nickel ....See Entry 103174

The role of non-equilibrium grain boundary structure in strain induced grain boundary migration (recrystallization after small strains) ......See Entry 103175

The effect of grain size on deformation twinning in a textured zinc alloy ....See Entry 103217

Observations of grain boundary sliding during superplastic deformation ....See Entry 103232

Influence of the cohesive strength of grain boundaries on strain and structure characteristics of fracture of dispersion-hardening copper-base alloys ....See Entry 103273

The micro-mechanisms of tempered martensite embrittlement in 4340-type steels ....See Entry 103304

Fatigue of Cu-1 pct Cd ....See Entry 103305

The influence of the $M_{23}(C,N)_6$ compound on the mechanical properties of type 422 stainless steel ....See Entry 103311

Creep crack growth behavior of several structural alloys ....See Entry 103315

Ductile fracture of a high manganese steel ....See Entry 103325

Effect of preliminary mechanical twinning on the ductile-brittle transition temperature for iron with different impurity contents ....See Entry 103333

Characterization of grain boundaries in polycrystalline solar cells using a computerized electron beam induced current system ....See Entry 103689

X-ray photoelectron spectroscopy studies of copper diffusion behaviour and related degradation phenomena in thin film $CdS{:}Cu_2S$ solar cells ....See Entry 103698

On the effective minority carrier diffusion length of polycrystalline silicon solar cells ....See Entry 103700

61.70P Stacking faults, stacking fault tetrahedra and other planar or extended defects

101722 High resolution electron-microscope studies on a quenched $(Ni_{0.5}Cr_{0.5})_7Nb_6$ alloy. L.Douxing, L.Stenberg, S.Andersson (Chem. Center, Lund, Sweden).
J. Solid State Chem. (USA), vol.48, no.3, p.368-75 (15 July 1983).
Crystals of a $(Ni_{0.5}Ct_{0.5})_7Nb_6$ alloy have been studied with a high-resolution electron microscope. Crystals of the Friauf-Laves and μ phases were identified in the sample, which is in agreement with the X-ray powder pattern. Planar defects of different kinds were easily and frequently observed. The structural model of defects have been derived via chemical twinning and intergrowth operations. (9 refs.)

101723 Stacking fault constant in X-ray diffraction: a high-resolution experimental study. S.-S.Jiang, A.R.Lang (H.H. Wills Phys. Lab., Univ. of Bristol, Bristol, England).
Proc. R. Soc. London Ser. A (GB), vol.388, no.1795, p.249-71 (8 Aug. 1983).
Stacking fault fringe patterns and related dynamical diffraction effects have been studied by X-ray section topographs in the case of a fault about 1 mm^2 in area contained in an unusually perfect and almost dislocation-free type I a natural diamond cut and polished into a plate 1 mm thick. The fault, a growth accident, lay on an octahedral plane inclined to the local octahedral growth surface and was bounded by a pair of partial dislocations parallel to ⟨110⟩. Images of the fault were recorded with $AgK\alpha_1$, $MoK\alpha_1$ and $CuK\alpha_1$ radiations. Those obtained with $AgK\alpha_1$ and $MoK\alpha_1$ represented the low absorption case, and were compared with computer simulated images. In the case of moderately high absorption ($CuK\alpha_1$) both diffracted beam (K_g-beam) and direct beam (K_0-beam) section topographs were recorded. (35 refs.)

Diffraction contrast from partial dislocations in the two-beam dynamical theory ....See Entry 101508

A structural description for the FCC→BCC martensitic transformation in terms of $\{011\}\ \langle 0\bar{1}1\rangle_{fcc}$ simultaneous double shear. Relation with the atomic configuration in $\{3,15,10\}_{fcc}$ habit plane. ....See Entry 101956

$V_{3.2}W_{1.8}O_{13}$ and studies of the V_2O_5-WO_3-VO_2 ternary system ....See Entry 103127

A comparison of microvoid sizes in nickel base alloys tested in air and in the presence of hydrogen ....See Entry 103328

61.70R Crystal impurities: general

(see also 71.55 Impurity and defect levels; 81.10 Purification techniques)

101724 Reexamination of β-alumina doped with chromium using photoacoustic spectroscopy. J.H.Kennedy, A.M.Schuler (Chem. Dept., Univ. of California, Santa Barbara, CA, USA), G.E.Cabaniss.
J. Solid State Chem. (USA), vol.48, no.3, p.439-45 (15 July 1983).
A previous publication (Kennedy and Akridge (1978)) presented evidence that supported the hypothesis that chromium-doped β-alumina was oxidized to Cr(IV) during air-sintering. This evidence included chemical reactions observed, magnetic susceptibility, and conductivity, but, in particular, the strongest supporting evidence came from absorption spectroscopy. However, the technique used, powder dispersed in a KBr pellet, was not conductive to high quality spectra. For this reason, a much more powerful technique for solid samples, photoacoustic spectroscopy, has been applied to chromium-doped β-alumina. Additional absorption peaks have been observed that now clearly show that chromium remains as Cr(III) in β-alumina. The other previous evidence has been reexamined and it too can be interpreted as resulting from the presence of chromium (III). (12 refs.)

101725 Gettering of impurities by incoherent light annealed porous silicon. V.E.Borisenko, A.M.Dorofeev (Minsk Radioengng. Inst., Minsk, USSR).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.375-9
The application of electrochemically formed porous silicon to getter Cu and Au atoms in silicon crystals during incoherent light annealing for 4 to 20 sec is reported. Exposure light power density of 30 W/cm^2 was used to heat the samples up to 950°C. Improvement of lifetime related to Au and Cu gettering with porous silicon has been observed. Excess impurity interstitials and their enhanced diffusion are supposed to be responsible for the gettering effect. (15 refs.)

Conductivity and 'negative *U*' for ionic grain boundaries ....See Entry 101716

Role of impurity precipitates in microhardness of $NaCl{:}Sr^{2+}$ crystals ....See Entry 101851

Spectroscopic standard for tetrahedrally coordinated ferric iron: γ $LiAlO_2{:}Fe^{3+}$ ....See Entry 102999

Effect of preliminary mechanical twinning on the ductile-brittle transition temperature for iron with different impurity contents ....See Entry 103333

61.70T Doping and implantation of impurities

101726 Ion implantation of Si and Be in $Al_{0.48}In_{0.52}As$. A.N.M.Masum Choudhury, W.Rowe, K.Tabatabaie-Alavi, C.G.Fonstad, K.Alavi, A.Y.Cho (Dept. of Electrical Engng. & Computer Sci., MIT, Cambridge, MA, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4374-7 (Aug. 1983).
Electrical characterization of (Al,In)As ion implanted with Be and Si following low and high dose multiple energy implant schedules, and annealed between 740 and 815°C with a pyrolytic silicon dioxide cap is reported. Only very low activation of Be is achieved (<3%). Silicon activation is considerably higher (>40%) and increases with increasing anneal temperature. However, a high concentration *n*-type surface layer is found on samples annealed at 815°C. This surface layer is not found on similarly annealed samples which were not implanted, or which were implanted with phosphorus. (14 refs.)

101727 The influence of growth conditions on sulfur incorporation in GaAs grown by molecular beam epitaxy. F.A.Andrews, R.Heckingbottom, G.J.Davies (British Telecom Res. Labs., Martlesham Heath, Ipswich, England).
J. Appl. Phys. (USA), vol.54, no.8, p.4421-5 (Aug. 1983).
An electrochemical sulfur cell has been used as a source of donors for molecular beam epitaxy grown GaAs. The galvanic cell is Pt/Ag/AgI/Ag_2S/Pt. The electrical and optical properties of the films grown in the substrate temperature range 550-590°C are good. However, at substrate temperatures above 600°C the incorporation rate of sulfur is much reduced. The reduction in the incorporation rate is explained on the basis of the competing reactions (1) the incorporation of sulfur into the GaAs matrix and (2) the formation of volatile Ga_2S. A detailed discussion of the incorporation at elevated substrate temperatures and with varying As_4/Ga ratio is presented. It is also demonstrated that if the substrate temperature is reproducibly known then the electrochemical cell can be used to introduce intricate doping profiles into epitaxial GaAs. A hyperabrupt varactor diode has been fabricated as an example. (22 refs.)

101728 Zn incorporation in $Ga_{1-x}Al_x$ As grown by liquid phase epitaxy and its electrical properties. G.Vassilieff, B.Saint-Cricq (Lab. d'Automatique et d'Analyse des Systemes, CNRS, Toulouse, France).
J. Appl. Phys. (USA), vol.54, no.8, p.4581-5 (Aug. 1983).
Zn doped $Ga_{1-x}Al_xAs$ layers with different Al concentrations ($x=0.2$, 0.3, 0.6) have been grown by the conventional liquid phase epitaxy method (LPE). The Zn mole fraction in the liquid solution has been varied from 5×10^{-4} to 5×10^{-2} and the corresponding hole concentration in the solid has been studied using Hall measurements. The results are as follows: hole concentrations up to 10^{18} cm^{-3} are easily obtained for a high x of 0.6. The hole concentration in the solid varies according to the square root of the Zn mole fraction in liquid ($X_{Zn}{}^l$), and varies as $\beta \exp(-\alpha x)$ for a given $X_{Zn}{}^l$. A global relation has been derived which totally defines Zn incorporation in $Ga_{1-x}Al_xAs$ crystal. The acceptor activation energy has been calculated for different aluminum concentrations and has been found to vary between 15 meV for $x=0$ and 30 meV for $x=0.6$. These results have been compared with the results obtained from other dopants. (9 refs.)

101729 A new type of electron beam doping—anomalous sputtering, anomalous room-temperature diffusion. T.Wada (Dept. of Electrical Engng., Mie Univ., Tsu, Japan).
Oyo Buturi (Japan), vol.52, no.3, p.239-44 (March 1983). In Japanese.
Gives the principles, experimental data and future prospects of the high-energy electron-beam impurity doping technique invented by the author. The method can dope an impurity by irradiating electron beams onto the desired impurity wafer placed on a mirror-finished Si (or Ge) substrate. A 0.2-mm thick impurity sheet provides maximum doping efficiency. For a 0.5-mm thick substrate, doping can be done deeply to the rear face. This shows extraordinary diffusion at room temperature. The amount of doping increases with increasing thickness of the impurity sheet. (34 refs.) *K.B.*

101730 Iron-ion—implantation effects in MgO crystals. A.Perez (Dept. de Phys. des Materiaux, Univ. Claude Bernard Lyon I, Villeurbanne, France), G.Marest, B.D.Sawicka, J.A.Sawicki, T.Tyliszczak.
Phys. Rev. B (USA), vol.28, no.3, p.1227-38 (1 Aug. 1983).
Magnesium oxide crystals implanted with $^{57}Fe^+$ ions at doses ranging from 10^{15} to 10^{17} ions/cm^2 (ion energy, 70, 100, and 150 keV) were studied with the conversion-electron Mossbauer spectroscopy technique. Supplementary data were obtained using the techniques of Rutherford backscattering and channeling of α particles, optical absorption, electron microscopy, and electrical conductivity. It was found that implantation introduces iron in MgO in three charge states: Fe^{2+}, Fe^{3+}, and metallic precipitates (Fe^0) with the dominant role of Fe^{3+} at low doses, Fe^{2+} at medium doses, and metallic iron clusters at the highest doses. The phase created in a medium range of doses can be compared with the magnesio-wustite solid solution. The isochronal thermal annealings in air at temperatures between 300 and 700°C gradually cause the oxidation and the nucleation of highly dispersed spinel-like clusters and then, at about 800-900°C, the growth of magnesioferrite particles. In contrast, the heat treatment in vacuum converts all iron into well-diluted Fe^{2+} in MgO phase. The nature of point defects and their role in annealing processes are discussed on the basis of the optical absorption data. A good corresondence between the results of Mossbauer and channeling data is indicated. The effect of the insulator-conductor transition occurring under iron-ion implantation in MgO and observed by electrical conductivity measurements is explained in terms of the atomistic properties of implanted crystals under study. (35 refs.)

101731 Ion-implantation dense cascade data. K.B.Winterbon.
Report AECL-8054, Atomic Energy Canada Ltd., Chalk River, Ont. (April 1983), 58 pp.
A tabulation is given of data useful in estimating various aspects of ion-implantation cascades in the nuclear stopping regime, particularly with respect to nonlinearity of the cascade at high energy densities. The tabulation is restricted to self-ion implantation. Besides power-cross-section cascade dimensions, various material properties are included. Scaling of derived quantities with input data is noted, so one is not limited to the values assumed by the author. (14 refs.)

101732 Pulsed UV excimer laser doping of semiconductors. T.F.Deutsch (Lincoln Lab., MIT, Lexington, MA, USA).
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.225-34
UV excimer lasers have been used to dope semiconductors by a one-step process in which the laser serves both to release dopant atoms from a parent molecule and to melt the surface, allowing incorporation of dopant atoms by liquid state diffusion. The technique has been used to dope Si, GaAs, and InP. Shallow junctions formed by the technique have been fabricated into efficient Si and GaAs solar cells. (21 refs.)

101733 Submicrometer-linewidth laser doping. J.Y.Tsao, D.J.Ehrlich (Lincoln Lab., MIT, Lexington, MA, USA).
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.235-42
Dopant patterns of 250-nm linewidth have been written in silicon by localized heating with a CW laser beam, and then transferred into positive and negative surface-relief patterns by preferential etching. The tightly focused beam both generates free dopant atoms and simultaneously promotes solid-state diffusion into the substrate. Because of the nonlinear dependence of diffusion rates on temperature, the linewidths of the patterns are substantially narrower than those of both the temperature and the laser-beam profiles on the surface. In addition, an enhancement is observed in diffusion rates under the strong thermal gradients associated with highly localized heating. (18 refs.)

101734 Characteristics of laser implantation doping. K.G.Ibbs, M.L.Lloyd (Hirst Res. Centre, GEC plc, Wembley, England).
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.243-8
UV laser photochemical dissociation and laser enhanced thermal dissociation have been used to generate free metal dopant species from a variety of organometallic molecules near a semiconductor substrate surface. Simultaneous laser annealing via a localised melt phase allows diffusion driven implantation of the metal atoms and subsequent electrical activation in the regrowing material. High levels of dopant concentration and activation are readily achieved in this way. Results are presented on doping of silicon by boron using an ArF laser. Data are given on junction depths, number density and carrier density as a function of depth and interpretation of the data in terms of calculated temperature profiles. The possibility of tailoring junction characteristics by control of laser and gas flow parameters is considered with preliminary experimental data. (11 refs.)

101735 Dopant incorporation during rapid solidification. C.W.White, D.M.Zehner, J.Narayan, O.W.Holland, B.R.Appleton (Solid State Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA), S.R.Wilson.
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.287-96
Incorporation of Group III, IV, V dopants in silicon occurs as a result of solute trapping during laser annealing. Distribution coefficients and substitutional solubilities are far greater than equilibrium values, and can be functions of growth velocity and crystal orientation. Mechanisms limiting dopant incorporation at high concentrations are identified and discussed. (22 refs.)

101736 Flame annealing of ion implanted silicon. J.Narayan, R.T.Young (Solid State Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.361-7
The authors have investigated flame annealing of ion implantation damage (consisting of amorphous layers and dislocation loops) in (100) and (111) silicon substrates. The temperature of a hydrogen flame was varied from 1050 to 1200°C and the interaction time from 5 to 10 seconds. Detailed TEM results showed that a 'defect-free' annealing of amorphous layers by solid-phase-epitaxial growth could be achieved up to a certain concentration. However, dislocation loops in the region below the amorphous layer exhibited coarsening, i.e. the average loop size increased while the number density of loops decreased. Above a critical loop density, which was found to be a function of ion implantation variables and substrate temperature, formations of 90° dislocations (a cross-grid of dislocation in (100) and a triangular grid in (111) specimens) were observed. Electrical (Van der Pauw) measurements indicated nearly a complete electrical activation of dopants with mobility comparable to pulsed laser annealed specimens. The characteristics of p-n junction diodes showed a good diode perfection factor of 1.20-1.25 and low reverse bias currents. (9 refs.)

Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium .... See Entry 98648

Industrial and medical applications of accelerators with energies less than 20 MeV .... See Entry 99771

Profile estimation of an implanted-diffused arsenic layer in silicon .... See Entry 101738

Impurity redistribution in ion implanted Si after picosecond Nd laser pulse irradiation .... See Entry 101741

Rapid thermal annealing of silicon using an ultrahigh power arc lamp .... See Entry 101759

Isothermal annealing of ion implanted silicon with a graphite radiation source .... See Entry 101760

Incorporation of Sb in Si during CW laser stimulated solid phase epitaxy .... See Entry 101763

Microprobe Raman analysis of picosecond laser annealing of implanted silicon .... See Entry 101788

Pulsed laser annealing of ion implanted Ge .... See Entry 101789

Surface studies of laser annealed semiconductors .... See Entry 101790

Oxygen implantation in GaAs: damage studies .... See Entry 101818

Ferromagnetism of alloys: a new probe in ion implantation ... See Entry 101820

Coherent precipitate formation in pulsed-laser and thermally-annealed, ion-implanted Si .... See Entry 101989

Two-dimensional numerical analysis of impurity atom diffusion in semiconductors .... See Entry 102061

Multizone modeling of impurity redistribution in ion-implanted materials .... See Entry 102065

Temperature and concentration dependence of epitaxial growth rate in Sb and Ga implanted Si .... See Entry 102192

Kinetics of the formation of concentrational transitions between epitaxial layers of silicon in the process of growth from a molecular beam .... See Entry 102208

Effects of growth temperature and substrate orientation on the entry of tellurium into epitaxial gallium arsenide films .... See Entry 102209

Effects of gas flow speed and chlorine concentration on tellurium uptake in gas-phase epitaxy of gallium arsenide .... See Entry 102210

Laser-induced solid phase crystallization in amorphous silicon films .... See Entry 102214

Solid-phase-epitaxial growth of ion implanted silicon using CW laser and electron beam annealing .... See Entry 102215

Defect control during epitaxial regrowth by rapid thermal annealing .... See Entry 102216

Highly doped sputtered amorphous silicon without hydrogen .... See Entry 102380

Electrical properties of shallow implanted layers in silicon ....See Entry 102418

Pile up of implanted phosphorus during palladium silicide formation and the characteristics of Schottky barrier diodes .... See Entry 102490

Effects of controlled hydrogenation by ion implantation on the localized states in vacuum evaporated amorphous silicon .... See Entry 102530

Influence of carbon addition on the electrical and structural properties of phosphorus and boron doped silicon layers .... See Entry 102536

Suppression of dielectric breakdown in MgO crystals at high temperatures by impurity doping .... See Entry 102816

Influence of anion impurities and X-rays on the piezoelectric effect in ammonium dihydrogen phosphate crystals .... See Entry 102822

Optical and crystallographic properties and impurity incorporation of $\alpha_x\mathrm{In}_{1-x}\mathrm{As}$ $(0.44<x<0.49)$ grown by liquid phase epitaxy, vapor phase epitaxy, and metal organic chemical vapor deposition .... See Entry 102926

Explosive recrystallization of ion implantation amorphous silicon layers .... See Entry 103047

A new self-limiting process for the production of thin submicron semiconductor films .... See Entry 103346

Oxidation of arsenic implanted polycrystalline silicon .... See Entry 103349

Stability of p-i-n hydrogenated amorphous silicon solar cells to light exposure .... See Entry 103690

Light-induced instability of amorphous silicon photovoltaic cells .... See Entry 103692

61.70W Impurity concentration, distribution, and gradients

(see also 66.30J Diffusion, migration and displacement of impurities)

101737 Oxygen-induced recombination centers in as-grown Czochralski silicon crystals. K.Nauka, H.C.Gatos, J.Lagowski (MIT, Cambridge, MA, USA).
Appl. Phys. Lett. (USA), vol.43, no.3, p.241-3 (1 Aug. 1983).
Simultaneous quantitative microprofiles of the interstitial oxygen concentration and of the excess carrier lifetime were obtained, for the first time, in Czochralski-grown Si crystals employing double laser absorption scanning. It was found that oxygen concentration maxima and minima along the crystal growth direction coincide with lifetime minima and maxima, respectively. It was further found that the magnitude of oxygen-induced lifetime changes increases dramatically in going from the center to the periphery of the crystal. The present findings imply that 'as-grown' oxygen precipitates are involved in lifetime limiting processes. (11 refs.)

101738 Profile estimation of an implanted-diffused arsenic layer in silicon. Way-Seen Wang, Huai-Ying Meng (Dept. of Electrical Engng., Nat. Taiwan Univ., Taipei, Taiwan).
J. Appl. Phys. (USA), vol.54, no.8, p.4671-3 (Aug. 1983).
The nonlinear diffusion coefficients of a solid-state diffusion equation is approximated by a linear function of concentration, and then the resulting diffusion equation is solved exactly by the method of self-similar solution to obtain a simple expression for the profile estimation of an implanted-diffused arsenic layer in silicon. This expression is dependent only upon the total implant dose and the initial junction depth, but not the specific form of the initial profile. However, as the diffusion time is long enough, only the total implant dose is of significance. The approximate profile, junction depth, surface concentration, and sheet resistance agree quite well with those obtained by solving the nonlinear diffusion equation numerically or by carrying out the diffusion experimentally. (15 refs.)

101739 Impurity compensation in $\mathrm{Ga}_{1-x}\mathrm{Al}_x\mathrm{As}$ alloys. A.K.Saxena, B.B.Singh (Dept. of Electronics & Communication Engng., Univ. of Roorkee, Roorkee, India).
Phys. Rev. B (USA), vol.28, no.2, p.1132-3 (15 July 1983).
The results obtained from the temperature dependence $(80 \lesssim T \lesssim 750\mathrm{K})$ of the Hall electron concentration have been interpreted to derive the variation of the impurity compensation ratio in $\mathrm{Ga}_{1-x}\mathrm{Al}_x\mathrm{As}$ alloys $(0 \leq x \leq 0.78)$ as a function of alloy composition. It is found that the maximum value of this ratio is ~ 3.0 at $x \simeq 0.4$, which decreases for values of x on either side of $x \simeq 0.4$. (12 refs.)

101740 Ising model simulations of impurity trapping in silicon. G.H.Gilmer (Bell Labs., Murray Hill, NJ, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.249-61
Laser annealing experiments on silicon have shown that rapid solidification can trap large amounts of certain impurities in the crystal lattice. Concentrations that exceed the equilibrium solubility limits by several orders of magnitude have been obtained. In this paper the authors discuss the impurity trapping process using Monte Carlo simulation data from the kinetic Ising model. The dependence of the impurity concentration in the crystal on the solidification rate is calculated. The simulation data are compared with recent laser annealing results for bismuth and indium. Excellent agreement between the model and the bismuth experiments is obtained. The larger trapping rate on the (111) relative to the (100) orientation is found to be caused by the slower crystallization kinetics on the (111) face. Similar results are obtained for indium, although the difference in trapping on the (111) and (100) faces is somewhat smaller in the model than in the experiment. (32 refs.)

101741 Impurity redistribution in ion implanted Si after picosecond Nd laser pulse irradiation. S.U.Campisano, P.Baeri, E.Rimini, G.Russo (Istituto di Fisicia, Catania, Italy), A.M.Malvezzi.
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.273-9
Impurity redistribution in Bi-implanted Si and in As-implanted Si has been investigated after irradiation with 25 ps Nd($\lambda = 1.06$ μm) laser pulse in the energy range 0.1-1.5 J/cm^2. Channeling effect in combination with 2.0 MeV He$^+$ backscattering in glancing detection has been used to characterize the epitaxial crystallization, the impurity location and its depth redistribution. The amorphous to single crystal transition occurs at an energy density of about 0.4 J/cm^2. Bi atoms are located after crystallization in substitutional lattice sites for the in depth part of the distribution. Part of the Bi atoms accumulated at the sample surface and the amount of segregation increases with the pulse energy density and depends on the substrate orientation. A computer model has also been developed to calculate several parameters of interest, as the melt threshold, the melt duration, the carrier temperature, etc., including a detailed description of the absorption and of the energy relaxation processes. The calculations indicate that the simple thermal description accounts quantitatively for the experimental data on melt duration and impurity segregation. (11 refs.)

101742 Impurity distribution profiles and surface disorder after laser induced diffusion. E.Forgarassy, R.Stuck, P.Siffert (CRN, Strasbourg, France), F.Broutet, J.C.Desoyer.
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.311-16
A model for laser induced diffusion is proposed, assuming the melting of a Si surface under pulsed laser irradiation and the diffusion, in the liquid phase of a thin film with impurities deposited according to the 'limited source' conditions. Depending on the thickness of the film, there results a dopant distribution profile with a surface disordered layer induced either by segregation effects or precipitation of the dopant in excess of the solubility limit achieved by laser annealing. Experimental results, obtained for a ruby laser irradiation of thin films of different impurities of group III and V, like antimony, bismuth, gallium and indium deposited on silicon substrates, are in good agreement with the model. Their effective segration coefficients have been deduced by fitting the experimental amount of dopant precipitated in the disordered surface layer with the numerical calculations. A cellular structure is seen on the surface. (17 refs.)

Dopant incorporation during rapid solidification .... See Entry 101735

Segregation and crystallization phenomena in germanium ..... See Entry 101990

Two-dimensional numerical analysis of impurity atom diffusion in semiconductors .... See Entry 102061

Diffusion of boron into polycrystalline silicon from a single crystal source .... See Entry 102063

Multizone modeling of impurity redistribution in ion-implanted materials .... See Entry 102065

Reduction of contact resistivity by As redistribution during $\mathrm{Pd_2Si}$ formation .... See Entry 102076

Kinetics of the formation of concentrational transitions between epitaxial layers of silicon in the process of growth from a molecular beam .... See Entry 102208

Electrical properties of low-compensation GaAs .... See Entry 102437

61.70Y Interaction between different crystal structure defects

101743 Impurity-vacancy dipoles in cadmium-doped silver bromide crystals. B.A.Devlin, J.Corish (Dept. of Chem., Univ. Coll., Dublin, Ireland).
Phys. Status Solidi a (Germany), vol.78, no.1, p.53-60 (16 July 1983).
Thermal depolarization for single crystals of silver bromide doped with cadmium is measured using improved data acquisition techniques. Two overlapping dipole reorientation peaks at 92.6 and 99.5K are analyzed by nonlinear least-squares fitting and the relaxation processes are found to have activation energies of 0.250 and 0.311 eV, respectively. The dependence of the dipole relaxation spectrum on the anneal temperature of the crystal is also investigated systematically and it is concluded that the lower temperature peak is due to nearest-neighbour cadmium-vacancy pairs. This conclusion is also based on theoretical calculations made using the lattice simulation methods in the HADES programme of the binding energies of such complexes and on the results of detailed analyses of ionic conductance data measured on the same crystal. The higher temperature peak is thought to be due to the relaxation of a larger complex. (13 refs.)

101744 Influence of the variation of the association energy on the equilibrium concentration of dipole aggregates in ionic crystals. G.Berg (Sektion Phys., Martin-Luther-Univ. Halle/Wittenberg, Halle, Germany), A.Pippel, F.Frohlich.
Phys. Status Solidi a (Germany), vol.78, no.1, p.77-83 (16 July 1983).
Association energies of dipoles and dipole aggregates calculated theoretically by different methods or determined experimentally by an analysis of kinetic processes of dipole aggregation show a wide scattering. But surprisingly the equilibrium concentration of these aggregates calculated by minimizing the free energy of the crystal and computed with these mentioned energies are lying in a very narrow range. It is shown, that this phenomenon can be attributed to the fact, that the absolute values of the energies are indeed very different, but that the energy differences per defect site are approximately equal comparing two data sets. Only additional deviations can influence the equilibrium concentrations. (11 refs.)

101745 The measurement of the trap binding energy by the thermal analysis technique. Gye-Won Hong, Jai-Young Lee (Korea Advanced Inst. of Sci. & Technol., Chongryang, Seoul, Korea).
Scr. Metall. (USA), vol.17, no.7, p.823-6 (July 1983).
The mechanism of hydrogen transport in iron and steel is very important in order to understand the problem of hydrogen embrittlement which is a serious problem in modern industry. The diffusion of hydrogen in iron and steel shows large abnormality and it is often thought to be caused by the trapping of hydrogen at the lattice defects existing in iron and steel. It is necessary to know the energy level of hydrogen around the trap site in order to understand the interaction between hydrogen and the trap site. The trap binding energy was obtained by modifying the thermal analysis method. The thermal analysis was done for normalized 0.49 carbon steel and the trap binding energy of ferrite-cementite interface was obtained. (16 refs.)

101746 Effect of X-irradiation on impurity-vacancy dipoles in lead and calcium-doped NaCl. J.M.Garcia, J.A.Hernandez, H.S.Murrieta, J.O.Rubio (Inst. de Fisica, Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
Solid State Commun. (USA), vol.47, no.7, p.515-18 (Aug. 1983).
The effects of the room temperature X-irradiation in calcium and lead-doped NaCl have been reinvestigated in order to get a deeper insight into the nature of the radiation induced halogen interstitial traps. Special attention has been paid to determine whether a correlation exists between the change in the concentration of Ca^{2+} (Pb^{2+})-cation vacancy dipoles and the color center formation. The results indicate that for both systems, the dipoles are the fundamental traps for the interstitial defects in agreement with the theoretical models recently developed for F-center formation in alkali halides doped with divalent impurities. This conclusion is, however, in disagreement with that reported by Ikeya et al. (1965, 1966) in a previous work on calcium-doped NaCl in which it was concluded that the isolated positive ion vacancies were the dominant traps for the halogen interstitial defects. (21 refs.)

Dislocation motion in a dispersion hardened Al-Zn-Mg alloy and its plastic properties .... See Entry 101707

Non-equilibrium state and recovery of grain boundary structure. II. Energetic analysis .... See Entry 101717

Helium partitioning between voids and dislocations .... See Entry 101755

Search for vacancies in laser annealed silicon .... See Entry 101787

61.80 RADIATION DAMAGE AND OTHER IRRADIATION EFFECTS

(for techniques of structure determination, see 61.10 to 61.16; for electron and ion impact phenomena, see 79.20)

101747 Uniformly valid asymptotic solutions of chemical rate equations for irradiation-produced point defects. R.E.Mickens (Univ. of Colorado, Boulder, Co, USA).
Acta Phys. Pol. A (Poland), vol.A64, no.1, p.59-67 (July 1983).
The author presents a perturbation technique for obtaining solutions to a pair of nonlinear coupled differential equations which model the behaviour of the kinetics of irradiation-produced interstitials and vacancies. The procedure eliminates secular terms at each stage of the calculation; consequently, the solutions are uniformly valid for $0 \leq t < \infty$. (6 refs.)

101748 Experimental determination of the energy dependence of defect production. K.L.Merkle, W.E.King (Argonne Nat. Lab., Argonne, IL, USA), A.C.Baily, K.Haga, M.Meshii.
J. Nucl. Mater. (Netherlands), vol.117, p.4-11 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
A knowledge of primary damage production as a function of recoil energy is essential for predicting defect production in radiation environments of practical interest. The damage function $\nu(T)$, i.e. the number of Frenkel pairs as a function of recoil energy, is determined for Cu from electron and ion damage-rate measurements. $\nu(T)$ shows a plateau at $\nu=0.54$ which extends up to $\sim 7T_{\mathrm{d}}^{\mathrm{min}}$. Therefore, simple damage models, such as the modified Kinchin-Pease expression, are strongly deficient, not only at high recoil energies where stimulated recombination in cascades reduces defect production but also in the single displacement regime. As a consequence, no simple relation between $T_{\mathrm{d}}^{\mathrm{min}}$ and $T_{\mathrm{d}}^{\mathrm{av}}$ is expected to exist. A procedure is suggested which uses anisotropy measurements in combination with polycrystal electron and ion irradiations to construct absolute damage functions in metals. (30 refs.)

101749 Molecular dynamics simulation of low energy displacement cascades in Cu. W.E.King, R.Benedek (Materials Sci. & Technol. Div., Argonne Nat. Lab., Argonne, IL, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.26-35 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
Molecular dynamics computer simulations have been performed to study properties of low-energy (<500 eV) displacement cascades in Cu. Various aspects of the time development of cascades are considered including instantaneous number of Frenkel pairs, partitioning of kinetic and potential energies, distribution of atom kinetic energies, cascade expansion rate, and Frenkel pair distributions. The anisotropy of the threshold energy for Frenkel pair production is interpreted in terms of 'branching'. Replacement sequences and the damage function are discussed based on analysis of events corresponding to 18 recoil directions. The damage function exhibits a plateau at $\nu \sim 0.5$ Frenkel pairs extending from 25-150 eV; at higher recoil energies the onset of multiple defect production is much slower than predicted by the modified Kinchin-Pease model. (23 refs.)

101750 Computer simulation of defect behavior under fusion irradiation environments. T.Muroga, S.Ishino (Dept. of Nuclear Engng., Univ. of Tokyo, Tokyo, Japan).
J. Nucl. Mater. (Netherlands), vol.117, p.36-45 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
To simulate defect behavior under irradiation, three kinds of cascade-annealing calculations have been carried out in alpha-iron using the codes MARLOWE, DAIQUIRI and their modifications. They are (1) cascade-annealing calculation with different masses of projectile, (2) defect drifting near dislocations after cascade production and (3) cascade-overlap calculation. The defect survival ratio is found to increase as decreasing mass of the projectile both after athermal close-pair recombination and after thermal annealing. It is shown that at moderate temperatures vacancy clustering is enhanced near dislocations. Cascade-overlap is found to decrease the defect survivability. In addition, the role of helium in vacancy clustering has been calculated in aluminum lattices and its effect is found to depend strongly on temperature, interstitials and the mobility of small clusters. These results correspond well to the experimental data and will be helpful for correlating between fusion and simulation irradiations. (27 refs.)

101751 Defect production in simulated cascades: cascade quenching and short-term annealing. H.L.Heinisch (Hanford Engng. Dev. Lab., Richland, WA, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.46-54 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
Defect production in displacement cascades in copper has been modeled using the MARLOWE code to generate cascades and the stochastic annealing code ALSOME to simulate cascade quenching and short-term annealing of isolated cascades. Quenching is accomplished by using exaggerated values for defect mobilities and for critical reaction distances in ALSOME for a very short time. The quenched cascades are then short-term annealed with normal parameter values. The quenching parameter values were empirically determined by comparison with results of resistivity measurements. Throughout the collisional, quenching and short-term annealing phases of cascade development, the high energy cascades continue to behave as a collection of independent lower energy lobes. For recoils above about 30 keV the total number of defects and the numbers of free defects scale with the damage energy. As the energy decreases from 30 keV, defect production varies with the changing nature of the cascade configuration, resulting in more defects per unit damage energy. The simulated annealing of a low fluence of interacting cascades revealed an interstitial shielding effect on depleted zones during Stage I recovery. (14 refs.)

101752 Precipitate dissolution by high energy collision cascades. P.Chou, N.M.Ghoniem (School of Engng. & Appl. Sci., Univ. of California, Los Angeles, CA, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.55-63 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
The evolution of the microstructures during irradiation is now widely recognized due to: (1) radiation altered kinetic phenomena; (2) collisional processes by energetic cascades. The authors investigate the specific nature of the collisional interaction between energetic cascades and precipitates. A new Monte Carlo-based computer program, TRIPOS, has been developed for the transport of ions in polyatomic solids. The computer code utilizes standard nuclear and electronic energy loss formulas, and compares well with experimental data on particle reflection, penetration and sputtering. One of the unique features of the code is its applicability to problems involving multispecie media in multilayers of 3-dimensional configurations. The interaction of neutron-initiated high energy collision cascades is demonstrated to result in the partial dissolution of precipitates. However, the maximum precipitate size that may be completely destroyed by a high energy collision cascade is only a small fraction of the cascade size. Matrix atom implantation inside precipitates as well as preferential sputtering of light atoms from the surface of precipitates into the matrix is demonstrated to lead to changes in precipitate stoichiometry. (19 refs.)

101753 Atomic displacement functions of cubic metals. P.Jung (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).
J. Nucl. Mater. (Netherlands), vol.117, p.70-7 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
Atomic displacement functions for various cubic transition metals are derived from electron, ion and neutron damage rate data. Damage rates under electron and light ion irradiation as well as the total number of defects produced during α-implantation are calculated over a wide range of energies from these displacement functions. General relations for displacement functions and displacement energies are given which may be used for other metals or alloys for which no experimental data are available. The results are suggested to find practical use for correlating material behaviour from simulation experiments to a fusion environment. (35 refs.)

101754 Quantitative modelling of swelling in M316 steel. R.Bullough, S.M.Murphy, T.M.Quigley, M.H.Wood (Theoretical Phys. Div., AERE, Harwell, Didcot, England).
J. Nucl. Mater. (Netherlands), vol.117, p.78-88 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
The chemical rate theory is widely used to describe the microstructural evolution in a material during irradiation. The authors describe recent improvements to the theory that increase its predictive capability. The incubation dose prior to the onset of void swelling is modelled by allowing partition of the gas between the various sinks in the microstructure. New dislocation and void sink strengths have been derived incorporating the field effects. These improvements to the theory have been incorporated into a new FACSIMILE computer code designated VS5. The new code has been successfully employed to model void swelling during HVM, VEC and fast reactor irradiation of 316 steel. (15 refs.)

101755 Helium partitioning between voids and dislocations. B.O.Hall (Materials Sci. Div., Westinghouse Res. & Dev. Center, Pittsburgh, PA, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.89-95 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
A model that describes the interaction of mobile helium with void and interstitial-loop distributions in irradiated metals has been developed. Both evolving loops and voids are assumed to provide saturable and reversible trap sites for interstitial helium and detrapping by thermal emission and by irradiation displacement is included. To avoid the computational limitations of standard rate-theory methods, differential equations have been derived for the moments of the cavity and loop distributions in the two-dimensional size spaces that include both point defect and helium number. Equations for the first and second moments are included in the partitioning model, along with the necessary mobile defect equations. The time dependence of the mean cavity size and gas content and the mean loop size and trap occupation number have been obtained in closed form for simplified conditions as an illustration. (15 refs.)

101756 Theory of helium transport and clustering in materials under irradiation. N.M.Ghoniem (School of Engng. & Appl. Sci., Univ. of California, Los Angeles, CA, USA), S.Sharafat, J.M.Williams, L.K.Mansur.
J. Nucl. Mater. (Netherlands), vol.117, p.96-105 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
A theoretical model is developed to describe helium transport and clustering during irradiation. Diffusional reactions of helium with vacancies and vacancy clusters, with extended sinks for helium absorption, and direct reactions with displacement producing particles are included. The full description developed is employed in numerical computations. A simpler description is also developed in the limits where certain reactions are unimportant. Analytical expressions for the effective diffusion coefficient of helium are derived. Regimes of the parameter space of dose rate, temperature, helium generation rate, sink strength and other important conditions, where the effective diffusion coefficient is dictated by three different physical processes, are defined. The result is determined by the dominant release mechanism of helium bound in vacancies-thermal detrapping, replacement by the self-interstitial or direct displacement. Results from the full computations and the analytical expressions are compared. (28 refs.)

101757 Theory of pulsed irradiation microstructures. E.P.Simonen (Pacific Northwest Lab., Richland, WA, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.113-17 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
Flux pulsing is predicted to influence microstructures because of pulse annealing effects on aggregate annealing and on point defect annealing. Specifically void annealing and vacancy annealing are analyzed. A high dislocation density enhances the void annealing effect but inhibits the point defect annealing effect. Furthermore, pulsing effects are greater for higher damage rates and smaller defect aggregates. It is concluded that pulsed ion irradiations can simulate pulsed fusion irradiations if it is recognized that the ions exaggerate the expected neutron effect. (7 refs.)

101758 The growth of gas-bubbles by coalescence in solids during continuous gas generation. D.Preininger, D.Kaletta (Inst. fur Material- und Festkorperforschung II, Kernforschungszentrum Karlsruhe, Karlsruhe, Germany).
J. Nucl. Mater. (Netherlands), vol.117, p.239-43 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
In order to get some insight into the mode of gas bubble growth during the high temperature irradiation of solids, the authors have calculated the distributions of bubbles grown by coalescence. The calculations are based on Gruber's coalescence model for annealing which have been extended to the case of an irradiation induced gas generation. The dominant assumption is that the continuously generated inert gas atoms go into new bubbles distributed around small radii. The results show that the bubble growth rate is markedly increased by the irradiation induced gas generation and that the calculated bubble distribution profile exhibits a double peak as often observed experimentally. (23 refs.)

101759 Rapid thermal annealing of silicon using an ultrahigh power arc lamp. R.T.Hodgson, J.E.E.Baglin, A.E.Michel (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA), S.Mader, J.C.Gelpey.
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.355-60
The authors have used an ultrahigh power, 100 kW vortex cooled arc lamp to anneal As^+ implant damage in ⟨100⟩ silicon wafers. When the wafer temperature was held above 1100°C for ~1 sec, TEM analysis indicated that the material was free of extended defects. The dopant diffused much more rapidly than would be expected from the usual models. However, preliminary results indicate that defect free material can be produced with dopant movement limited to ~100 Å. (9 refs.)

101760 Isothermal annealing of ion implanted silicon with a graphite radiation source. S.R.Wilson, R.B.Gregory, W.M.Paulson (SRDL, Motorola Inc., Phoenix, AZ, USA), A.H.Hamdi, F.D.McDaniel.
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.369-74
Both (100) and (111) Si wafers were implanted with As, P or B to doses from 10^{13} to $10^{16}/cm^2$ and annealed with a Varian IA-200 isothermal annealer. The anneal occurs in a vacuum using infrared radiation for exposure times of 5 to 30 sec. Sheet resistance (R_s), Hall effect, RBS and SIMS were used to analyze the wafers. For each dopant a decreasing R_s occurs with increasing exposure time until a minimum value is reached. Longer anneals produce increased dopant diffusion, and the R_s for As and P implanted wafers increased unless the wafer was capped with 0.05 μm of SiO_2 which prevents a loss of dopant. The results for (100) wafers are better than for (111) with As doses $\leq 10^{15}/cm^2$ however, at doses $>10^{15}/cm^2$ and the (100) and (111) results are comparable. The As implanted, isothermally annealed layers were thermally stable for As concentrations $\leq$2E 20/cm^3. (15 refs.)

Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals' .... See Entry 98642

The role of radiation damage analysis in the fusion program ..See Entry 99718

Gettering of impurities by incoherent light annealed porous silicon .... See Entry 101725

Irradiation effects in perovskite-type fluorides .... See Entry 101792

Defects induced in single thoria crystals by X and far UV irradiation .... See Entry 101793

Negative photoplastic effect due to the relaxed excited state of the F-center in alkali halides .... See Entry 101846

Surface structural damage produced in InP(100) by RF plasma or sputter deposition .... See Entry 102141

Defect control during epitaxial regrowth by rapid thermal annealing .... See Entry 102216

Light-induced dynamic instability of the domain structure in $FeBO_3$:Ni .... See Entry 102694

Defect characterization in III-V compounds by ESR .... See Entry 102746

The influence of radiation defects on the nonlinear properties of TGS in the neighbourhood of the temperature of ferroelectric transition .See Entry 102828

Photochemical conversion and optical absorption spectra of V centers in coloured KI crystals .... See Entry 102917

Low energy photoluminescence of pure and doped LiF .... See Entry 102950

About one variational principle in the stress analysis of an elastic solid under irradiation taking into account the geometrical nonlinearity ..See Entry 103192

61.80B Laser beams

101761 Regimes of laser-induced periodic surface structure on germanium: radiation remnants and surface plasmons. J.F.Young, J.E.Sipe, H.M.van Driel (Dept. of Phys., Univ. of Toronto, Toronto, Ontario, Canada).
Opt. Lett. (USA), vol.8, no.8, p.431-3 (Aug. 1983).
The authors' present experimental evidence showing that the period of the rippled surface structure induced on germanium by 1.06 μm laser pulses undergoes a discontinuous shift above a certain threshold intensity. The measured shift, as a function of the angle of incidence of the damaging beam is quantitatively interpreted as a transition between a regime of inhomogeneous melting controlled by radiation-remnant field structures and a regime of ripple formation involving surface plasmons in an optically thick layer of liquid, metallic germanium formed at the surface. (16 refs.)

101762 Deposition of laser energy into inhomogeneous layer systems. H.-D.Geiler, K.Hehl, D.Stock (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Phys. Status Solidi a (Germany), vol.78, no.1, p.193-9 (16 July 1983).
A model of the primary energy deposition during laser annealing in layer systems is developed based on the calculation of the divergence of the Poynting vector and taking into account the superposition of the field amplitudes inside each layer. The energy deposition function is calculated for the following model systems: amorphous on crystalline silicon, polycrystalline Si/SiO_2 crystalline Si, and molten Si amorphous Si/crystalline Si. The influence of the interference effect on the total reflectivity, the energy deposition, and the transmission is discussed with reference to the dependence on the thicknesses of the layers. (11 refs.)

101763 Incorporation of Sb in Si during CW laser stimulated solid phase epitaxy. H.Hedler, G.Gotz (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Phys. Status Solidi a (Germany), vol.78, no.1, p.237-41 (16 July 1983).
The determination of the temporal temperature distribution shows that CW laser annealing is a multi-pulse process. It can divided into three stages: the preannealing stage, the recrystallization stage and the postannealing stage. The first two stages determine the nucleation and the recrystallization behaviour during irradiation. After ion implantation of 6×10^{15} Sb/cm^2 in ⟨100⟩ Si and CW laser stimulated recrystallization a partial incorporation of impurities on lattice sites depending on the duration of the preannealing stage and on the effective annealing temperature is observed. A linear connection is found between the substantial Sb part and the effective annealing temperature. (9 refs.)

101764 Using optical fibers in laser processing. L.D.Laude, L.Baufay, A.Pigeolet (Faculte des Sci., Univ. de l'Etat, Mons, Belgium).
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.249-53
Phase transformations occurring upon CW laser irradiating through optical fiber polymetallic, multilayered films deposited on insulating substrates is shown to provide a simple and versatile way to optically micro-print predetermined patterns. The technique allows both further reduction to the Rayleigh limit and simultaneous multiplication of the patterns. (3 refs.)

101765 Picosecond time-resolved detection of plasma formation and phase transitions in silicon. J.M.Liu, H.Kurz, N.Bloembergen (Div. of Appl. Sci., Harvard Univ., Cambridge, MA, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.3-12
Picosecond time-resolved reflectivity and transmission changes of bulk silicon and silicon-on-sapphire have been measured to study the electron-hole plasma formation and phase transitions in silicon, induced by picosecond green of ultraviolet pulses. The results provide direct evidence of ultrafast energy transfer to the lattice and ultrafast phase transitions in silicon. Lattice heating up to the melting point and overheat of the melt or boiling have been observed during the picosecond pulse duration. (17 refs.)

101766 Femtosecond time resolved reflectivity of optically excited silicon. R.Yen, C.V.Shank, C.Hirlimann (Bell Telephone Labs., Holmdelm, NJ, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.13-16
The authors report measurements of the time resolved reflectivity of silicon following excitation with an intense 90 femtosecond optical pulse. These measurements clearly time resolve the process of energy transfer from the optically excited electron-hole plasma to the crystal lattice and subsequent melting within the first few picoseconds. (8 refs.)

101767 Raman scattering with nanosecond resolution during pulsed laser heating of silicon. D.von der Linde, G.Wartmann, A.Ozols (Fachbereich Phys., Univ. Essen-GHS, Essen, Germany).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.17-22
The authors present time-resolved measurements of spontaneous anti-Stokes and Stokes Raman scattering during pulsed laser heating of crystalline silicon. The time-evolution of the lattice temperature is determined from the measured anti-Stokes/Stokes intensity ratio. In a separate calibration experiment they measure the temperature dependence of the anti-Stokes/Stokes ratio of an oven-heated silicon crystal from 300K up to 900K. The phase transition occurring during laser heating is detected by monitoring the changes of the optical reflectivity during laser irradiation. The data suggest that the phase transition occurs at a lattice temperature of ~600K. (7 refs.)

101768 Pulsed Raman measurements of phonon populations: time reversal, correction factors, and all that. A.Compaan (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany), H.W.Lo, A.Aydinli, M.C.Lee.
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.23-33
Transient optic phonon populations are measured in crystalline Si as a function of 532 nm laser energy density. The use of a continuously tunable pulsed dye laser as the Raman probe allows one to obtain, under exact experimental conditions, all correction factors necessary to extract the phonon population without the necessity of relying on room temperature or oven-heated conditions. The authors find the shift of the 520 cm^{-1} Raman-line to be consistent with the observed Stokes/anti-Stokes ratios indicating a maximum optic phonon temperature of 450±100°C. A discussion is also given of the errors in several recent criticisms of the Raman results. (25 refs.)

101769 A detailed examination of time-resolved pulsed Raman temperature measurements of laser annealed silicon. G.E.Jellison,Jr., D.H.Lowndes, R.F.Wood (Solid State Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.35-40
Raman temperature measurements during pulsed laser annealing of Si by Compaan and co-workers (1980) are critically examined. It has been shown previously that the Stokes to anti-Stokes ratio depends critically upon the optical properties of silicon as a function of temperature. These dependences, coupled with the large spatial and temporal temperature gradients normally found immediately after the high reflectivity phase, result in large variations in the calculated temperature depending upon the probe laser pulse width and the pulse-to-pulse and spatial variations in the annealing pulse energy density. (9 refs.)

101770 Instability of the electron-hole plasma and its possible relation with melting. M.Combescot, J.Bok (Groupe de Phys. des Solides, Ecole Normale Superieure, Paris, France).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.41-2
The authors show that the softening of the TA phonon mode produces an instability in the electron-hole plasma of a silicon-like semiconductor and suggest that this instability can be the mechanism for melting of this type of material. This allows one to estimate the characteristics of a laser pulse which are necessary to modify the usual melting, i.e. which would lead to a substantial decrease of the melting temperature. (4 refs.)

101771 Time-resolved study of silicon during pulsed-laser annealing. B.C.Larson, C.W.White, T.S.Noggle, J.F.Barhorst (Solid State Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.43-50
Near surface temperatures and temperature gradients have been studied in silicon during pulsed laser annealing. The investigation was carried out using nanosecond resolution X-ray diffraction measurements made at the Cornell High Energy Synchrotron Source. Thermal-induced-strain analyses of these real-time, extended Bragg scattering measurements have shown that the lattice temperature reached the melting point during 15 ns, 1.1-1.5 J/cm^2 ruby laser pulses and that the temperature of the liquid-solid interface remained at that temperature throughout the high reflectivity phase, after which time the surface temperature subsided rapidly. The temperature gradients below the liquid-solid interface were found to be in the range of 10^7°C/cm. (8 refs.)

101772 Measurement of fast melting and regrowth velocities in picosecond laser heated silicon. P.H.Bucksbaum, J.Bokor (Bell Telephone Labs., Holmdel, NJ, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.51-6
Fast regrowth of amorphous silicon from liquid silicon films has been directly observed in a time resolved picosecond laser melting experiment. Liquid films up to 100 nm thick were formed on crystalline substrates with 15 picosecond 248 nm pulses from a KrF* excimer laser. The film thickness as a function of time was probed directly by observing attenuation of 1.64 μm 15 psec light pulses transmitted through the melt. Melting and regrowth velocities were compared to a heat diffusion model, and evidence for melt undercooling was observed. The resolidified silicon was amorphous at all values of incident laser intensity. (8 refs.)

101773 Time resolved measurements of interface dynamics during pulsed laser melting observed by transient conductance. M.O.Thompson, G.J.Galvin (Dept. of Material Sci., Cornell Univ., Ithaca, NY, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.57-67
The transient conductance technique has been used in a detailed study of the liquid-solid interface dynamics during pulsed laser melting of Si and silicon-on-sapphire. Average melt and regrowth velocities, as well as the maximum melt depth, can be obtained with the technique. The measurements are found to agree well with a computer simulation based on a thermal model of the melt and subsequent solidification. The melt-in velocity has been observed to exceed 200 m/sec. Under 2.5 ns UV irradiation, the critical velocity for amorphization of <100> Si has been measured at 15 m/sec. (24 refs.)

101774 Ultra-high speed solidification and crystal growth in transiently molten semiconductor layers. A.G.Cullis (Royal Signals & Radar Establ., Malvern, England).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.75-82
The use of Q-switched laser melting techniques to investigate new rapid solidification phenomena is described. It has been found that Si, Ge, GaP and GaAs can give rise to orientation-dependent, kinetically-controlled defect generation processes during fast recrystallization from the melt. Indeed, these materials yield amorphous phases at sufficiently high solidification rates. Ultra-fast pulsed melting permits the study of the basic thermodynamic properties of amorphous solids. It is shown that amorphous Si melts to give a normal, low viscosity, undercooled liquid and that novel explosive crystal growth processes can occur in this low temperature regime. (18 refs.)

101775 Amorphous phase trapping as a result of pulsed laser irradiation of silicon. R.F.Wood (Solid State Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.83-8
It is concluded that large interface undercoolings of ~300 deg are not likely to occur during pulsed laser annealing and that the observed liquid to amorphous phase transition is not a purely thermodynamic effect. It is then shown that the formation of the amorphous phase can be understood on the basis of a kinetic rate model which makes large undercoolings of the interface unnecessary. (15 refs.)

101776 Nonlinear laser melting of indium antimonide and silicon. M.P.Hasselbeck, H.S.Kwok (Dept. of Electrical & Computer Engng., State Univ. of New York, Amherst, NY, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.97-104
Pulsed 10.6 μm TEA CO_2 laser light has been used to melt the semiconductors silicon and InSb. Measurements indicate that generation of free carriers necessary for melting may take place by nonlinear processes such as two-phonon absorption or intraband avalanche ionization. If the semiconductor is sufficiently doped, melting may also result from linear free carrier absorption. In all cases, it appears that the molten depth exceeds several μm, which is much greater than obtained with lasers of shorter wavelength. (6 refs.)

101777 Thermodiffusion—a new approach to plasma self-confinement. A.Forchel, B.Laurich (Phys. Inst., Univ. Stuttgart, Stuttgart, Germany), G.Mahler.
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.105-10
From a model for the thermodiffusion of high density plasma an electronic mechanism for plasma self-confinement is derived. Due to the increase of the confinement densities with the density of states masses this effect should be most important in laser annealing experiments in Si but much weaker in GaAs. A fast diffusion of the surface generated plasma is found to enhance the impact ionization rate. (8 refs.)

101778 Temperature characterization of pulsed laser annealing of semiconductors. D.L.Kwong, D.M.Kim (Dept. of Electrical Engng., Univ. of Notre Dame, Notre Dame, IN, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.111-16
The dynamic characteristics of lattice temperature, T attained in Si under the influence of a high power laser beam irradiation are examined analytically over a wide range of laser wavelengths, pulse intensities and durations. The strongly temperature-dependent material parameters, such as optical absorption coefficient $\alpha(T)$ and thermal diffusivity $D(T)$ are incorporated in heat diffusion equation, and their nonlinear coupling effect on the ensuing temperature in laser-processed semiconductors are examined. Specifically, the threshold pulse energy for surface melting is characterized as a function of both material and annealing laser beam parameters. This analytic description of pulsed laser heating of semiconductors should provide considerable insight into the transient heating phenomena and localized material modifications. (10 refs.)

101779 Substrate latent heat effects in the calculations for pulsed laser irradiated thin films. J.J.Cao, K.Rose (Center for Integrated Electronics, Rensselaer Polytech. Inst., Troy, NY, USA), O.Aina, W.Katz, J.Norton.
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.117-22
The authors present a numerical model for the calculation of the temperature rise caused by pulsed laser irradiation of a thin film/substrate structure. This model included phase changes in both the thin film and the substrate. The inclusion of phase changes results in more complex thermal behaviour and significantly affects melt durations. This model was applied to the AuGe/GaAs system. Morphological observation using the scanning electron microscope and SIMS profiles provides experimental verification for the numerical calculations. (7 refs.)

101780 Laser induced temperature rise in semiconductors: analytical solutions, application to the transient. A.Maruani, Y.I.Nissim, F.Bonnouvrier, D.Paquet (CNET, Bagneux, France).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.123-8
It is shown how the systematic use of the method of integral transforms greatly simplifies the calculation of the temperature rises in laser irradiated media. In general, this method leads ultimately either to analytical results or to very simple numerical integrals (e.g. no poles, exponential kernels). The authors focus on the analytical results, and discuss some aspects of CW laser heating, for large surface absorption, including radial dependence, depth dependence and transient nonlinearities. The new results derived in this treatment are in good agreement with experimental data from other studies. (6 refs.)

101781 Visualization of temperature profiles in a-Si crystallized in the explosive mode by CW laser. M.Rivier, A.Cserhati, G.Goetz (Bendix Advanced Technol. Center, Columbia, MD, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.185-9
The authors present an experimental method, based on the isothermal nature of the boundaries of explosively crystallized silicon, to display instantaneous isotherms produced by fast scanning laser beams. This method is especially useful for the case of multilayer structures or complex geometries, where thermal profiles simulation is a difficult problem. The authors can also obtain directly a measure of the spatial intensity distribution in the laser beam. (12 refs.)

101782 Surface electromagnetic waves in laser material interactions. D.J.Ehrlich, S.R.J.Brueck, J.Y.Tsao (Lincoln Lab., MIT, Lexington, MA, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.191-6
Transient ripple formation in pulsed laser annealing of semiconductor materials is shown to arise from amplified surface polariton scattering. The permanent ripple patterns are frozen in after transverse thermal and material diffusion during the laser-annealing process. The model is in good agreement with time-resolved measurements of the ripple formation in 1.06-μm laser anealing of Ge. Dispersion of the ripple wavevector in the UV spectral region is discussed. (12 refs.)

101783 Laser induced periodic surface structure. H.M.Van Driel, J.F.Young, J.E.Sipe (Dept. of Phys., Erindale College, Univ. of Toronto, Toronto, Ontario, Canada).
Laser-Solid Interactions and -Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.197-204
Laser induced periodic surface structure can be understood as a universal phenomenon which occurs when high intensity pulses are absorbed near the surface of solids or liquids. The phenomenon occurs on metals, semiconductors and insulators because of the interference between the incident pulse and an induced 'radiation remnant'. This scattered field may be enhanced by the existence of true surface modes such as surface plasmons or phonon-polaritons, but this is not essential. The universality characteristics include beam polarization, since they show that circularly polarized light can induce surface ripples, with the damage structure showing a dependence on the sense of rotation. They also present time resolved results of the formation of the ripples to illustrate the essential dynamical processes that occur. (23 refs.)

101784 Picosecond laser-induced surface transformations in solids. P.M.Fauchet, Z.Guosheng, A.E.Siegman (Edward L. Ginzton Lab., Stanford Univ., Stanford, CA, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.205-10
The authors report the results of a study of surface transformations in semiconductors (Si, GaAs) and metals (Cu) produced by 100 ps long pulses from a Nd:YAG laser system. They present and outline the conclusions of their model for growth of spontaneous periodic surface structures or ripples often associated with laser damage and annealing. The effect of repetitive subthreshold illumination is also examined. Theoretical analysis is presented to support time-resolved experiments performed with two excitation pulses at different wavelengths. (15 refs.)

101785 Aligned, coexisting liquid and solid regions in pulsed and CW laser annealing of Si. R.J.Nemanich, D.K.Biegelsen, W.G.Hawkins (Xerox Palo Alto Res. Center, Palo Alto, CA, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.211-16
Aligned, coexisting liquid and solid regions are observed in CW laser annealing of polycrystalline Si films on quartz susbstrates. These stripe patterns are the precursors of surface topography that exists after cooling. It is proposed that a similar situation exists in the pulse annealing process. A calculation of the temperature evolution which assumes stripe symmetry and kinetic restraints of the crystallization process has been carried out. The calculations indicate a lattice temperature of between 1100 and 1300K, 10 nsec after the sample has fully solidified. (10 refs.)

101786 Interferometric measurements of surface properties during laser annealing. M.Bertolotti, A.Ferrari, C.Sibilia (Istituto di Fisica, Ingegneria, Univ. Roma, Rome, Italy).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.217-20
A simple interferometric method is presented which allows measurement of small vertical displacement of a surface heated by a laser beam. Calculations applied to a silicon crystal in the case of a CW laser show reasonable agreement with experiment. The method can be applied to assess surface temperature and thermal constants. (2 refs.)

101787 Search for vacancies in laser annealed silicon. H.J.Stein, P.S.Peercy (Sandia Nat. Labs., Albuquerque, NM, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.229-34
In an effort to enhance vacancy trapping and detection in laser-annealed Si, float zone Si was implanted with oxygen to achieve concentrations between one and two orders of magnitude greater than the equilibrium saturation limit. Oxygen, which is known to be an effective trap for vacancies, was found to incorporate efficiently into Si regrown with Q-switched laser annealing. Interstitial oxygen, oxygen-vacancy defects and divacancies were observed after implantation. The laser-regrown layers, however, were free of detectable vacancy-associated defects. (12 refs.)

101788 Microprobe Raman analysis of picosecond laser annealing of implanted silicon. J.Sapriel, Y.I.Nissim, J.L.Oudar (CNET, Bagneux, France).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.235-40
Picosecond laser annealing has been performed on implantation-amorphised silicon. A multiannular (up to five rings) recrystallization pattern has been generated by a single-30 psec pulse at 1.06 μm and 0.53 μm wavelength and energy density just below the damage threshold. The different patterns have been investigated by scanning the surface with a Raman microprobe with a 1 μm spacial resolution. Information is thus given on the different phases (amorphous or crystalline) and on lateral as well as in depth dimensions of the different rings. (9 refs.)

101789 Pulsed laser annealing of ion implanted Ge. O.W.Holland, J.Narayan, C.W.White, B.R.Appleton (Solid State Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.297-302
Ion backscattering/channeling and transmission electron microscopy (TEM) were used to investigate the annealing behavior of ion implanted Ge single crystals using a Q-switched ruby laser. The impurities studied where Bi, In, Sb and Pb, which were implanted at liquid nitrogen temperature into both (100) and (111) crystal orientations. A rather unique damage structure which can form during room temperature implantation of Ge is discussed. Maximum substitutional concentrations, which far exceed the retrograde maxima, are reported for all the dopants studied in (100)Ge. The maximum concentrations were limited by an interfacial instability during epitaxial growth following laser irradiation which led to the formation of a well-defined cellular structure. (14 refs.)

101790 Surface studies of laser annealed semiconductors. D.M.Zehner, C.W.White (Solid State Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.317-28
The surface regions of semiconductor single crystals have been examined following laser annealing in an ultrahigh vacuum environment with output of a pulsed ruby laser. Atomically clean surfaces with impurity levels below 0.1% of a monolayer can be produced by multiple pulse irradiation. Ordered surface structures are produced on low index oriented crystals as well as crystals slightly misoriented. Metastable surface structures exhibiting (1×1) LEED patterns have been produced on (111) orientations and are believed to be a consequence of the rapid cooling rates of 10^9 degs/sec achieved with the laser irradiation process. The surface and subsurface regions of ion-implanted Si crystals have been examined both before and after laser irradiation and results obtained from Si samples implanted with As are discussed. (17 refs.)

101791 Laser-induced surface defects. J.M.Moison, M.Bensoussan (Dept. OMT, CNET, Bagneux, France).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.329-34
The influence of pulsed laser processing (PLP) on the structure and composition of Si, GaAs, InP and Au surfaces has been investigated as a function of the laser fluence. Above a threshold fluence, all initial structures turn into a (1×1) structure and the V-element content of the compound surfaces is decreased. The structure change is shown to be related to the existence of a number of atomic steps on the PLP surface (up to $10^{14}/cm^2$ equivalent broken bonds). These defects can be eliminated by further annealings. On the other hand, the stoichiometry defects, which are less numerous (10^{12}-$10^{13}/cm^2$) cannot be eliminated. A model for the mechanisms of defect creation and annihilation during PLP is outlined. The incidence of PLP-induced defects on device technology is evaluated. (14 refs.)

Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium .... See Entry 98648

Cohesive Properties of Semiconductors under Laser Irradiation. Proceedings of the NATO Advanced Study Institute .... See Entry 98653

Laser-Solid Interactions and Transient Thermal Processing of Materials .... See Entry 98657

Explosive crystallization in a-Ge and a-Si: a review .... See Entry 101559

Pulsed UV excimer laser doping of semiconductors .... See Entry 101732

Submicrometer-linewidth laser doping .... See Entry 101733

Characteristics of laser implantation doping .... See Entry 101734

Dopant incorporation during rapid solidification .... See Entry 101735

Ising model simulations of impurity trapping in silicon .... See Entry 101740

Impurity redistribution in ion implanted Si after picosecond Nd laser pulse irradiation .... See Entry 101741

Impurity distribution profiles and surface disorder after laser induced diffusion .... See Entry 101742

Pulsed neodymium: yttrium aluminum garnet laser (532 nm) melting of crystalline silicon: experiment and theory .... See Entry 101917

Coherent precipitate formation in pulsed-laser and thermally-annealed, ion-implanted Si .... See Entry 101989

Segregation and crystallization phenomena in germanium .... See Entry 101990

Impurity diffusion in silicon annealed by semi-continuous laser .... See Entry 102073

Determination of surface tension coefficient of liquid metals and alloys using the phenomenon of capillary wave formation .... See Entry 102123

Ordered steps on Bi(~0001) vicinal surfaces by laser pulse anneal .... See Entry 102137

Analysis of laser-enhanced adsorption/desorption processes on semiconductor surfaces via electronic surface state excitation .... See Entry 102182

Epitaxial $NiSi_2$ formation by pulsed laser irradiation of thin Ni layers deposited on Si substrates .... See Entry 102188

TEM observations of laser-induced Pt and Au deposition on InP .... See Entry 102198

Laser-induced solid phase crystallization in amorphous silicon films .... See Entry 102214

Solid-phase-epitaxial growth of ion implanted silicon using CW laser and electron beam annealing .... See Entry 102215

Defect control during epitaxial regrowth by rapid thermal annealing .... See Entry 102216

Deep levels subsisting in ion implanted silicon after various transient thermal annealing procedures .... See Entry 102301

Laser annealed ohmic contact to n^+-GaAs .... See Entry 102505

The properties of laser-alloyed zinc layers on GaAs .... See Entry 102509

Laser-recrystallized polycrystalline silicon resistors for integrated circuit applications .... See Entry 102535

Gamma quantum resonance scattering in crystals being irradiated by a laser wave .... See Entry 102788

Time-resolved reflectivity measurements in silicon [with reply] .... See Entry 102839

Raman scattering as a temperature probe for laser heating of Si .... See Entry 102895

Temperature dependence of the absorptivity of aluminum targets at the 10.6 μ wavelength .... See Entry 103008

Ion and electron spectroscopy during pulsed laser irradiation of silicon .... See Entry 103009

Explosive recrystallization of ion implantation amorphous silicon layers .... See Entry 103047

Laser chemical etching of conducting and semiconducting materials .... See Entry 103366

Formation of CdO and Cu_2O films by laser irradiation of the corresponding metallic films in air .... See Entry 103407

61.80C X-rays

101792 Irradiation effects in perovskite-type fluorides. N.Kristianpoller, B.Trieman (Dept. of Phys. & Astron., Tel Aviv Univ., Tel Aviv, Israel).
Radiat. Eff. (GB), vol.72, no.1-4, p.201-8 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
Nominally pure as well as variously doped ABF_3 crystals were irradiated by X-rays or by monochromatic UV radiation in the spectral region from 300 to 110 nm. It appears that some of the absorption bands, induced by the low energy radiation are due to the same defects as the electron induced bands at the same wavelengths; this is supported by the finding that the related bands decay in both cases in a similar way. Correlations were also found between the spectral composition of the TL emitted during thermal annealing of certain radiation defects and the emission bands of the *X*-luminescence. Some emission bands are attributed to a radiative decay of self trapped excitons, others to the recombination of holes with F centers or with electrons trapped at the sites of impurity ions. Experimental data obtained even from differently structured samples, showed similar and consistent results, indicating that radiolysis processes are responsible for the defect formation by X and by VUV-radiation also in this type of crystals. (8 refs.)

101793 Defects induced in single thoria crystals by X and far UV irradiation. N.Kristianpoller, A.Rehavi (Dept. of Phys. & Astron., Tel Aviv Univ., Tel Aviv, Israel).
Radiat. Eff. (GB), vol.72, no.1-4, p.209-17 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
Effects of X and of monochromatic vacuum UV irradiations on nominally pure and on Y^{3+} doped ThO_2 crystals were studied by optical and electrical methods. A strong luminescence appeared during the irradiations at 80K; the spectral composition and temperature dependence of the main emission bands were measured. Irradiation at 80K and heating to 500K caused the appearance of TL and TSC peaks. TL excitation spectra were measured and showed maxima at wavelengths corresponding to band-to-band transitions as well as at the long wavelength tail of the fundamental absorption. Results indicate that the UV induced defects are identical with some of those created by X-rays. The emission spectra showed in addition to the known impurity bands also broad bands at 305, 450 and 500 nm. The 305 nm band is apparently due to the intrinsic recombination of self trapped excitons. The 450 and 500 nm bands, which were also dominant in most TL peaks, are attributed to recombination processes of holes with F and F^+ centers respectively. (5 refs.)

101794 F and photochromic centers in $LiYF_4$:Nd crystals. S.P.Morato, T.C.A.Macedo (Inst. de Pesquisas Energeticas e Nucleares, Sao Paulo, Brazil).
Radiat. Eff. (GB), vol.72, no.1-4, p.229-35 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
Samples of Nd doped $LiYF_4$ single crystals (scheelite structure) were X-irradiated at room temperature and valence changes plus defect production by radiation damage were studied by optical spectroscopy techniques. The band centered at 3.70 eV showed a temperature dependent gaussian shape indicating a strong electron-phonon coupling suggestive of an F type center defect. Reversible valence changes of $Nd^{3+} \rightarrow Nd^{2+}$ transitions after irradiation were observed throughout luminescence studies when $(Nd^{3+})^* \rightarrow Nd^{3+}$ transitions were identified. A new band centered at 4.57 eV was found. This band showed an optical switching mechanism and a correlation to the $4D_{3/2}$ transition of the Nd^{3+} ion. This band was assigned as being due to a photochromic $(F\text{-}Nd^{3+})$ center. (7 refs.)

Study of defect formation in irradiated KL and KI(Pb) by Raman scattering and optical absorption techniques .... See Entry 101694

F^+ centre in (Ca-Sr) carbonated hydroxyapatites .... See Entry 101702

Effect of X-irradiation on impurity-vacancy dipoles in lead and calcium-doped NaCl .... See Entry 101746

Comment on the model of the Mg centres in NaCl crystals .... See Entry 102302

Interstitial Tl^0 atoms in alkali halides: ESR study of a ⟨111⟩-oriented Tl_2^+ center .... See Entry 102748

Optically and X-ray-induced paramagnetism in amorphous phosphorus .... See Entry 102749

Influence of anion impurities and X-rays on the piezoelectric effect in ammonium dihydrogen phosphate crystals .... See Entry 102822

Raman scattering induced by V centers and their aggregates in alkali halides .... See Entry 102890

On the use of X-ray-excited optical luminescence (XEOL) for the analysis of multisite rare-earth systems .... See Entry 102923

A study of recombination centres in $YAlO_3$, $EuAlO_3$, $LaAlO_3$ and Y_2O_3 using ODMR .... See Entry 102947

Thermoluminescence of X- or γ-irradiated KI and $KI(Ca^{2+})$ crystals .... See Entry 102966

Vacuum-UV absorption and thermoluminescence of X-rayed quartz crystals .... See Entry 102968

61.80E Gamma rays

Electric conduction of low density polyethylene induced by high dose rate gamma rays .... See Entry 102413

The ⟨110⟩ oriented FCl^- molecule-ion in KF .... See Entry 102743

Currents generated in pyroelectrics by γ irradiation .... See Entry 102825

Effect of thermoradiation treatment on the radiation stability of glasses .... See Entry 102845

Optical absorption spectra of mercury centres in KCl and NaCl ....See Entry 102915

Thermoluminescence of X- or γ-irradiated KI and KI(Ca^{2+}) crystals ....See Entry 102966

61.80F Electrons and positrons

101795 Determination of the threshold-displacement energy in α-Al_2O_3 by high-voltage electron microscopy. G.Das (Super Semi Conductor (P), Calcutta.Ltd.,India).
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.453-6 (Aug. 1983).
The author describes the determination of the displacement-threshold energy of α-Al_2O_3 single crystals having [0001] and ⟨1120⟩ orientations by the HVEM method of monitoring the onset of observable defect clusters. (11 refs.)

101796 Heating of solid targets by electron beams. M.K.Bhattacharyya, D.T.Tuma (Dept. of Electrical Engng., Carnegie-Mellon Univ., Pittsburgh, PA, USA).
IEEE Trans. Electron Devices (USA), vol.ED-30, no.6, p.602-8 (June 1983).
The heating of a solid material by a high-energy electron beam is discussed. The two-dimensional transient nonlinear heat equation has been solved by the finite element method, considering both the penetration of the beam into the target and its finite size. The importance of the temperature dependences of each of the material properties on melt time have been established. Results are presented for the time needed for the first melting of the target for Cu, Al, Si, GaAs, impinged by beams having energies and parameters covering a wide range of values. Also the regimes of validity of the one-dimensional heat equation are discussed. (25 refs.)

101797 Thermal profiles and thermal stresses introduced on silicon during scanning line shaped beam annealing. L.Correra, G.G.Bentini (CNR-Istituto Lamel, Bologna, Italy).
J. Appl. Phys. (USA), vol.54, no.8, p.4330-7 (Aug. 1983).
The evaluation of thermal profiles and introduction of defects due to thermal stresses induced on ⟨100⟩ silicon during the annealing carried out by the scanning of a line shaped *e*-beam source, has been performed. The computation of the temperature profiles along the sample for different beam scan speed and incident power has been used to evaluate the two-dimensional map of the thermal stresses induced over a 4×2 cm^2 silicon sample ⟨100⟩ oriented. The computed stresses were then compared with the yield stress of the material at the actual annealing temperature. The topographic distribution of the thermal stresses shows quite a complicated trend changing drastically from compressive to tensile as a function of beam position along the sample; it can be concluded that the introduction of defects takes place mainly at the edge of the sample which is irradiated last. An experimental check of the authors' computations has been performed by using a fast multiscanning electron beam along a line, joined to a mechanical translation of the sample through the scanned region. Pyrometric temperature measurements performed during the irradiation confirm our computed temperature profiles, whereas both sheet resistivity measurements and X-ray topography show that the introduction of defects actually takes place in the region of the sample and at the irradiation conditions foreseen by the present computation. (19 refs.)

101798 Creation of quasistable lattice defects by electronic excitation in SiO_2. K.Tanimura, T.Tanaka, N.Itoh (Dept. of Crystalline Materials Sci., Nagoya Univ., Nagoya, Japan).
Phys. Rev. Lett. (USA), vol.51, no.5, p.423-6 (1 Aug. 1983).
The transient volume change of α-quartz and fused silica induced by irradiation with an electron pulse has been measured above 80K. It is shown that transient changes of volume and optical absorption due to the E_1' centers (oxygen vacancies) decay in parallel and that he volume change per E_1' center is of the order of a unit molecular volume. The results show unambiguously that recombination-induced defect formation occurs in SiO_2 but the defects created are not stable even at low temperatures. (24 refs.)

101799 Recent studies of radiation induced F-center and colloid particle formation in synthetic NaCl and natural rock salt. P.W.Levy, J.M.Loman, K.J.Swyler, D.R.Dougherty (Brookhaven Nat. Lab., Upton, NY, USA).
Radiat. Eff. (GB), vol.72, no.1-4, p.303-8 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
Radiation induced F-center and Na metal colloid formation have been studied, at temperatures between 100 and 350°C, in melt grown synthetic NaCl crystals and natural rock salt samples, using equipment for making optical measurements during 1-3 MeV electron irradiation. In both types of NaCl the damage formation kinetics are qualitatively similar. However, there are large quantitative differences which depend on irradiation temperature, dose rate, total dose, inherent strain, strain applied prior to irradiation and other factors. Natural rock salt samples from different localities exhibit markedly different radiation induced colloid formation rates. An extrapolation of the current data to the doses expected in radioactive waste depositories indicate that natural salt immediately adjacent to the planned waste canisters could develop between 0.1 and 50 percent colloidal sodium in 50 to 400 years. (13 refs.)

101800 Disordering kinetics in neutron and electron irradiated Fe-Co alloy. J.P.Riviere, J.F.Dinhut (Lab. de Metallurgie Phys., Poitiers, France).
Scr. Metall. (USA), vol.17, no.7, p.885-8 (July 1983).
Electrical resistivity measurements have been used to study the disordering kinetics under irradiation at liquid hydrogen temperature either with 2.5 MeV electrons or fission neutrons in an equiatomic Fe-Co ordered alloy. (20 refs.)

101801 Mechanism of contamination build-up induced by fine electron probe irradiation. N.Yoshimura, H.Hirano, T.Etoh (JEOL Ltd., Tokyo, Japan).
Vacuum (GB), vol.33, no.7, p.391-5 (July 1983).
To clarify the transfer mechanism of contaminating molecules and the dominant source of them, carbon thin films were irradiated with a fine electron probe of 12 nm dia using three types of anti-contamination devices, individually. No contamination deposit was observed for a certain period or an incubation time after the specimen was pretreated by an electron beam shower. After the incubation time, the growth rate increased gradually with the elapsed time after the electron beam shower treatment and reached the saturated rate. The incubation time and the saturated growth rate depended largely on the type of the anti-contamination device used. It can be concluded that hydrocarbon molecules being adsorbed on the specimen surface are transferred to the irradiated area by surface diffusion. The dominant source of contaminating molecules is the residual gas molecules in the vicinity of the specimen even in a clean high vacuum. (11 refs.)

101802 Analysis of temperature and stress profiles induced by a CW line scanned electron beam in ⟨100⟩ oriented silicon. G.G.Bentini, L.Correra (CNR, Istituto Lamel, Bologna, Italy).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.241-6
Evaluation of thermal profiles along the scan direction of a line shaped e-beam as well as the topographic distribution of the thermally induced stresses have been performed by solving the heat diffusion equation for several incident power values. The resulting stresses have been computed in the 'nearly isotropic' approximation but taking into account that the slip planes, in ⟨100⟩ oriented silicon crystals, are (111) and the slip directions in the plane are ⟨110⟩. The threshold of damage introduction has been evaluated by comparing the computed stresses with the yield stress of the material at any annealing temperature. Experimental observations based on X-ray topography have been performed in order to study the damage introduction on ⟨100⟩ silicon samples annealed in the same conditions used for stress computation. A very good agreement between computed and experimental results was found. (9 refs.)

Carrier dependent parameters in a silicon optical waveguide . See Entry 100888

Threshold energy surface and Frenkel pair resistivity for Cu ....See Entry 101690

A new type of electron beam doping—anomalous sputtering, anomalous room-temperature diffusion ....See Entry 101729

Experimental determination of the energy dependence of defect production ....See Entry 101748

Atomic displacement functions of cubic metals ....See Entry 101753

Temperature effect on the increase of the Kumakhov radiation yield at axial channeling of relativistic electrons ....See Entry 101827

Solid-phase-epitaxial growth of ion implanted silicon using CW laser and electron beam annealing ....See Entry 102215

Deep levels subsisting in ion implanted silicon after various transient thermal annealing procedures ....See Entry 102301

Effects of keV electron irradiation on the avalanche-electron generation rates of three donors on oxidized silicon ....See Entry 102399

Magneto-optical studies of atomic thallium centers in KCl: Magnetic circular dichroism tagged by spin resonance ....See Entry 102855

Parametric X-rays from ultrarelativistic electrons in a crystal: theory and possibilities of practical utilization ....See Entry 103001

A computer controlled investigation of the electron energy spectra formed under electron bombardment during the early stages of the oxidation of iron ....See Entry 103013

Explosive recrystallization of ion implantation amorphous silicon layers ....See Entry 103047

Changes in the structure and mechanical properties of 25Kh2MFA steel under the effect of programmed increasing load and irradiation ......See Entry 103252

Radiation damage to lyophilized mineral solutions during electron probe analysis: quantitative study of chlorine loss as a function of beam current-density and sample mass-thickness ....See Entry 103619

Electron irradiation effects on amorphous silicon solar cells . See Entry 103688

61.80H Neutrons

101803 Evaluation method of fast neutron irradiation dose in JMTR. F.Sakurai, T.Niibo.
J. At. Energy Soc. Jpn. (Japan), vol.25, no.5, p.372-82 (May 1983). In Japanese.
The neutron fluence above 1.0 MeV or 0.1 MeV is routinely reported as the fast neutron irradiation dose value for materials irradiation experiments in the Japan Materials Testing Reactor (JMTR). The radiation damage of materials is, however, affected by not only the amount of the neutron fluence but also the neutron energy spectrum. Therefore, in the radiation damage studies of materials the neutron irradiation dose values should be expressed in the exposure parameter containing the information of the neutron energy spectrum. The authors describe some exposure parameters such as displacement per atom and damage fluence, and correlations between these parameters and the neutron fluence above 1.0 MeV in the JMTR. These parameters have deep connections with changes in the physical properties of materials under neutron irradiation. The neutron irradiation dose values in the JMTR can be evaluated in some kinds of exposure parameters containing the information of the neutron energy spectrum from the neutron fluence above 1.0 MeV measured using the $^{54}Fe(n,p)^{54}Mn$ monitor. (5 refs.)

101804 Microstructural and microchemical comparisons of AISI 316 irradiated in HFIR and EBR-II. H.R.Brager, F.A.Garner (Westinghouse Hanford Co., Richland, WA, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.159-76 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
Two alternative interpretations of a unique but limited set of swelling data have been advanced in an attempt to predict the influence of helium on the swelling of 20% cold-worked AISI 316. It is shown that swelling data for annealed AISI 316 provide substantial insight concerning the role of helium on swelling. Additional insight has been obtained by a series of microstructural and microchemical examinations conducted on specimens of both annealed and cold-worked steel after irradiation in EBR-II and HFIR. These reactors differ greatly in neutron spectra and in AISI 316 generate quite different helium/d.p.a. ratios and solid transmutant levels. At least in the range 500-750°C, the results of these studies show that helium's influence on swelling is manifested in the cavity density but not in the dislocation density or the major features of the microchemical evolution of the alloy matrix. The results also suggest that the influence of helium at high displacement levels is not strong on either the total swelling or the steady-state swelling rate. (59 refs.)

101805 Impact of the injected interstitial on the correlation of charged particle and neutron-induced radiation damage. F.A.Garner (Westinghouse Hanford Co., Richland, WA, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.177-97 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
The successful conclusion of an intercorrelation program developed in the US Breeder program has provided significant insight on the factors governing the swelling that develops in ion-bombardment studies and its relationship to the swelling that occurs during neutron irradiation. It appears that the injected interstitial or a related phenomenon exerts a pronounced influence on ion-induced swelling. This conclusion has ramifications with respect to the conduct and interpretation of ion irradiation experiments employed to study the effect of helium or composition on swelling. (56 refs.)

Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors .... See Entry 98632
Atomic displacement functions of cubic metals .... See Entry 101753
Quantitative modelling of swelling in M316 steel .... See Entry 101754
Helium partitioning between voids and dislocations .... See Entry 101755
Theory of pulsed irradiation microstructures .... See Entry 101757
Disordering kinetics in neutron and electron irradiated Fe-Co alloy .... See Entry 101800
Void growth in a pulsed irradiation environment .... See Entry 101808
On the relationship between the electronic density of states and the superconducting critical temperature of disordered V_3Si .... See Entry 102552
Polarized IR reflectance spectra of pure and neutron irradiated $Qn(TCNQ)_2$ mosaics .... See Entry 102882

61.80J Ions

(for ion implantation, see 61.70T)

101806 Ion mass effects on bombardment-induced disordering of γ'-Ni_3Si. S.P.Lamond, D.I.Potter (Metall. Dept., Univ. of Connecticut, Storrs, CT, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.64-9 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
The kinetics of disordering of the ordered compound γ'-Ni_3Si during ion bombardment were investigated at a temperature of 270°C. The disordering followed first order kinetics and the rate constant was measured as a function of incident ion flux, ion energy, and ion mass. The rate constant varied approximately in direct proportion with the ion flux during bombardment with 1 MeV $^{84}Kr^+$-ions: from ~ 0.28 min^{-1} at ~ 70 nA/cm^2 to ~ 50 min^{-1} at ~ 4.4 μA/cm^2. During bombardment with a flux of ~ 1 μA/cm^2 of $^{132}Xe^+$-ions, the rate constant was directly proportional to the calculated near-surface damage rate. It varied from ~ 50 min^{-1} for 200 KeV ions with calculated damage rates of $\sim 2.3 \times 10^{-2}$ dpa/s to ~ 1.8 min^{-1} for 3 MeV ions with damage rates of 2×10^{-3} dpa/s. The disordering rate was also observed to be directly proportional to the near surface damage rate for heavier mass ions ($^{40}Ar^+$, $^{84}Kr^+$ and $^{132}Xe^+$); the ratio of disordering rate to damage rate was ~ 17. This ratio dropped to ~ 3 for $^{20}Ne^+$-ion bombardment, and to ~ 0.4 for bombardment with $^4He^+$-ions. The decrease in the ratio with decreasing mass is discussed in terms of cascade size, replacement-to-displacement ratio, and random recombination. (9 refs.)

101807 Compositional changes in Fe-Cr-Ni alloys under proton bombardment at elevated temperatures. N.Q.Lam (Materials Sci. & Technol. Div., Argonne Nat. Lab., Argonne, IL, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.106-12 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
Compositional redistribution in austenitic Fe-Cr-Ni alloys during energetic proton bombardment has been calculated as a function of time, temperature, and ion energy, using a kinetic model of radiation-induced segregation recently developed for ternary alloys. The effect of spatial nonuniformity in damage rates was taken into account and found to have a peculiar effect on the redistribution of the alloying elements. Enrichment of Ni occurs at the bombarded surface and in the bulk beyond the damage range, whereas Fe and Cr are enriched in the peak-damage region at the expense of their depletion in regions near the surface and beyond the damage range. These compositional changes can lead to local phase transformation, since the composition of local regions of the alloy is shifted away from the initial composition into different parts of the multicomponent phase diagram. The stability of the austenite phase in the sub-surface and post-range regions is enhanced by irradiation, while the austenite-to-ferrite transformation takes place in the peak-damage region. (16 refs.)

101808 Void growth in a pulsed irradiation environment. J.L.Brimhall, E.P.Simonen, L.A.Charlot (Pacific Northwest Lab., Richland, WA, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.118-22 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
The shrinkage of voids in pure nickel during the pulse annealing period was found to be significant only for very small voids. Rapid void growth and coarsening become the dominant mechanism early in the irradiation period at high temperatures. Pulsed irradiation produced increased coarsening which could be accounted for by increased time at temperature compared to steady irradiation. Qualitatively the change in microstructure upon changing irradiation temperature agreed with results from other studies. (8 refs.)

101809 Effects of pulsed dual-ion irradiation on phase transformations and microstructure in Ti-modified austenitic alloy. E.H.Lee, N.H.Packan, L.K.Mansur (Metals & Ceramics Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.123-33 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
The influence of pulsed 4 MeV Ni ion bombardment with and without simultaneous helium injection, has been explored in a low swelling, Ti-modified austenitic stainless steel. Irradiations were carried out to 70 d.p.a. at 950K; the pulsing frequencies were either 60 s on/off or 1 s on/off. Compared to continuous irradiation, pulsing caused a decrease in the interstitial loop diameter at 1 d.p.a., although at higher doses the overall dislocation density was not affected. Pulsing and helium both promoted the stability of MC precipitates and retarded the subsequent G phase formation; in some cases G-phase was suppressed and η phase formed instead. Small bubble-like cavities were observed to grow into large voids after steady dual beam irradiation to 70 d.p.a.. However, this conversion was suppressed by pulsed irradiation to 70 d.p.a. and furthermore the sizes of the small cavities were somewhat reduced. The results are explained in terms of current mechanistic understanding of mean point defect kinetics and the evolution of microstructure and microcomposition during irradiation with superimposed annealing periods. (20 refs.)

101810 Depth dependent damage profile in stainless steel irradiated with He-ions. K.Shiraishi, K.Fukai (Div. of Nuclear Fuel Res., Ibaraki-ken, Japan).
J. Nucl. Mater. (Netherlands), vol.117, p.134-42 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
Type 316 stainless steel was irradiated with 24 MeV He-ions up to 3.2×10^{20} ions/m^2 at ambient temperature. A peak in microhardness occurred at a distance of 105 μm. A pair of parallel lines with a space of 8 μm centered at a distance of 107 μm from the radiated surface were revealed on the top surface of the specimen by chemical etching after post-irradiation annealing for 1 h at 1023K. The parallel lines correspond to arrays of fairly large Frank loops aligned in narrow bands on each side of a region containing helium bubbles. The observed damage profiles agree with those predicted by Littmark and Ziegler. (25 refs.)

101811 Effect of helium preinjection and prior thermomechanical treatment on the microstructure of type 316 SS. A.Kohyama, G.Ayrault, A.P.L.Turner, N.Igata (Materials Sci. & Technol. Div., Argonne Nat. Lab., Argonne, IL, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.143-50 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
Samples of 316 SS were preinjected with 15 a.p.p.m. helium either hot (650°C) or cold (room temperature) and irradiated with 3 MeV Ni^+ ions to a dose level of 25 d.p.a. at 625°C in order to test the validity of helium preinjection as a means of simulation of transmutant helium production. Results for preinjected and single-ion irradiated samples were compared to samples irradiated at 625°C to a 25 d.p.a. dose level with 3 MeV Ni^+ and simultaneously injected with helium at a rate of 15 a.p.p.m. He/d.p.a. (dual-ion irradiated samples). Preinjected samples exhibited bimodal cavity size distributions. Preinjected samples of solution annealed or solution annealed and aged material showed lower swelling than dual-ion irradiated samples. However, He preinjected 20% cold worked samples showed greater swelling than dual-ion irradiated samples. (8 refs.)

101812 Influence of helium injection schedule and prior thermomechanical treatment of the microstructure of type 316 SS. A.Kohyama, G.Ayrault, A.P.L.Turner (Materials Sci. & Technol. Div., Argonne Nat. Lab., Argonne, IL, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.151-8 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
The influence of different helium injection schedules on microstructure development in Ni^+ ion-irradiated 316 SS at 625 °C is discussed. Injection schedules were chosen to either approximate the MFR condition or mimic the mixed-spectrum reactor condition. Dual-iron irradiation to 25 d.p.a. produced strongly bimodal cavity size distributions in solution annealed and solution annealed and aged samples, whereas single-ion irradiation followed by dual-ion irradiation to the same dose produced a cavity size distribution with a substantial component of intermediate-size cavities. Dual-ion irradiation produced only very small cavities in 20% CW material, while single-ion followed by dual-ion irradiation produced some intermediate size cavities and greater swelling. (3 refs.)

101813 Evolution of cavity size distributions in dual-ion irradiated austenitic stainless steel and Fe-Cr-Ni ternary alloys. J.A.Spitznagel, W.J.Choyke, J.Lauer, B.O.Hall (Westinghouse Res. & Dev. Center, Pittsburgh, PA, USA), J.N.McGruer, J.R.Townsend, R.B.Irwin.
J. Nucl. Mater. (Netherlands), vol.117, p.198-207 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
The first four moments of experimentally measured cavity size distributions in dual-ion irradiated 304SS Fe-12Ni-15Cr and Fe-30Ni-15Cr alloys have been calculated for a range of fluences, helium injection rates, and irradiation temperatures. The moments are shown to correctly describe the effects of alloy composition, fluence, helium and temperature on the evolution of the cavity size distributions. Experimentally determined moments are compared with those calculated from cavity nucleation and growth theories. The moments reflect the competition between nucleation and growth processes and provide insight into the details of the transient low swelling regime. (22 refs.)

101814 Effects of temperature and helium on void formation in self-ion irradiated aluminum. S.K.McLaurin, G.L.Kulcinski (Dept. of Nuclear Engng., Univ. of Wisconsin, Madison, WI, USA), R.A.Dodd.
J. Nucl. Mater. (Netherlands), vol.117, p.208-12 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
High-purity aluminum was irradiated with 9 MeV aluminum ions at several temperatures in the range 25-125°C, both with and without pre-injected helium. The aluminum ion irradiation doses ranged from 0.2 to 20 d.p.a. Void swelling in the temperature range studied was found to occur only when the aluminum contains helium gas, and as little as 0.1 a.p.p.m. helium is sufficient to nucleate a substantial void population. In the absence of helium, even doses of 20 d.p.a. do not result in void formation. The void number density and size follow the general trends in conventional nucleation theories, and are similar to trends observed in nickel and stainless steels. The microstructure quite often contained heterogeneous distributions of void stringers, suggesting nucleation of voids on dislocations. (17 refs.)

101815 Helium bubble formation in Cu, Ni and Cu-Ni alloys. S.J.Zinkle, R.A.Dodd, G.L.Kulcinski, K.Farrell (Dept. of Nuclear Engng., Univ. of Wisconsin, Madison, WI, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.213-17 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
Copper, nickel, and Cu-Ni alloys have been irradiated with 200-400 keV ^3He ions at a constant homologous temperature of $T/T_m = 0.65$. The samples have been analyzed by TEM to compare helium bubble size and density. Visible bubbles were observed in all samples. The pure copper and the Cu-Ni alloys were found to contain similar bubble densities and sizes after irradiation. The pure nickel samples contained helium bubbles of smaller size and higher density as compared to the alloys. (14 refs.)

101816 Effect of irradiation on phosphorus segregation. J.L.Brimhall, D.R.Baer, R.H.Jones (Pacific Northwest Lab., Richland, WA, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.218-23 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
Phosphorus strongly segregated to the surface during irradiation of austenitic-type alloys in the temperature range 775-925 K. Much weaker but measurable radiation induced segregation of phosphorus occurred in a Ni+0.03% P alloy. Irradiation under similar conditions produced no measurable phosphorus segregation in the ferritic HT-9 or Fe+0.003% P alloy. The lack of segregation in the ferritic alloys was suggested to result from a weak point defect-impurity interaction in the BCC iron structure while a strong interaction was suggested for the FCC iron structure. The slow accumulation of radiation damage in BCC iron alloys is also consistent with a lack of observable segregation. The evidence strongly suggests a radiation induced mechanism but a radiation enhanced, thermally activated equilibrium segregation cannot be ruled out. (23 refs.)

101817 **Saturation of proton-induced swelling in AISI 316.** A.Kumar (Dept. of Nuclear Engng., Univ. of Missouri, Rolla, MO, USA), F.A.Garner.
J. Nucl. Mater. (Netherlands), vol.117, p.234-8 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
There is some evidence which suggests the void swelling may not increase continuously with increasing irradiation but may saturate a level dependent on irradiation conditions, helium/d.p.a. level or artifacts of the simulation such as the presence of injected interstitials. An experiment was therefore performed to determine the saturation level of swelling of annealed AISI 316 at 625°C in the absence of helium and injected interstitials. Using 140 keV protons and step-height measurements it was found that saturation did not occur until 260% swelling was achieved at ~600 d.p.a.. Prior to saturation the swelling curve exhibited the anticipated bilinear form with a steady state swelling rate of 0.64%/d.p.a. based on a 20 eV threshold energy. (24 refs.)

101818 **Oxygen implantation in GaAs: damage studies.** R.S.Bhattacharya, A.K.Rai, P.P.Pronko (Universal Energy Systems Inc., Dayton, OH, USA).
Phys. Status Solidi a (Germany), vol.78, no.1, p.283-6 (16 July 1983).
Rutherford backscattering-channeling (RBS-C) and transmission electron microscopy (TEM) are used to investigate the level and nature of the damage in O^+ implanted GaAs layers before and after annealing at 700°C. Two different energies, 80 and 350 keV are used in the dose range of 5×10^{13} to 5×10^{15} cm^{-2}. Damage in the as implanted layer is found to increase as a function of dose, but the layers remained crystalline for the dose range employed. Furnace annealing at 700°C for 15 min removes all the damage up to the dose of 1×10^{15} cm^{-2}. Dislocation lines and loops are observed in the case of 5×10^{15} cm^{-2} implanted layer. However, no precipitation of oxygen is observed in any of these samples. (12 refs.)

101819 **The annealing behavior of ion-irradiated garnet crystals.** B.Strocka, P.Hansen, H.Heitmann (Forschungslab. Hamburg, Philips GmbH, Hamburg, Germany).
Radiat. Eff. (GB), vol.72, no.1-4, p.219-27 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
The relaxation of irradiation induced lattice strain in single crystalline garnet caused by thermal annealing in oxygen has been studied by means of rocking curves using an X-ray double-crystal diffractometer. A 4-μm thick epitaxial $Y_{2.8}La_{0.2}Fe_{4.2}Ga_{0.8}O_{12}$ garnet film on a (111) $Gd_3Ga_5O_{12}$ substrate was irradiated with ^{238}U-ions of 1.4 MeV/u specific energy with doses from 10^{10} cm^{-2} to 3×10^{11} cm^{-2}. Annealing of the irradiated crystal volume becomes significant around 700K with a higher annealing rate for the substrated compared to the epitaxial film. At temperatures above 1300K a decrease of the film lattice constant due to decomposition, preferentially in the irradiated areas, is observed. From the correspondence of the annealing behavior of the irradiation induced lattice variation with that of the saturation magnetization, the Faraday rotation and optical absorption, it is inferred that the annealing process occurs stepwise. (13 refs.)

101820 **Ferromagnetism of alloys: a new probe in ion implantation.** M.Hitzfeld, P.Ziemann, W.Buckel (Phys. Inst. Univ. Karlsruhe, Karlsruhe, Germany), H.Claus.
Solid State Commun. (USA), vol.47, no.7, p.541-4 (Aug. 1983).
It is demonstrated that the ferromagnetic transition temperature of PdFe alloys is a very sensitive probe for lattice defects produced by the implantation of Fe^+ into Pd films and foils. Using this new probe it is shown that the large difference in defect concentration in implanted films and foils is due to a difference in oxygen content. (14 refs.)

101821 **Gas desorption during irradiation of metals with molybdenum ions.** N.P.Katrich, V.N.Kanishchev.
Sov. At. Energy (USA), vol.53, no.6, p.832-6 (Dec. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.6, p.379-82 (Dec. 1982).
The authors investigate the mechanism of gassing during bombardment of a solid with accelerated heavy ions. (7 refs.)

101822 **Simulation of reactor conditions in investigations of radiation damage of the surface of materials.** B.A.Kalin.
Sov. At. Energy (USA), vol.53, no.6, p.837-41 (Dec. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.6, p.382-6 (Dec. 1982).
The study of radiation damage of a surface under bombardment with light ions is of interest for estimation of the durability of materials in fusion reactors and, as a rule, is based on models. In order to simulate the effect of the expected integrated energy spectrum, e.g. materials have been bombarded successively with monoenergetic helium-ion beams of various energies. In this case it has been shown that with the same total dose of implanted helium, blistering and erosion turned out to be less than under bombardment with a helium beam of the same energy. (25 refs.)

101823 **Transient conductivity measurements in pulsed ion beam melted silicon.** R.M.Fastow, J.Gyulai, J.W.Mayer (Dept. of Materials Sci. & Engng., Cornell Univ., Ithaca, NY, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.69-74
A pulsed proton beam, ~200 ns in duration, has been used to melt and regrow single crystal silicon. The protons had an energy of 300 kev, yielding a measured energy density of 0.8-2.0 J/cm^2. The method of transient conductivity has been used to determine the melt depths, melt durations, and regrowth velocities. The measured values for 2.0 J/cm^2 were, respectively, 1.7 μm, 2 μsec, and 1.4 m/sec. Computer generated melt curves were compared to experiment with good agreement. The energy required to initiate melt was determined, and a linear dependence of melt depth with energy has been observed. (8 refs.)

Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors ....See Entry 98632

Atomic displacement rates of light ions in cubic metals ....See Entry 99626

Use of axially symmetric electrostatic fields for ion beam focusing ....See Entry 100651

Cleaning of GaAs surfaces with low-damage effects using ion-beam milling ....See Entry 100797

Ion-implantation dense cascade data ....See Entry 101731

Experimental determination of the energy dependence of defect production ....See Entry 101748

Atomic displacement functions of cubic metals ....See Entry 101753

Helium partitioning between voids and dislocations ....See Entry 101755

Theory of pulsed irradiation microstructures ....See Entry 101757

Impact of the injected interstitial on the correlation of charged particle and neutron-induced radiation damage ....See Entry 101805

Growth of metastable $Cu_{1-x}Cr_x$ solid solutions by ion mixing during bias-sputter deposition ....See Entry 102189

Microstructure and superconducting properties of helium-saturated niobium-titanium alloy ....See Entry 102548

On the relationship between the electronic density of states and the superconducting critical temperature of disordered V_3Si ....See Entry 102552

Changes in the chemical reactivity of metals exposed to an inert gas glow discharge ....See Entry 103404

61.80M Channelling, blocking and energy loss of particles

(see also 29.70 Energy loss and range relations)

101824 **Ranges, reflections and secondary electron emission for keV hydrogen ions incident on solid N_2.** P.Borgesen, H.Sorensen, Chen Hao-Ming (Assoc. Euratom-Rise Nat. Lab., Roskilde, Denmark).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.517-28 (1 July 1983).
Ranges were measured for 0.67-3.3 keV/amu hydrogen and deuterium ions in solid N_2. Comparisons with similar results for N_2-gas confirm the previously observed large phase effect in the stopping cross section. Measurements of the secondary electron emission coefficient for bulk solid N_2 bombarded by 0.67-9 keV/amu ions also seem to support such a phase effect. (78 refs.)

101825 **Accuracy of stopping cross section determination from RBS-spectra by Warters' method.** F.Aumayr, P.Bauer, D.Semrad (Inst. fur Experimentalphys., Johannes-Kepler-Univ. Linz, Linz, Austria).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.529-32 (1 July 1983).
The determination of stopping cross sections from the width of Rutherford backscattering (RBS) spectra by the method of Warters (1953) implies approximations that lead to systematic errors for the derived quantities. These errors are determined by computer calculations for protons in the energy range from 60 keV to 1 MeV and for a scattering angle of 175°. All elements from lithium to uranium are taken as target materials. Graphs are presented from which the accuracy of the method can be read quantitatively, as a function of the atomic number Z_2, the areal density of the target and the energy. It turns out, e.g., that for $Z_2>8$, areal mass densities below 100 $\mu g/cm^2$ and proton energies above 250 keV the systematic error of Warters' method is below 1% but that for an aluminium target of 100 $\mu g/cm^2$, it may reach 10% at 100 keV. (5 refs.)

101826 **Characteristics and applications of radiation from channeled particles.** R.H.Pantell, H.Park, R.L.Swent, J.O.Kephart, R.K.Klein (Dept. of Electrical Engng., Stanford Univ., Stanford, CA, USA), S.Datz, B.L.Berman.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3150-4 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Charged particles channeled in crystals traverse nearly periodic trajectories, which produce radiation that has spectral peaks at photon energies determined by the particle energy and the periodicity of the motion. This effect is analogous to the radiation enhancement that occurs when a magnetic undulator is placed in a storage ring. For $\gamma=10$ to 100, the period of the motion is several hundred to several thousand lattice sites in the crystal, so that the forward directed emission is in the soft-to-hard X-ray portion of the spectrum. Channeling radiation can be used to study the channeling phenomenon, to investigate the properties of crystals in which channeling occurs, and as a source of X-rays. (12 refs.)

101827 **Temperature effect on the increase of the Kumakhov radiation yield at axial channeling of relativistic electrons.** F.F.Komarov (Inst. of Appl. Phys. Problems, Belorussian State Univ., Minsk, USSR), V.I.Telegin, M.H.Hokonov.
Phys. Lett. A (Netherlands), vol.96A, no.9, p.491-3 (1 Aug. 1983).
The possibility of a sharp increase of the Kumakhov radiation intensity at low crystal temperatures as compared to room temperature is investigated theoretically. The analysis is based on a solution of the Fokker-Planck kinetic equation describing the change of the particle distribution over the axial channel depth due to scattering at thermal vibrations of nuclei and electrons. (9 refs.)

Charged beam interaction with solids ....See Entry 98675

Energy-loss straggling and higher-order moments of energy-loss distributions for protons ....See Entry 100215

Iron-ion−implantation effects in MgO crystals ....See Entry 101730

Ion-implantation dense cascade data ....See Entry 101731

Oxygen implantation in GaAs: damage studies ....See Entry 101818

Channeling and optical study of thin Si crystals distorted by pressure ....See Entry 102135

Vacuum polarisation and electron screening effects on leptonic bremsstrahlung ....See Entry 102982

62.00 MECHANICAL AND ACOUSTIC PROPERTIES OF CONDENSED MATTER

(see also 46.30 Mechanics of solids and rheology, 61.70 Defects in crystals, 68.25 Surfaces and interfaces, 81. Materials science; for thermomechanical effects, see 65.70; for magnetomechanical effects, see 75.80; for piezoelectric effects, see 77.60; for elasto-optical effects, see 78.20H)

62.10 MECHANICAL PROPERTIES OF LIQUIDS

(for viscosity of liquids, see 66.20)

101828 **Excess volumes & deviations in isentropic compressibilities for the binary mixtures of acetonitrile with alcohols.** G.Dharmaraju, P.Venkateswarlu, G.K.Raman (Dept. of Chem., Coll. of Engng., Sri Venkateswara Univ., Tirupati, India).
Indian J. Pure & Appl. Phys., vol.21, no.6, p.352-3 (June 1983).
Excess volumes (V^E) and deviations in isentropic compressibilities (K_s) have been determined at 30°C for the binary systems of acetonitrile with *n*-pentanol, *n*-hexanol, *n*-heptanol and *n*-octanol. Excess volumes have been measured directly by the dilatometric method and isentropic compressibilities have been computed from experimentally determined densities and velocities of sound. The positive values of V^E and K_s in all the systems are attributed to weak complex formation and predominating dissociation of associated alcohols

by acetonitrile. Values of V^E and K_s increase with an increase in chain length of alcohol. (3 refs.)

101829 Fibrillation of the mixtures of crystallizable, amorphous and poorly crystalline polymers. M.V.Tsebrenko (Lab. of Synthetic Fibres, Kiev Technol. Inst. of Light Industry, Kiev, USSR).
Int. J. Polym. Mater. (GB), vol.10, no.2, p.83-119 (1983).
A brief review is given of investigations devoted to the formation of ultrathin fibres in the flow of melt of mixtures of thermodynamically incompatible polymers through forming ducts (fibrillation phenomenon). It considers the mechanism of the process, the role of rheological factors in the initiation of fibrillation, and the peculiarities of viscoelastic properties of melts of polymer mixtures for which this phenomenon is clearly observed. The possibility is shown of controlling the fibrillation process by varying the deformation conditions, rheological properties of mixture components, the introduction of plasticizer, surface-active substance, and varying the degree of dispersion of fibre-forming component. It also points out a number of characteristic properties and structural features of ultrathin synthetic fibres in comparison with the fibres formed using ordinary technology. (78 refs.)

101830 Isentropic pressure derivative of the excess partial molar volume of a mixture. G.C.Benson, M.K.Kumaran (Div. of Chem., Nat. Res. Council of Canada, Ottawa, Canada).
J. Chem. Thermodyn. (GB), vol.15, no.8, p.799-800 (Aug. 1983).
A number of publications on the speed of sound in binary liquid mixtures have reported excess values of the partial molar quantities $K_{S,i}$ defined by the equation $K_{S,i}=\{\partial(V\kappa_S)/\partial n_i\}_{T,p,nj\neq i}$, where V is the volume of the mixture, κ_S is its isentropic compressibility (obtained from the speed of sound), and n_i is the amount of substance of component i. The excess quantity $K_{S,i}{}^E$ is obtained by subtracting from $K_{S,i}$ the value $K_{S,i}{}^{id}$ for the corresponding ideal mixture. On some occasions $-K_{S,i}{}^E$ has been identified with $(\partial V_i{}^E/\partial p)_S$, the isentropic pressure derivative of the excess partial molar volume. The authors investigate this relationship by plotting curves of $(\partial V_i{}^E/\partial p)_s$ for (di-*n*-propyl ether+*n*-heptane) at 298.15K. These curves were calculated using $K_{S,i}{}^E$ values reported previously, and from the results of the authors' investigations of the volume and heat capacity of this mixture. Curves were also obtained from their previous studies of (water+ethanol). (6 refs.)

Thermodynamics and structure of simple dense fluids ....See Entry 101519

Computer simulation of molecular dynamics of anisotropic fluids ....
....................See Entry 101546

Multiplexible liquid crystalline broad range systems ....See Entry 101547

Ultrasonic study of tetrabutyltin in benzene, chlorobenzene, and dichloroethane ....See Entry 101862

Densities and partial molar volumes of supercooled aqueous solutions ....
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Density studies in *N*(*p*-*n*-heptyloxy benzylidene)*p*-*n*-butyl aniline across S_G-S_C, S_C-S_A, S_A-*N* and *N*-*I* phases ....See Entry 101971

Positron annihilation in and compressibility of water-organic mixtures. I. The system water-tetrahydrofuran ....See Entry 102987

62.20 MECHANICAL PROPERTIES OF SOLIDS (RELATED TO MICROSCOPIC STRUCTURE)

(see also 81.40 Treatment of materials and its effects on microstructures and properties, 81.70 Materials testing)

Crystal structure and density data. I. Intermetallic compounds of titanium ....
....................See Entry 98666

Crystal structure and density data. II. Titanium halides and chalcogenides ....
....................See Entry 98667

Lattice parameters, thermal expansion coefficients, and vacancy density in solid CD_4 ....See Entry 101684

Density and deposition rate of chemically vapour-deposited Si_3N_4-TiN composites ....See Entry 103061

62.20D Elastic constants

(see also 03.40D Mathematical theory of elasticity, 81.40J Elasticity and anelasticity)

101831 Elastic properties of metals with the cubic symmetry and an axial texture. E.A.Mityushov, R.A.Admesku, V.I.Yushkov (S.M. Kirov Ural Polytech. Inst., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1079-82 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A method is proposed for calculating the elastic moduli of metals with the cubic symmetry of the crystal lattice and an axial texture. The method can be applied to materials with any type of texture and any dispersion of the texture. It can also be used to determine the average values of the compliance and elastic constants of single crystals from the results of measurements carried out on textured polycrystalline samples. (3 refs.) *A.T.*

101832 Thermoelastic analysis of hybrid fabric composites. T.Ishikawa, Tsu-Wei Chou (Dept. of Mech. & Aerospace Engng., Univ. of Delaware, Newark, DE, USA).
J. Mater. Sci. (GB), vol.18, no.8, p.2260-8 (Aug. 1983).
Examines the thermoelastic behaviour of hybrid fabric composites. The analysis is based upon modifications of the 'fibre undulation model' and 'bridging model' originally developed by the authors for non-hybrid fabric composites. Predictions of elastic stiffness constants as well as in-plane thermal expansion and thermal bending coefficients of hybrids have been made. Numerical results compare very favourably with the limited experimental data available. (15 refs.)

101833 The hydrostatic pressure derivatives of the elastic constants of bismuth alloys. Tu.Hailung, G.A.Saunders (School of Phys., Univ. of Bath, Bath, England).
J. Mater. Sci. (GB), vol.18, no.8, p.2337-44 (Aug. 1983).
Measurements of the effect of hydrostatic pressure on the velocity of ultrasonic waves have been used to obtain the pressure derivatives $(\partial C_{IJ}/\partial P)$ of the elastic constants of single crystals of a bismuth-10 at.% antimony alloy and of heavily tellurium-doped (n-type) bismuth. A theoretical model is used to predict that there should be no electronic (*L* to *L* point) contributions to these pressure derivatives. This is established experimentally by the finding that the $\partial C_{IJ}/\partial P$ values of the n-type bismuth doped with tellurium (carrier density $n=1.2\times10^{20}$ cm^{-3}) are the same within experimental error as those of pure bismuth. The zone centre acoustic mode Gruneisen parameters, obtained from the elastic constants and their pressure derivatives, are used to quantify the anharmonicity of the acoustic mode lattice vibrations for these bismuth alloys. It is concluded that the vibrational anharmonicity of bismuth is insensitive to alloying with up to 10 at.% antimony. (15 refs.)

101834 The elastic strain energy and stability of some idealized lead-bismuth sulphides. K.Aizawa, E.Iguchi (Dept. of Metall. Engng., Yokohama Nat. Univ., Yokohama, Japan), R.J.D.Tilley.
J. Solid State Chem. (USA), vol.48, no.2, p.284-94 (1 July 1983).
The elastic strain energy of idealized structures related to the homologous series of chemically twinned phases xPbS.Bi_2S_3, which includes the naturally occurring sulphides lillianite, $Pb_3Bi_2S_6$, and herovskyite, $Pb_6Bi_2S_9$, have been calculated using the Fourier transform method and an ionic model to represent the bonding. The elastic strain energy depends critically upon the distribution of the Pb and Bi atoms over the sites in the twin planes and the PbS-like matrix between the twin planes. The elastic strain energy terms so calculated do not explain why lillianite and heyrovskyite are the only stable compounds but do account for the fact that doping with other atoms can stabilize members of the homologous series not found in the pseudo-binary PbS-Bi_2S_3 system. (23 refs.)

101835 Temperature dependence of the elastic constants in CsCN measured by Brillouin scattering. K.Strossner, W.Henkel, H.D.Hochheimer, M.Cardona (Max-Planck-Institut fur Festkorperforschung, Stuttgart, Germany).
Solid State Commun. (USA), vol.47, no.7, p.567-71 (Aug. 1983).
The temperature dependence of the elastic constants of CsCN has been studied by Brillouin scattering in the high-temperature disordered cubic phase from 193 to 300K. The elastic constants c_{11} and c_{44} decrease whereas c_{12} increases when approaching the phase transition from above. This anomalous behaviour is similar to that found in NaCN, KCN and RbCN. The softening of the symmetry-adapted elastic constants $c_{Eg}=(c_{11}-c_{12})/2$ and c_{44} can be described by a linear coupling of the strain field and the order parameter. (14 refs.)

101836 Refinement of the equations for calculating the third-order elastic constants of cubic crystals and isotropic media from ultrasonic measurement data. S.S.Sekoyan, E.K.Subbotina (All-Union Sci.-Res. Inst. of Physicotech. & Radio-Engng. Measurements, USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.55-7 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.96-100 (Jan.-Feb. 1983).
The equations used to determine the third-order elastic constants of cubic crystals and isotropic elastic media from measurements of the transit time of elastic waves in samples as a function of the hydrostatic pressure and uniaxial stresses are refined and augmented. (11 refs.)

101837 Kinetics of systems with crystal structure. N.M.Lavrinenko, S.V.Peletminskii, Yu.V.Slyusarenko (Physicotech. Inst., Acad. of Sci., Kharkov, Ukrainian SSR).
Theor. & Math. Phys. (USA), vol.53, no.3, p.1243-52 (Dec. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.3, p.456-68 (Dec. 1982).
The method of ergodic relations is used in conjunction with quasi-averages to find the nonequilibrium statistical operator of weakly homogeneous states of a crystal corresponding to the 'hydrodynamic' stage of evolution. An important role in the construction is played by the procedure of additional averaging over the unit cell of the crystal. Expressions are obtained for the adiabatic moduli of elasticity, the viscous stress tensor, and the thermal conductivity tensor. (4 refs.)

Elastic constants and structure of the vitreous system H_2O-P_2O_5 ....
....................See Entry 101574

The structure and elasticity of polyurethane networks. I. Model networks of poly(oxypropylene) triols and diisocyanate ....See Entry 101595

Physical properties of high-pressure ethylene vinylacetate copolymers and their saponified derivatives ....See Entry 101600

Properties of polyisobutylene-polyurethane block copolymers. I. Macroglycols from ozonolysis of isobutylene-isoprene copolymer ....See Entry 101601

The atom as the building block in crystal: the use of electron charge-density data base for calculating structural properties of metals ....See Entry 101626

Structure and intermolecular excitations of β-N_2 at 400 MPa and 55K ....
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Changes in the flow stress of nickel at low temperatures due to variation of a magnetic field ....See Entry 101840

A theory of yielding of amorphous polymers at low temperature—a molecular viewpoint ....See Entry 101841

The magnetio-elastic properties of the Invar alloy, Fe_3Pt ......See Entry 102721

Vibrational modes, elastic stiffness, and piezomagnetic strain of a magnetization rod ....See Entry 102723

Dielectric and electromechanical properties of calcium-doped lead zirconate titanate ....See Entry 102813

Youngs modulus and linear expansion coefficient anomalies in 18Cr8Ni and 18Cr25Ni alloys at low temperatures ....See Entry 103190

Temperature dependence of mechanical and thermal expansion properties of T300/5208 graphite/epoxy ....See Entry 103191

Mechanical properties of ceramics. I. Elastic properties of ceramics ....
....................See Entry 103194

The effect of Mo^{5+} ions (in the presence of Mo^{6+} ions) on the elastic moduli of molybdenum phosphate glasses ....See Entry 103195

Polyisobutylene model elastomers prepared using demonstrably complete end-linking reactions. I. Elongation moduli of the trifunctional and tetrafunctional networks prepared from the linear polymers ....See Entry 103198

Rules of the change in Young's modulus of glass and carbon-reinforced plastics in relation to temperature ....See Entry 103203

Elastic properties of nongradient glasses and glasses synthesized by ion-exchange diffusion above and below the glass-transition temperature ....
....................See Entry 103204

Elastic moduli, hardness and thermal expansion of CaO-P_2O_5 and MgO-P_2O_5 glasses ....See Entry 103205

The elastic properties of the glasses in the systems R_2O-B_2O_3-SiO_2 (R=Na and K) and Na_2O-B_2O_3 ....See Entry 103206

The influence of prestrains on the buckling behaviour of a normalized plain carbon steel (German grade Ck45) ....See Entry 103209

Water absorption of glass/epoxy laminates under bending stresses ....
....................See Entry 103213

Some mechanical properties of rigid polyurethane structural form ....
....................See Entry 103240

Effect of the addition of EPM copolymers on the properties of high density polyethylene/isotactic polypropylene blends. II. Morphology and mechanical properties of extruded samples ....See Entry 103242

Anisotropy of the physicomechanical characteristics of asbestos, glass, and carbon textolites in the 293-873K temperature range ....See Entry 103255

The hardness of $PbO-ZnO-B_2O_3$ glasses ....See Entry 103282

Environmental resistance of carbon fibre-reinforced polyether etherketone ....See Entry 103342

Determination of the behaviour of composite materials under dynamic conditions ....See Entry 103417

Critical behaviour of the elastic constant and the friction coefficient in the gel phase of gelatin ....See Entry 103598

62.20F Deformation and plasticity

(inc. yield, ductility and superplasticity; see also 81.40L Deformation, plasticity and creep)

101838 Deformation anisotropy induced by presence of physical fields. M.R.Sitzer, A.Troost (Inst. fur Werkstoffkunde (Lehrstuhl A),,Aachen. Rheinisch-Westfalische Tech. Hochschule,Germany).
Arch. Eisenhuettenwes. (Germany), vol.54, no.6, p.223-6 (June 1983).
An attempt is made to develop an internally consistent theory of plastic flow with anisotropic hardening induced by physical fields of arbitrary structure. Standard theories of plastic flow based on the assumption that the deformation anisotropy is induced by presence of plastic strain, strain rate and temperature. It is worth to be noted that the presence of plastic anisotropy may be induced by influence of another physical field, like radiation, magnetic fields and so on. (8 refs.)

101839 On experimental two-dimensional models of intercrystalline sliding and fracture in polycrystalline metals. W.Szczepinski (Inst. of Fundamental Technol. Res., Polish Acad. of Sci., Warsaw, Poland).
Arch. Mech. (Poland), vol.34, no.4, p.503-14 (1982).
Simple experimental models of polycrystalline structure of metals composed of rigid hexagonal elements forming a regular aggregate are proposed in order to simulate intercrystalline sliding and fracture. The grain boundaries are simulated by layers of solid lubricant between adjacent hexagons or by rows of holes prepared in a solid block of a ductile metal. The behaviour of these models is compared with the properties of an analogous theoretical model. (8 refs.)

101840 Changes in the flow stress of nickel at low temperatures due to variation of a magnetic field. V.A.Desnenko (Physicotech. Inst. of Low Temperatures, Acad. of Sci., Kharkov, Ukrainian SSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1187-93 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
An analysis was made of characteristic changes in the flow stress of nickel due to the application and removal of a static magnetic field of $H=420$ Oe intensity at temperatures 300, 77, and 4.2K and of a magnetic field $H\leq 34$ kOe at 4.2K. The most important factors responsible for the observed changes in the stress-strain curve on application and removal of magnetic fields were the defect of the Young modulus of nickel, the Joule heating of a sample by eddy currents, and pulling of a part of a sample subjected to an inhomogeneous magnetic field into a solenoid. (20 refs.) *A.T.*

101841 A theory of yielding of amorphous polymers at low temperature—a molecular viewpoint. N.Brown (Dept. of Materials Sci. & Engng., Univ. of Pennsylvania, Philadelphia, PA, USA).
J. Mater. Sci. (GB), vol.18, no.8, p.2241-54 (Aug. 1983).
Nearly homogeneous elastic shear on a molecular level rather than localized defect motion was considered to be the primary strain mechanism prior to yielding. The greatest or ideal value of the yield point for an amorphous polymer in the absence of the thermal activation was calculated. The theory involves a picture of the molecular motions under a shear stress involving three interconnected processes: (1) shearons or intermolecular shear, (2) rotons or intramolecular shear, (3) tubons or motion along the covalent bond. The shear resistance was based on the stress to overcome the van der Waal's bond using a (6-12) potential. The model assumes that all atoms move cooperatively by the above motions, up to the point of yielding. Temperature was considered only as it affects the modulus, but the theory has not been extended to include thermal activation. The predicted vaue of shear yield point divided by shear modulus is <0.064 to 0.092; a review of all the experimental data obtained by extrapolations to 0K gives an average value of 0.076 ± 0.03. (42 refs.)

101842 Stress-strain properties of graft copolymers of polyethylene and acrylic acid. I.F.Osipenko, A.P.Polikarpov, N.R.Prokopchuk (Inst. of Phys. Organic Chem. Byelorussian Acad. of Sci., Minsk, Belorussian SSR).
J. Polym. Sci. Polym. Lett. Ed. (USA), vol.21, no.7, p.527-30 (July 1983).
The ability of graft copolymers of polyethylene (PE) and acrylic acid (AA) to act as cation-exchange materials is determined to a great extent by their stress-strain properties (SSP). The grafting of AA to PE is commonly followed by the deterioration of SSP of an initial polymer. It is possible to prepare strong and highly elastic films on the basis of graft copolymers of PE and AA by the radiation-induced liquid-phase graft copolymerization technique. The dependence of SSP of PE and AA graft copolymers on the segmental mobility of PE macromolecules has been established by comparing the results of mechanical tests to the data obtained by the broad-line proton magnetic resonance (PMR) method. This explained the difference in SSP of copolymers prepared under different conditions as well as outlining the ways of production of cation-exchange materials on the basis of the PE and AA graft copolymers of improved SSP. (12 refs.)

101843 Double gauge theory of stresses and defects. H.Kleinert (Inst. for Theoretical Phys., Univ. of California, Santa Barbara, CA, USA).
Phys. Lett. A (Netherlands), vol.97A, no.1-2, p.51-4 (8 Aug. 1983).
Elasticity and plasticity can both be formulated in a geometric language. In linear approximation, there are two gauge theories. The authors exhibit the dual relationship between the two and present a coupled unified double gauge theory of both stresses and defects. (11 refs.)

101844 On the relation between the plastic strain rate of a crystal and microscopic characteristics of dislocation motion. V.N.Lukerchenko (A.A. Baikov Inst. of Metall., Acad. of Sci., Moscow, USSR).
Phys. Status Solidi a (Germany), vol.78, no.1, p.K9-12 (16 July 1983).
The establishment of the master kinematic relation (MKR), i.e. the relation between the plastic strain rate of a crystal $\dot{\varepsilon}$ and characteristics of dislocation motion, are of great importance in developing the physical theory of plasticity. The authors generalize the relation obtained by Seitz and Reed (1941) to the case of two types of non-straight-line dislocations: loops and segments. (6 refs.)

101845 Plastic flow in close-packed crystals via nonequilibrium molecular dynamics. A.J.C.Ladd (Dept. of Appl. Sci., Univ. of California, Davis, CA, USA), W.G.Hoover.
Phys. Rev. B (USA), vol.28, no.4, p.1756-62 (15 Aug. 1983).
The measurement of plastic-wave profiles in strong shock waves suggests a power-law dependence of the solid-phase shear stress on strain rate. The strain rates in these experiments vary from about 10 kHz to 0.1 GHz. The authors have carried out molecular-dynamics simulations of steady-state plastic flow in two- and three-dimensional close-packed crystals, using recently developed 'nonequilibrium' equations of motion to maintain a constant strain rate and temperature. These calculations appear to be consistent with current experimental data and suggest that the flow of close-packed metals is described by a single physical mechanism over a range of strain rates from 10 kHz to 1 THz. (15 refs.)

101846 Negative photoplastic effect due to the relaxed excited state of the F-center in alkali halides. T.Hagihara (Dept. of Phys., Osaka Kyoiku Univ., Osaka, Japan), Y.Inoue, T.Okada.
Radiat. Eff. (GB), vol.72, no.1-4, p.293-7 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
To make clear the mechanism of the photoplastic effect (PPE) in alkali halides containing F-centers, on the basis of the photochemical reaction of the F-center, the temperature dependence of the PPE in KCl, and KBr and NaCl was studied from 95K up to RT. The characteristic critical points θ_ts in colored KCl and KBr were determined to be 110 and 190K, respectively. Below θ_t the sign of the PPE in both crystals was negative, i.e. decrement of the flow stress during light illumination was observed. Moreover, the θ_ts were in good agreement with the temperature where the photoconductivities show remarkable increase in the course of the measurements. The negative PPE is explained in terms of the rotation of the principal strain axis of the relaxed state of the F-center having ⟨100⟩ tetragonarity as to relax the stress around the edge dislocation coming closely. (30 refs.)

101847 Baroplastic effect in superplasticity. I.I.Papirov, V.I.Zaitsev, G.Ya.Akimov, P.I.Stoev, G.F.Tikhinskii, E.S.Karpov, Yu.A.Galkin (Physicotech. Inst., Acad. of Sci., Kharkov, Ukrainian SSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.965-7 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.370-2 (Nov. 1982).
Experimental investigation of the influence of high hydrostatic pressure on the behavior of a superplastic material—the alloy Zn-0.4% Al—has made it possible to discover a baroplastic effect in this phenomenon. The finding that the plasticity of the alloy Zn-0.4% Al is reduced under pressure evidently indicates significant changes in the mechanism of superplastic deformation. It is possible that pressure affects the characteristics of grain-boundary glide, i.e. it changes the parameters of the mechanism controlling the superplasticity. In view of the incomplete accommodation of grain-boundary glide, according to present ideas, pores which affect subsequent flow are frequently formed during superplastic flow. The deformation of superplastic materials under high hydrostatic pressures, therefore, should be accompanied by obstruction of pore formation and a lowering of the coefficient of self-diffusion, in addition to possible other defects. (13 refs.)

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Research on rheological models for solid polymers under large impact velocity. Identification problems ....See Entry 101071

Large strain solutions of rubber components ....See Entry 101075

On the use of hardness tests to estimate the extent of plastic deformation ....See Entry 101092

Some peculiarities of the buckling of ribbed cylindrical shells ....See Entry 101094

ADINA analysis of large deflections and stresses in bending fatigue specimens ....See Entry 101135

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Influence of ultrasonic action on the bending deformation of D16 and V95 alloy plates .... See Entry 103250

Nonuniformity of distribution of residual microstrains during cyclic deformation .... See Entry 103251

Changes in the structure and mechanical properties of 25Kh2MFA steel under the effect of programmed increasing load and irradiation .... See Entry 103252

Effect of stress-state invariants on the geometry of strength theories of structural materials. II .... See Entry 103253

Effect of the ferrite grain size on the deformation and fracture characteristics of a structural steel .... See Entry 103254

Anisotropy of the physicomechanical characteristics of asbestos, glass, and carbon textolites in the 293-873K temperature range .... See Entry 103255

Some aspects of thermoplasticity .... See Entry 103257

Sliding mode crack closure and mode III fatigue crack growth in mild steel .... See Entry 103258

Influence of the notch radius on the collapse and initiation limiting temperature of weldable structural steels .... See Entry 103260

Influence of the cohesive strength of grain boundaries on strain and structure characteristics of fracture of dispersion-hardening copper-base alloys .... See Entry 103273

Influence of precracking load on critical stress intensity factor of mild steel .... See Entry 103276

Contribution of texture to the strengthening and fracture in hot-rolled magnesium-12.7 at.% cadmium alloy .... See Entry 103278

Strength and fracture of amorphous and partially crystallized selenium .... See Entry 103279

The hardness of PbO-ZnO-B_2O_3 glasses .... See Entry 103282

Effects of aging treatment on the mechanical properites of cold rolled high strength low alloy steel .... See Entry 103288

Flexural properties of moldings of rigid polyurethane RIM .... See Entry 103293

Relation between bending and direct stress fatigue strengths of steels .... See Entry 103295

High temperature strength of SUS 316 stainless steel subjected to creep damage .... See Entry 103298

The transition from stage I to stage II fatigue crack propagation in copper single crystals cycled at constant strain amplitudes .... See Entry 103303

Deformation and fracture of strongly textured Ti alloy sheets in uniaxial tension .... See Entry 103306

Stretch forming and fracture of strongly textured Ti alloy sheets .... See Entry 103307

Effect of prestrain on the mechanical properties of eutectoid steel .... See Entry 103309

The influence of the $M_{23}(C,N)_6$ compound on the mechanical properties of type 422 stainless steel .... See Entry 103311

Localized heat generation during fracture of cyclically loaded steel .... See Entry 103312

Surface deformation and crack initiation during fatigue of vacuum melted iron: environmental effects .... See Entry 103313

Comparison of the plane strain crack arrest fracture toughness of 4340, 4140, and 1340 steel .... See Entry 103314

The effect of hydrogen gas on the plasticity/cleavage balance in Fe-3.5 pct Si .... See Entry 103317

Flow localization accompanying the intergranular fracture of Ni_3Al .... See Entry 103319

Lower-tail approximations for the probability of failure of three-dimensional fibrous composites with haxagonal geometry .... See Entry 103322

Ductile fracture of a high manganese steel .... See Entry 103325

Correlation between cyclic plastic strain zone size and the fatigue fracture rate of 15Kh2MFA steel at low temperatures .... See Entry 103332

Effect of preliminary mechanical twinning on the ductile-brittle transition temperature for iron with different impurity contents .... See Entry 103333

Environmental resistance of carbon fibre-reinforced polyether etherketone .... See Entry 103342

Influence of oxidation and gas-impregnation process on the mechanical properties of VT1-0 and VT14 titanium alloys .... See Entry 103390

Load fixture for uniform plastic deformation of single crystals .... See Entry 103440

Acoustic emission during thermal cycling of heat-resistant steel .... See Entry 103444

Effect of the stiffness of testing machines on the relationships of deformation and fracture of materials with a heterogeneous structure ...... See Entry 103445

62.20H Creep

(see also 81.40L Deformation, plasticity and creep)

101848 Effect of impurities on the diffusion-controlled creep activation energy in MgO. J.Crampon, B.Escaig (Lab. de Structure et Proprietes de l'Etat Solide, Univ. des Sci. et Tech. de Lille, Villeneuve d'Ascq, France).
J. Mater. Sci. (GB), vol.18, no.8, p.2283-9 (Aug. 1983).
By studying the theoretical variation of mass-transport self-diffusion activation energy, with temperature and vacancy concentration, the various rate-limiting possibilities for diffusional creep in MgO are discussed. Because of anion-cation ambipolar coupling it is shown that only four distinct regimes of diffusion controlled creep are, in principle, observable in MgO when considering lattice diffusion. As oxygen ions are by far the slowest species a minimum in the activation energy appears at some temperature for an oxygen vacancy excess but correlatively for a magnesium vacancy excess such a minimum should not be observed. The analysis of creep energies in the experimental domain investigated by several authors allows, in the first case, a correlation with the extrinsic diffusion of oxygen vacancies in excess, but in the reverse case of magnesium vacancy excess no such correlation is observed with extrinsic diffusion of rarefied oxygen vacancies. Instead, neutral vacancy pairs should prevail in the diffusional creep of MgO in this case. (20 refs.)

101849 Influence of the shape and transmission regime of current pulses on the plastic strain of zinc crystals. V.I.Stashenko, O.A.Troitskii (Inst. of Phys. Chem., Acad. of Sci., Moscow, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.984-5 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.638-40 (Nov. 1982).
The application of a pulsed current during the creep of crystals is usually accompanied by a jump in the strain, the size of the jump depending on the structure of the crystals, the size of the prior strain, and the parameters of the current pulses. The study of this dependence, especially the study of the various arrangements for passing the current in the case of the most favorable pulse shape, is also of importance for understanding the physical nature of the heightened plasticity of a metal under the influence of a current. (7 refs.)

Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors .... See Entry 98632

Calculation of turbine rotors in secondary creep range .... See Entry 101074

Diffusion of nitric acid in rigid polyvinyl chloride .... See Entry 102067

Hot isostatic pressing of niobium C-103 alloy shapes .... See Entry 103088

Physical aging in polystyrene: comparison of the changes in creep behavior with the enthalpy relaxation .... See Entry 103185

Control of the steady creep in Ag-2.7 wt.% Al by dissolution-enhanced diffusion .... See Entry 103225

Deformation behavior of a 16-8-2 GTA weld as influenced by its solidification substructure .... See Entry 103228

Cyclic creep and stress rupture of a mechanically alloyed oxide dispersion and precipitation strengthened nickel-base superalloy .... See Entry 103230

The effect of titanium on creep strength in 2.25 pct Cr-1 pct Mo steels .... See Entry 103231

Observations of grain boundary sliding during superplastic deformation .... See Entry 103232

Physical ageing in rigid chain polymers .... See Entry 103238

Some mechanical properties of rigid polyurethane structural form .... See Entry 103240

Influence of ultrasonic action on the bending deformation of D16 and V95 alloy plates .... See Entry 103250

Comparison between high temperature dead-load creep and stress-relaxation deformation in iron-doped polycrystalline aluminum and magnesium oxides .... See Entry 103256

Creep fracture in polymers: technique and data handling for a statistical characterization .... See Entry 103302

Creep crack growth behavior of several structural alloys .... See Entry 103315

62.20M Fatigue, brittleness, fracture, and cracks

(inc. hardness; see also 81.40N Fatigue, embrittlement and fracture)

101850 The random variation of stress concentration factors in fibrous composites. R.L.Smith (Dept. of Maths., Imperial Coll. London, London, England).
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.385-7 (Aug. 1983).
S.B. Batdorf and R. Ghaffarian (1982) proposed an extension of the method of S.B. Batdorf (1982) to allow for random stress concentration factors. Specifically, they supposed that the stress concentrations factors have a Weibull distribution, presumably independent of the distribution of the strengths of the fibres themselves. They suggested that this randomness in the stress concentration factors might arise from the fibres being unequally spaced within the matrix, but they did not investigate the relation between the two. The present author derives such a relation in the two-dimensional case. The derivation is based on a simple discrete approximation to the equations of T.M. Hedgepeth (1961). Because of this, the results can only be regarded as an approximate solution to the problem, but they do enable one to draw some qualitative conclusions which are to some extent at variance with the assumptions made by Batdorf and Ghaffarian. (12 refs.)

101851 Role of impurity precipitates in microhardness of NaCl:Sr^{2+} crystals. K.Narasimha Reddy (Dept. of Phys., Arts & Sci. Coll., Osmania Univ., Secunderabad, India), V.Hari Babu.
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.400-2 (Aug. 1983).
An attempt was made to study the hardness of pre-quenched and quenched crystals doped with Sr^{2+} impurity. Depending on temperature, it was found that the precipitation process affected the microhardness of supersaturated solid solution crystals in different ways. (3 refs.)

101852 On subcritical crack growth in ceramics as influenced by grain size and energy-dissipative mechanisms. A.Krell, W.Kreher (Acad. of Sci., Zentralinst. fur Festkorperphys. und Werkstofforschung, Dresden, Germany).
J. Mater. Sci. (GB), vol.18, no.8, p.2311-18 (Aug. 1983).
A model is presented concerning the possibility that an unstable crack becomes stabilized by the initiation of some energy-dissipative mechanism if the stress intensity reaches a threshold value K_I^D. Depending on the toughness and the grain size distribution of the material, different crack propagation modes may occur. For sintered alumina, measurements of the fracture induced photon emission can be explained in terms of this model, substantiating in this way the assumption that microcracking is the dominating form of energy dissipation in this single phase ceramic material. (23 refs.)

101853 The influence of the crack tip stress field on the nucleation and growth of voids. K.Jagannadham (Dept. of Engng. Sci. & Mech., Tennessee Technol. Univ., Cookeville, TN, USA).
Mater. Sci. & Eng. (Switzerland), vol.60, no.2, p.95-108 (Aug. 1983).
The discrete dislocation method is employed to determine the influence of the crack tip stress field on the nucleation and growth of microvoids in the plastic zone. Voids nucleated from both climb-type and glide-type lattice dislocations are considered. In particular, voids in the shear mode parallel to the slip plane and those in the tensile mode either parallel to the crack plane or perpendicular to the slip plane are analyzed to determine the most favorable orientation. The void nucleation and growth leading to the largest decrease in energy or negative energy gradient are chosen as those with the most favorable orientation. The significance that the results have on the experimental observations of the ductile fracture behaviour of metals and alloys with respect to void coalescence mechanism is emphasized. (16 refs.)

Symposium on Environmental Effects on Fibre-Reinforced Plastics .... See Entry 98620

Analysis of the hexcan of a fast breeder reactor with a through crack .... See Entry 99617

The use of NONSAP to compare the Von Mises and a modified Von Mises yield criteria .... See Entry 101073

Large strain solutions of rubber components .... See Entry 101075

On the analysis of creep stability and rupture .... See Entry 101090

Determination and simulation of stable crack growth in ADINA .... See Entry 101131

Three-dimensional *J*-integral calculations of part-through surface crack problems .... See Entry 101132

Analysis of surface cracks in plates and shells using the line-spring model and ADINA .... See Entry 101136

Application of the finite method in micromechanical analyses of creep fracture problems .... See Entry 101137

Predicting stress corrosion crack growth rates at high stress levels. II. The general yield situation .... See Entry 101144

Destruction of a metal ring subjected to pulsed loading .... See Entry 101146

Physical properties of high-pressure ethylene vinylacetate copolymers and their saponified derivatives .... See Entry 101600

Effects of high dynamic pressures on the structure and mechanical properties of martensitic steels 38KhS and 30KhGSN2A .... See Entry 101635

Conditions of formation and growth of mechanical twins at the tip of a dynamic crack .... See Entry 101720

The measurement of the trap binding energy by the thermal analysis technique .... See Entry 101745

Depth dependent damage profile in stainless steel irradiated with He-ions .... See Entry 101810

On experimental two-dimensional models of intercrystalline sliding and fracture in polycrystalline metals .... See Entry 101839

Anomaly of the solubility of hydrogen in ferromagnetic metals near the Curie point .... See Entry 101977

Effect of cold working on the hydrogen trapping phenomena in pure iron .... See Entry 102068

Deuterium transport and trapping in aluminum alloys .... See Entry 102069

Grain boundary strength of molybdenum bicrystals with a ⟨110⟩ twist boundary .... See Entry 102185

Grain boundary fracture in molybdenum bicrystals with a ⟨110⟩ symmetric tilt boundary .... See Entry 102186

The influence of ageing on changes in coercivity and in the mechanism of decohesion of CuNiFe permanent magnet alloy .... See Entry 102697

An ESR investigation of environmental effects on polymeric materials. II. Polyethylene .... See Entry 102752

Mechanisms of reactive sputtering of titanium nitride and titanium carbide. II. Morphology and structure .... See Entry 103052

Dispersion hardening—a low cost technique for improving the hot strength of copper alloys .... See Entry 103090

A new composite ceramic material containing alumina: aluminalon .... See Entry 103101

Microstructure and mechanical properties of rapidly quenched L1$_2$ alloys in Ni-Al-X systems .... See Entry 103135

On the kinetics of discontinuous precipitation in Cu-Mg alloys .... See Entry 103158

New aspects on the appraisal of the cooling process during hardening of steel .... See Entry 103167

Effects of surface and thickness of specimens on the aging in Al-Zn alloys .... See Entry 103168

Influence of the annealing temperature on changes in the properties of hydrogen-phase-hardened palladium exhibiting hydride brittleness .... See Entry 103172

Elastic moduli, hardness and thermal expansion of CaO-P$_2$O$_5$ and MgO-P$_2$O$_5$ glasses .... See Entry 103205

On the very heterogeneous behaviour of plastic deformation during rolling of ferrite-martensite dual phase steels and on the mechanism of microcrack formation and their propagation through the material .... See Entry 103212

Short glass fiber-natural rubber composites .... See Entry 103215

Superplastic flow and failure at 773K in the aluminium-calcium eutectic alloy .... See Entry 103218

Effects of SME cycle on the mechanical properties of the TiNi alloys .... See Entry 103219

Some surprising features of the plastic deformation of body-centered cubic metals and alloys .... See Entry 103227

Deformation behavior of a 16-8-2 GTA weld as influenced by its solidification substructure .... See Entry 103228

Cyclic creep and stress rupture of a mechanically alloyed oxide dispersion and precipitation strengthened nickel-base superalloy .... See Entry 103230

Mechanical properties of composite microwires (copper-glass) .... See Entry 103249

Effect of the ferrite grain size on the deformation and fracture characteristics of a structural steel .... See Entry 103254

Sliding mode crack closure and mode III fatigue crack growth in mild steel .... See Entry 103258

Comparison of transition temperatures from instrumented impact tests with the Robertson crack-arrest-temperature .... See Entry 103259

Influence of the notch radius on the collapse and initiation limiting temperature of weldable structural steels .... See Entry 103260

Crack growth in vitreous silica under dynamic loading .... See Entry 103261

Load bearing capacity of TiN coated WC-Co cemented carbides .... See Entry 103262

Fracture morphology of rubber compounds containing recycled rubber powder .... See Entry 103263

High velocity indentation study of the brittleness of rigid PVC after ageing .... See Entry 103264

The effect of moisture on the shear properties of carbon fibre composites .... See Entry 103265

Effect of moisture on the notch sensitivity of carbon fibre composites .... See Entry 103266

The effects of water absorption on a polyester/chopped strand mat laminate .... See Entry 103267

Environmental fatigue of reinforced plastics .... See Entry 103268

The effects of environmental exposure on the fatigue behaviour of CRFP laminates .... See Entry 103269

Post-impact fatigue performance of carbon fibre laminates with non-woven and mixed-woven layers .... See Entry 103270

Effect of composition on the fracture toughness of hard metals .... See Entry 103271

Structure and quantitative fractography of brittle fracture faces of low-carbon and low-alloy steels .... See Entry 103272

Influence of the cohesive strength of grain boundaries on strain and structure characteristics of fracture of dispersion-hardening copper-base alloys .... See Entry 103273

Investigation of the mechanical lifetime of polymer films under the action of electrical fields and discharges .... See Entry 103274

Fracture toughness of composite adherend adhesive joints under mixed mode I and III loading .... See Entry 103275

Influence of precracking load on critical stress intensity factor of mild steel .... See Entry 103276

A fracture mechanics analysis of polypropylene/rubber blends .... See Entry 103277

Contribution of texture to the strengthening and fracture in hot-rolled magnesium-12.7 at.% cadmium alloy .... See Entry 103278

Strength and fracture of amorphous and partially crystallized selenium .... See Entry 103279

Properties of $Na_2O.3SiO_2$ glasses impregnated with ethyl alcohol .... See Entry 103280

The measurement of glass fibre strength in composites from studies of their fracture surfaces .... See Entry 103281

The tearing of highly oriented linear polyethylene .... See Entry 103283

Fracture toughness and limiting strength of cermets .... See Entry 103284

Hydrogen embrittlement of Ni-Cu binary alloys .... See Entry 103285

Some problems on the practical use of a 3.5 GPa grade maraging steel .... See Entry 103286

Fatigue crack propagation characteristic and fatigue fracture toughness in 780 MPa grade high strength steel weldments at low temperature .... See Entry 103287

Effects of aging treatment on the mechanical properites of cold rolled high strength low alloy steel .... See Entry 103288

A study on the tempered embrittlement of martensite-bainite duplex structure in Ni-Cr-Mo steel .... See Entry 103289

Mechanical properties of ceramics. II. Strength and fracture of ceramics .... See Entry 103290

Mechanical properties of ceramics. III. Hardness and toughness of ceramics .... See Entry 103291

Results of fatigue tests and prediction of fatigue life under superposed stress wave and combined superposed stress wave (case of SCM 435 and $2^1/_4$Cr-1Mo steel, room temperature and 500°C) .... See Entry 103292

Flexural properties of moldings of rigid polyurethane RIM .... See Entry 103293

Fracture criterion of flake graphite cast iron .... See Entry 103294

Relation between bending and direct stress fatigue strengths of steels .... See Entry 103295

Propagation and non-propagation of fatigue cracks in notched plates of low-carbon steel .... See Entry 103296

Evaluation of fatigue crack growth characteristics of SCM 435 steel by ultrasonic method .... See Entry 103297

High temperature strength of SUS 316 stainless steel subjected to creep damage .... See Entry 103298

Thermal fatigue strength of high-temperature structural materials for power plant .... See Entry 103299

Energetic conditions for brittle fracture. XI. Interaction between strength and elasticity .... See Entry 103300

Fatigue life of brittle superconducting alloys in normal and superconducting states .... See Entry 103301

Creep fracture in polymers: technique and data handling for a statistical characterization .... See Entry 103302

The transition from stage I to stage II fatigue crack propagation in copper single crystals cycled at constant strain amplitudes .... See Entry 103303

The micro-mechanisms of tempered martensite embrittlement in 4340-type steels .... See Entry 103304

Fatigue of Cu-1 pct Cd .... See Entry 103305

Deformation and fracture of strongly textured Ti alloy sheets in uniaxial tension .... See Entry 103306

Stretch forming and fracture of strongly textured Ti alloy sheets .... See Entry 103307

Statistical aspects of cleavage fracture in steel .... See Entry 103308

Effect of prestrain on the mechanical properties of eutectoid steel .... See Entry 103309

Tempered martensite embrittlement in Fe-Mo-C and Fe-W-C steel .... See Entry 103310

The influence of the $M_{23}(C,N)_6$ compound on the mechanical properties of type 422 stainless steel .... See Entry 103311

Localized heat generation during fracture of cyclically loaded steel .... See Entry 103312

Surface deformation and crack initiation during fatigue of vacuum melted iron: environmental effects .... See Entry 103313

Comparison of the plane strain crack arrest fracture toughness of 4340, 4140, and 1340 steel .... See Entry 103314

Creep crack growth behavior of several structural alloys .... See Entry 103315

Low cycle fatigue of Ti-Mn alloys: microstructural aspects of fatigue crack growth .... See Entry 103316

The effect of hydrogen gas on the plasticity/cleavage balance in Fe-3.5 pct Si .... See Entry 103317

Oxide scale induced cleavage fracture in an ODS Fe-Cr-Al alloy .... See Entry 103318

Flow localization accompanying the intergranular fracture of Ni_3Al .... See Entry 103319

Fatigue crack growth rate of Ti-6Al-4V prealloyed powder compacts .... See Entry 103320

Microfracture model for hydrogen embrittlement of austenitic steels .... See Entry 103321

Lower-tail approximations for the probability of failure of three-dimensional fibrous composites with haxagonal geometry .... See Entry 103322

Energy criterion for modelling creep rupture of high-density polyethylene .... See Entry 103323

Notch sensitivity and fractography of polyolefins .... See Entry 103324

Ductile fracture of a high manganese steel .... See Entry 103325

Low-cycle fatigue of the non-magnetic ageing 40G18N13F and 35Kh14G16N10FR steels at +20° and −196°C .... See Entry 103326

Influence of martensite content on the hydrogen embrittlement of dual-phase steels .... See Entry 103327

A comparison of microvoid sizes in nickel base alloys tested in air and in the presence of hydrogen .... See Entry 103328

Fracture mechanics in the presence of electrical fields .... See Entry 103329

Combined manifestation of the factors of surface roughness and loading frequency in the fatigue of patented wire .... See Entry 103330

Fatigue damage caused to the material by inelastic loading with periods of load holding .... See Entry 103331

Correlation between cyclic plastic strain zone size and the fatigue fracture rate of 15Kh2MFA steel at low temperatures .... See Entry 103332

Effect of preliminary mechanical twinning on the ductile-brittle transition temperature for iron with different impurity contents .... See Entry 103333

Local exothermic effects during failure of rubber .... See Entry 103334

Fracture toughness of Mn-Zn ferrite single crystal .... See Entry 103335

Room temperature strength of sintered β-Sialon .... See Entry 103336

Fracture toughness of polycrystalline Ni-Zn ferrite and polycrystalline Ba ferrite .... See Entry 103337

On the mechanism of stress corrosion of E-glass fibres .... See Entry 103339

The environmental degradation of notched CFRP in compression .... See Entry 103341

Stress corrosion cracking and its implications for the long-term durability of E-glass fibre composites .... See Entry 103344

Prediction of long-term stress-rupture life for glass fibre-reinforced polyester composites in air and in aqueous environments .... See Entry 103345

Thermo-oxidative ageing and its effect on the network structure and fracture mode of natural rubber vulcanizates .... See Entry 103353

Molecular weight distribution effects on craze micromechanics .... See Entry 103354

Solvent-crazing criteria .... See Entry 103356

Influence of mineral oils on polystyrene fracture .... See Entry 103358

Influence of liquid media on the strength of a composite with an aluminum matrix .... See Entry 103359

Study by factorial analysis of the influence of chemical composition on the stress corrosion cracking of austenitic stainless steels .... See Entry 103368

Analysis of oxide wedging during environment assisted crack growth .... See Entry 103373

Dynamic and static crack propagation properties of austenitic steels in dilute acidic geothermal brine .... See Entry 103376

Surface hardening or high-C steel by CO_2 laser .... See Entry 103378

Stress corrosion cracking susceptibility of SUS 304 stainless steel cathodically precharged with hydrogen .... See Entry 103379

Influence of composite protection on the cyclic crack resistance of medium-carbon steel in a corrosive medium .... See Entry 103384

Rules of fatigue fracture under fretting conditions .... See Entry 103385

Influence of phosphorus impurity on the intergranular corrosion cracking of iron and iron-carbon alloys in nitrates .... See Entry 103386

Influence of a passive film on the corrosion cracking of austenitic steel .... See Entry 103387

Corrosion fracture micromechanism of cast steel .... See Entry 103388

Electrochemical mechanism of jump-like corrosion crack development under stress in carbon steels .... See Entry 103389

Influence of oxidation and gas-impregnation process on the mechanical properties of VT1-0 and VT14 titanium alloys .... See Entry 103390

Influence of diffusion impregnation in polymer-containing compositions on the physicomechanical properties of steels .... See Entry 103394

Role of iron sulfide in the formation of solidification cracks in welding of electrical steel .... See Entry 103395

The fatigue properties of mild steel with surface diffusion coatings of nickel-iron and nickel-cobalt-iron alloys .... See Entry 103401

An autoradiographic technique for studying the segregation of hydrogen absorbed into carbon and low alloy steels .... See Entry 103418

Acoustic emission from graphite/epoxy composite laminates with special reference to delamination .... See Entry 103427

Simulation model of acoustic emission due to microscopic fracture in metals .... See Entry 103429

Non-destructive detection of creep damage for Cr-Mo-V steel forgings .... See Entry 103430

Acoustic emission during thermal cycling of heat-resistant steel .... See Entry 103444

Effect of the stiffness of testing machines on the relationships of deformation and fracture of materials with a heterogeneous structure .... See Entry 103445

62.20P Tribology

(see also 81.40P Friction, lubrication and wear)

Analysis of the puncture of a bisphenol-A polycarbonate disc .... See Entry 103241

A study of the frictional, wear and contact resistance performance of tin alloy coatings .... See Entry 103338

Rules of fatigue fracture under fretting conditions .... See Entry 103385

Influence of diffusion impregnation in polymer-containing compositions on the physicomechanical properties of steels .... See Entry 103394

Critical behaviour of the elastic constant and the friction coefficient in the gel phase of gelatin .... See Entry 103598

62.30 MECHANICAL AND ELASTIC WAVES

(see also 03.40K Mathematical aspects)

101854 Polarization of elastic waves in gyrotropic crystals. S.S.Girgel', P.A.Khilo (State Univ., Gomel', USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.71 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.120-1 (Jan.-Feb. 1983).
The most important evidence of acoustic activity, which is one of the first-order spatial dispersion effects, is a change of polarization of normal modes in crystals. The authors calculate the polarization for arbitrary directions of the wave normal. The results are applicable to media with a stimulated acoustic gyrotropy such as that induced by, for example, an applied magnetic field. (7 refs.)

Application of metal single crystal wedges to high frequency Rayleigh wave propagation .... See Entry 103414

62.40 ANELASTICITY, INTERNAL FRICTION, AND DAMPING

(see also 81.40J Elasticity and anelasticity)

101855 Electronic phenomena in mechanical relaxation of semiconducting oxide glasses. A.K.Bandyopadhyay, J.Phalippou, J.Zarzycki (Lab. of Materials Sci., Univ. of Montpellier 2, Montpellier, France).
J. Non-Cryst. Solids (Netherlands), vol.57, no.1, p.41-8 (Aug. 1983).
The internal friction spectrum of a $2BaO\text{-}3B_2O_3$ glass does not show any peak. Transition metal oxides are added to this base glass to give rise to semiconductor glasses (V_2O_5 and Fe_2O_3). The internal friction spectra of iron glasses show that relaxation phenomena occur at relatively high temperature and for low amounts of Fe_2O_3. For vanadium glasses it is necessary to add a large quantity of TM oxide to observe a relaxation effect. A mixed TM oxide (Fe+V) glass does not show any relaxation due to the high activation energy of the vanadium ion. (15 refs.)

Transformation processes in deformed Al-30 wt.% Zn alloy containing metastable precipitates .... See Entry 101942

Hydrogen in $Fe_{40}Ni_{40}P_{14}B_6$ amorphous alloys studied by magnetic aftereffect, internal friction, and positron annihilation .... See Entry 102710

Rheo-optical Fourier transform IR spectroscopy of polyurethane elastomers. I. Principle of the method and measurements at ambient temperature .... See Entry 102886

Isochrone based mastercurves of viscoelastic functions .... See Entry 103196

Temperature dependence of the dynamic viscoelastic response of amorphous poly(diethylene glycol terephthalate) chains .... See Entry 103197

Polyisobutylene model elastomers prepared using demonstrably complete end-linking reactions. I. Elongation moduli of the trifunctional and tetrafunctional networks prepared from the linear polymers .... See Entry 103198

Temperature dependent uniaxial stress relaxation in polyamide 6 .... See Entry 103199

Dynamic mechanical and thermomechanical properties of silicone-polycarbonate block copolymers .... See Entry 103200

Relationship between polymerization conditions and rheological properties for styrene-acrylonitrile copolymers .... See Entry 103201

Measurement of the microscopic volume strain element in amorphous alloys .... See Entry 103202

Changes in the structure and mechanical properties of 25Kh2MFA steel under the effect of programmed increasing load and irradiation .... See Entry 103252

Comparison between high temperature dead-load creep and stress-relaxation deformation in iron-doped polycrystalline aluminum and magnesium oxides .... See Entry 103256

Influence of water on the relaxation properties of filled elastomers .... See Entry 103361

62.50 HIGH-PRESSURE AND SHOCK-WAVE EFFECTS IN SOLIDS

101856 The compressibility measurements of ThO_2, Li_2O and $4H\text{-}CdI_2$ by using a diamond-anvil pressure cell. A.Kaimai, H.Arashi, M.Ishigame (Res. Inst. for Sci. Measurements, Tohoku Univ., Sendai, Japan).
Bull. Res. Inst. Sci. Meas. Tohoku Univ. (Japan), vol.31, no.2-3, p.109-19 (1982). In Japanese.
The compressibility measurements of ThO_2, Li_2O and $4H\text{-}CdI_2$ are described. A pressure dependence of lattice constant of these materials measured by X-ray diffractions at high pressures is used to determine the compressibilities. The high pressure is obtained using a diamond-anvil pressure cell. The compressibilities of ThO_2 and Li_2O which are measured for the first time are used to determine Gruneisen constants. The compressibility of layered compound $4H\text{-}CdI_2$ is used to investigate the interaction between layers. (11 refs.)

101857 Response of liquid carbon disulfide to shock compression: equation of state at normal and high densities. S.A.Sheffield (Sandia Nat. Labs., Albuquerque, NM, USA), G.E.Duvall.
J. Chem. Phys. (USA), vol.79, no.4, p.1981-90 (15 Aug. 1983).
Liquid carbon disulfide (CS_2) is known to exhibit unusual behavior when it is shock compressed to pressures of approximately 6.0 GPa. This behaviour has been explained by either a phase transition to a 'black solid CS_2' or a decomposition chemical reaction. In order to learn more about the anomalous behavior as it relates to a shock-induced chemical reaction, it was necessary to develop equations of state for both the unreacted liquid and the reaction products. The paper describes the development of these equations of state along with comparisons of calculated Hugoniot information to measured data available in the literature. Both equations are based on the use of a Murnaghan isotherm relation (1951) along with assumed forms for specific heat and the Gruneisen parameter. Methods employed to match the calculations to the data in order to establish the values of various adjustable parameters are detailed. Temperature calculations are included although there is some uncertainty as to their accuracy because of lack of experimental temperature data. (35 refs.)

101858 Valence charge in a solid at 0K viewed as a pressure-ionization effect. B.K.Godwal (Neutron Phys. Div., Bhabha Atomic Res. Centre, Bombay, India).
Phys. Rev. A (USA), vol.28, no.2, p.1103-7 (Aug. 1983).
Modified Saha ionization theory has recently been used to obtain the dominant pressure and thermal ionization effects in the 'intermediate' region (0.5-10 TPa) of the equation of state. The present work is aimed at providing the justification for the use of this theory in the presence of interactions. The valence charges at 0K at normal density as determined using this theory are in very good agreement with their normal valence charges for a number of elements. The equation of state as computed from it is also in good agreement with the Thomas-Fermi-Dirac equation of state. Finally the theory is shown to simulate the valence transition under pressure in Eu and Yb. (19 refs.)

101859 Effect of the shell structure of atoms on the shock adiabats of aluminum and iron. A.F.Nikiforov, V.G.Novikov, V.B.Uvarov (M.V. Keldysh Inst. of Appl. Math., Acad. of Sci., Moscow, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.956-8 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.615-18 (Nov. 1982).
Using the modified Hartree-Fock-Slater (MHFS) model, the authors calculated the equations of state of substances in a wide range of temperature and densities—for a rarefied and a dense gaseous plasma, and for solids. They compare the experimental data on shock compression of continuous aluminum and iron metal with the results of calculations using the MHFS model. The shock adiabat is determined by the Hugoniot relation. (15 refs.)

101860 Conditions of stationarity and stability of detonation waves in condensed media. V.A.Danilenko, V.M.Kudinov (E.O. Paton Inst. of Electrical Welding, Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.975-7 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.623-6 (Nov. 1982).
Presents some experimental results of an investigation of the stability of detonation waves in elongated charges of heterogeneous condensed media of different classes, as well as results from an inspection of the condition of stationarity and stability (CSS) of the detonation in elongated charges. The lengths l of the charges were chosen from the condition $l>l_{st}$, where l_{st} is the length at which the stationary and stable regime is attained. The behavior of detonation waves in charges of length not less than 3.5 d is identical to that in an arbitrarily long charge consisting of the same explosive. This identity permits the authors to apply the results obtained in studying detonations in charges of finite length to detonation waves in large-scale charges of arbitrary length. The possibility of predicting the behavior of detonation waves over long time intervals while studying their behavior over short time intervals follows from the CSS. (7 refs.)

ESR study of the change in the local structure of As_2Se_3 caused by the action of high pressure and by annealing .... See Entry 101583

Effects of high dynamic pressures on the structure and mechanical properties of martensitic steels 38KhS and 30KhGSN2A .... See Entry 101635

Baroplastic effect in superplasticity .... See Entry 101847

The equation of state of molecular hydrogen at very high density .... See Entry 101893

Calculation of high-pressure phase transitions in solid N_2 and the pressure dependence of intramolecular mode frequencies .... See Entry 101957

Pressure-temperature phase diagrams of several $(TMTTF)_2X$ compounds: stabilisation of a highly conducting metallic state under pressure in $(TMTTF)_2Br$ .... See Entry 102362

Influence of high pressures and magnetic fields on magnetic ordering in Cr-Fe alloy .... See Entry 102632

Shock-induced radiation spectra of fused quartz .... See Entry 102956

Temperature conductivity of calcite, hornblende and crystalline shale at a pressure of up to 8 GPa .... See Entry 104342

Phase transitions and equations of state for the sodium halides: NaF, NaCl, NaBr, and NaI .... See Entry 104345

62.60 ACOUSTIC PROPERTIES OF LIQUIDS

(see also 62.80 Ultrasonic relaxation; for sound propagation, see 43.; for second sound in quantum fluids, see 67.40, 67.50 and 67.60)

101861 Temperature dependence of acoustic velocity in benzene, toluene, acetone and chloroform on the basis of the Carnahan-Starling hard sphere equation. J.D.Pandey, K.Misra (Dept. of Chem., Univ. of Allahabad, Allahabad, India).
Acoust. Lett. (GB), vol.6, no.10, p.148-51 (April 1983).
The Carnahan-Starling rigid sphere equation has been used to calculate the acoustic velocity in benzene, toluene, acetone and chloroform at different temperatures. The agreement between the theoretical and experimental values is quite satisfactory, showing the validity of this model. (19 refs.)

101862 Ultrasonic study of tetrabutyltin in benzene, chlorobenzene, and dichloroethane. T.N.Srivastava, R.P.Singh (Dept. of Chem., Lucknow Univ., Lucknow, India).
Acoust. Lett. (GB), vol.6, no.10, p.152-7 (April 1983).
Ultrasonic wave propagation has been studied in binary mixtures of tetrabutyltin with benzene, chlorobenzene and dichloroethane, at 45°C and 55°C, using a single crystal ultrasonic interferometer at a frequency of 2 MHz. The

ultrasonic velocities and densities of the pure components and their mixtures have been used to calculate isentropic compressibility β, intermolecular free length, L_f, molar volume V, available volume Va and also the excess isentropic compressibility β^E, excess intermolecular free length L_f^E, excess molar volume V^E and excess available volume Va^E. The refractive indices for tetrabutyltin with benzene (25°C) and chlorobenzene (29.5°C) have also been measured. The systems studied show a nonideal behaviour, and the deviations from ideality have been explained on the basis of molecular interaction. (12 refs.)

101863 Ultrasonic absorption measurements near the critical point of a reactive binary mixture. H.Dunker, D.Woermann (Inst. fur Phys. Chem., Univ. Koln, Koln, Germany), J.K.Bhattacharjee.
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.7, p.591-7 (July 1983).
Measurements of sound attenuation and velocity in the homogeneous phase near the critical mixing point of isobutyric acid and water have been carried out. The data are obtained by a pulse transmission technique at seven frequencies between 9 and 45 MHz in a temperature range between 26.29°C and 40°C. The experimental results are analysed in terms of a theory of critical ultrasonic absorption proposed by Bhattacharjee and Ferrell (1981). All the values of these parameters are known for the investigated system from independent experiments. The frequency dependence of the absorption coefficient of ultrasound at the critical temperature is in good agreement with this theory which takes into account only sound absorption by local concentration fluctuations. The absorption data obtained at temperatures away from the critical temperature do not scale when plotted as function of a reduced frequency given by the theory. This clearly indicates an additional mechanism causing absorption of ultrasound. This additional sound absorption can be represented by a single temperature dependent relaxation process. It is assumed that this process is due to an unspecified chemical reaction. The temperature dependence of the relaxation time follows a power law of the form $\tau_r \propto (T-T_c)^{-a}$ with $1 \leq a \leq 1.25$. (35 refs.)

101864 Rotational isomerism and ultrasonic relaxation in 1,2-dibromoethane. K.Takagi, P.-K.Choi, W.Seki (Inst. of Industrial Sci., Univ. of Tokyo, Tokyo, Japan).
J. Chem. Phys. (USA), vol.79, no.2, p.964-8 (15 July 1983).
Three different ultrasonic techniques, pulse echo, HRB (high-resolution Bragg reflection), and Brillouin scattering were used to measure the sound velocity and absorption in 1,2-dibromoethane at 11, 20, and 30°C over the frequency range from 3 MHz and 6 GHz. The observed results showed a typical spectrum for a single relaxation process, from which the relaxation frequency and strength were determined. The temperature dependence of the relaxation frequency and strength suggested that the activation energy for the gauche molecule is 3.0 ± 0.5 kcal/mol and that the energy difference is 1.3 ± 0.2 kcal/mol, respectively. The magnitude of the relaxation strength was successfully described by taking the effect of the volume change into account, and $\Delta V/V$ was estimated to be 0.05. (18 refs.)

101865 Oscillations in the ultrasonic velocity during heating of liquid gallium. V.M.Glazov, S.G.Kim (Moscow Inst. of Electronic Technol., Moscow, USSR).
JETP Lett. (USA), vol.37, no.5, p.245-7 (5 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.5, p.208-12 (5 March 1983).
High sensitive measurements have revealed oscillations in the temperature dependence of the ultrasonic velocity in liquid gallium. The oscillations are interpreted as a compressibility-oscillation effect and attributed to the particular nature of the interaction between the medium and microscopic regions in which the crystal structure has been partially retained. (6 refs.)

101866 Anisotropic propagation of ultrasound in the nematic phase of *N-p*-butoxybenzylidene-*p*-butylaniline with varying thermodynamic state parameters. V.A.Balandin, A.N.Larionov, S.V.Pasechnik (All-Union Correspondence Inst. of Mech. Engng., USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.1-2 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.1-4 (Jan.-Feb. 1983).
The anisotropy of the absorption of ultrasound at a frequency of 2.9 MHz in the nematic phase of *N-p*-butoxybenzylidene-*p*-butylaniline is measured at various pressures. It is established that the anisotropy index of the given quantity in the vicinity of the nematic-smectic *A* phase transition is equal to −1.0 and does not depend on the pressure. (9 refs.)

Scattering of the second harmonic of an acoustic wave in a liquid containing gas bubbles .... See Entry 100951

Effect of pressure on sound absorption in synthetic seawater and in aqueous solutions of $MgSO_4$ .... See Entry 100953

Excess volumes & deviations in isentropic compressibilities for the binary mixtures of acetonitrile with alcohols .... See Entry 101828

Ultrasonic relaxation of poly(*N*-vinylpyrrolidone) and dextran in aqueous solution .... See Entry 101871

Prediction of structures and magnetic orientations in solid α-and β-O_2 .... See Entry 101881

The Anderson-Gruneisen parameter of the liquid state and its relation with Rao's acoustical parameter .... See Entry 101994

The calculation of molecular interaction in phosphoryl chloride .... See Entry 102001

Positron annihilation in and compressibility of water-organic mixtures. I. The system water-tetrahydrofuran .... See Entry 102987

Correlation of dielectric relaxation and positron annihilation in glass-forming liquids .... See Entry 102991

62.65 ACOUSTIC PROPERTIES OF SOLIDS

(see also 62.80 Ultrasonic relaxation; for sound propagation, see 43.; for lattice dynamics and phonons, see 63.; for magnetoacoustic effects, see 72.55; for acoustoelectric effects, see 72.50; for acousto-optical effects, see 78.20H)

101867 The influence of the iron ions admixture and domain walls upon the propagation of longitudinal ultrasonic waves in TGS crystals. S.Szuba (Dept. of Experimental Phys., Higher Pedagogical School, Zielona Gora, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.1, p.39-53 (July 1983).
The velocity of propagation of longitudinal ultrasonic waves and their attenuation were measured in the three principal crystallographic directions of pure and Fe^{3+}-doped monocrystals of the concentration: $5\times10^{-4}\%$, $14\times10^{-4}\%$, $27\times10^{-4}\%$ and $36.10^{-4}\%$, in temperatures varying throughout the range of 293K-343K. The measurements for nonpolarized and permanently polarized samples were performed using the pulse echo technique with ultrasonic waves of the frequencies of: 9.8 MHz, 15.1 MHz and 29.4 MHz. On the basis of velocity and attenuation coefficient measurements, the relaxation time of spontaneous polarization and the size of lattice regions deformed by the introduction of foreign ions were determined. The velocity value and the value of the attenuation coefficient of the same, nonpolarized and permanently polarized, samples were compared. It was determined that in the vicinity of the phase transition in the ferroelectric phase, the attenuation coefficient value is lower for the single-domain samples than for the multi-domain ones, whereas the wave velocity value is higher for the single-domain samples than for the multi-domain ones. (21 refs.)

101868 Anisotropy of the sound absorption quantum oscillations in white tin. A.N.Vasil'ev, A.A.Nurmagambetov.
Fiz. Nizk. Temp. (USSR), vol.9, no.7, p.714-21 (July 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The sound absorption quantum oscillations of different polarizations of the transverse sound waves in white tin are investigated by a transducerless method. A model is proposed, describing the anisotropy of the observed oscillations amplitudes. (12 refs.)

101869 Acoustic emission in the interaction of iron and its alloys with surface-active melts. M.A.Krishtal, A.A.Borgardt, P.V.Loshkarev (Polytech. Inst., Togliatti, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.977-9 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.626-9 (Nov. 1982).
In the interaction of iron and iron-silicon alloys with surface-active melts of indium and lead a zone with a high density of dislocations is formed in a surface layer of the solid metal. To estimate that part of the released energy which is spent in the formation of the dislocation structure the authors have carried out a transmission-electron-microscope study of Armco-iron foil wetted by an indium melt for 1-2 sec. (6 refs.)

101870 A comparison of two theories of acoustoelasticity. A.V.Clark, R.B.Mignogna (Nondestructive Evaluation Section, Naval Res. Lab., Washington, DC, USA).
Ultrasonics (GB), vol.21, no.5, p.217-25 (Sept. 1983).
The presence of a plane stress field causes small changes in the phase velocities of orthogonally polarized SH waves. The (small) difference in phase velocities (birefringence) can be used for non-destructive stress measurement. However, material anisotropy can affect phase velocity to the same extent as stress. Two theories have been developed which account for the effect of both stress and anisotropy. The theory of Iwashimizu and Kubomura (1973) assumes isotropy in the third-order elastic moduli and anisotropy in second-order moduli. A different approach was taken by Okada (1980), who assumed the existence of a matrix analogous to the index of the refraction matrix in optics. In this paper, the authors generalize the theory of Iwashimizu and Kubomura by retaining anisotropy in third-order moduli. They show how Okada's theory can be made to agree with this more general theory. They also compare the predictions of the various theories with birefringence data obtained from uniaxial tension tests on 2024-T351 aluminium specimens. Both the Okada theory and the theory of Iwashimizu and Kubomura gave good agreement with experiment. (14 refs.)

On a certain inverse problem in γ-acoustic spectroscopy .... See Entry 99245

Low temperature properties of metallic glasses .... See Entry 101563

Elastic constants and structure of the vitreous system H_2O-P_2O_5 .... See Entry 101574

Effect of the third component on the technical and elastic properties of phosphorus-containing glasses .... See Entry 101585

Model of acoustic emission from accelerated dislocations .... See Entry 101703

Refinement of the equations for calculating the third-order elastic constants of cubic crystals and isotropic media from ultrasonic measurement data .... See Entry 101836

Polarization of elastic waves in gyrotropic crystals .... See Entry 101854

Sagittal elastic waves in infinite and semi-infinite superlattices .... See Entry 101880

Photoacoustic determination of the band gaps of Ca_2MnO_4 and $Ca_3Mn_2O_7$ .... See Entry 102250

Possibility of acoustic plasmons in mixed-valence metals and their interaction with phonons .... See Entry 102283

Elastic properties of nongradient glasses and glasses synthesized by ion-exchange diffusion above and below the glass-transition temperature .... See Entry 103204

Acoustic emission during thermal cycling of heat-resistant steel .... See Entry 103444

62.80 ULTRASONIC RELAXATION

(see also 74.30G Ultrasonic attenuation in superconductors, 43.35 Ultrasonics)

101871 Ultrasonic relaxation of poly(*N*-vinylpyrrolidone) and dextran in aqueous solution. M.C.Pereira, P.L.Jobling, E.Wyn-Jones (Dept. of Chem. & Appl. Chem., Univ. of Salford, Salford, England), E.R.Morris, R.A.Pethrick.
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.7, p.977-88 (July 1983).
The ultrasonic relaxation spectra of the polymers dextran and and poly(*N*J-vinylpyrrolidone) have been studied in aqueous solution over the frequency range 1-100 MHz. A range of molecular weights and concentrations were used to span dilute and semi-dilute solution conditions $(0.44<c[\eta]<11)$. The results indicate that the relaxation spectra can be resolved into two components, one associated with the viscoelastic normal mode of the polymer chain and the other a significant contribution associated with more local conformational changes within chain segments. (30 refs.)

Anisotropic propagation of ultrasound in the nematic phase of *N-p*-butoxybenzylidene-*p*-butylaniline with varying thermodynamic state parameters .... See Entry 101866

63.00 LATTICE DYNAMICS AND CRYSTAL STATISTICS

(see also 05.50 Lattice theory, 65. Thermal properties, 66.70 Thermal conduction, 68.30 Dynamics of surface and interface vibrations, 78.30 Infrared and Raman spectra)

63.10 GENERAL THEORY

101872 Solitons and next nearest neighbours coupling in 1-D anharmonic lattices. S.Pnevmatikos (Univ. de Dijon, Dijon, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.14, p.1031-4 (18 April 1983). In French.
Supersonic and subsonic kink soliton solutions are found in the continuum limit of a discrete monoatomic chain for different harmonic or anharmonic coupling regimes between first and second nearest neighbours. The propagation of these solutions on the discrete chain is studied numerically, in particular for the competitive force case where some interesting lattice destabilisations are observed at the moment of the head-on collisions between two large amplitude solitary waves. (10 refs.)

63.20 PHONONS AND VIBRATIONS IN CRYSTAL LATTICES

101873 Determination of vibronic parameters for GR1 centre in diamond by an optimisation technique. S.Muramatsu (Dept. of Electronic Engng., Utsunomiya Univ., Utsunomiya, Japan).
J. Phys. C (GB), vol.16, no.24, p.4849-52 (30 Aug. 1983).
The parameters involved in vibronic models for the GR1 centre in diamond have been determined by using a optimisation technique. Two vibronic models and experimental data from optical measurements reported by Davies and Foy (1980) are used. The following values are obtained for the parameters of the Jahn-Teller coupling in the ground E and the excited T_2 states: $S_E=2.71$, $\beta/\alpha=1.36$, $S_T{}^e=0.22$ and $S_T{}^t=0.12$-0.14. The effective phonon energy for an e-mode vibration has been estimated to be 55 meV, which is close to the value of 40 meV obtained by Davies (1981) from a study of the emission spectrum. (10 refs.)

101874 Lattice dynamics and interaction potentials in molecular crystals. V.Schettino, S.Califano (Lab. di Spettroscopia Molecolare, Univ. di Firenze, Florence, Italy).
J. Mol. Struct. (Netherlands), vol.100, p.459-83 (July 1983).
Presents a critical analysis of harmonic and anharmonic calculations of crystal vibrations in the determination of intermolecular potentials. The main purpose is to show that the dynamical properties are specifically sensitive to different terms of the potential and thus that information extracted from vibrational spectra of crystals is of the greatest importance for the theory of intermolecular forces. The most important conclusion is that these calculations point to the development of anisotropic short-range potentials and orient future researches towards the more complex and elaborate anharmonic treatment of crystal vibrations. (36 refs.)

101875 Bound states of optical phonons for idealized models of crystal lattices. A.A.Anik'ev, V.S.Gorelik, B.S.Umarov.
Sov. Phys.-Lebedev Inst. Rep. (USA), no.10, p.41-6 (1982). Translation of: *Sb. Kratk. Soobshch. Fiz. AN SSSR Fiz. Inst. P.N. Lebedeva*, no.10, p.46-52 (1982).
It is shown that for the scalar model of a crystal, bound states of optical phonons are formed for certain definite values of the coupling constant. The calculated densities of states are compared with the experimental spectra of ammonium chloride crystals. (5 refs.)

Vibrational study of strong C-H...X hydrogen bonds in solid complexes of boron decachlorocarboranes .... See Entry 100405

Anisotropy in light emission by Zn porphin molecules in n-octane single crystals .... See Entry 100454

Relation of low-frequency skeleton vibrations in glassy polymers with equilibrium rigidity of macromolecules .... See Entry 101602

Molecular dynamics on a parallel computer .... See Entry 101604

Structure and intermolecular excitations of β-N_2 at 400 MPa and 55K .... See Entry 101645

Calculation of high-pressure phase transitions in solid N_2 and the pressure dependence of intramolecular mode frequencies .... See Entry 101957

Coupling of phonons to a helium atom adsorbed on graphite .... See Entry 102169

Dispersion of magnetoplasmons in layered systems .... See Entry 102287

The effect of hydrostatic pressure on shallow and deep impurity states in semiconductors .... See Entry 102304

Quasistatic long-range correlations on Jahn-Teller centers via the phonon field in K_2ZnF_4:Cu^{2+} at low temperatures .... See Entry 102330

A classic example of an Evans hole caused by intermolecular interaction in solid $2ND_3.D_2O$ at 15 to 145K .... See Entry 102866

Infrared-active combination band in a surface formate species .... See Entry 102880

Raman scattering induced by V centers and their aggregates in alkali halides .... See Entry 102890

Raman effect in single crystal $NiSO_4.6H_2O$ .... See Entry 102892

Effect of hyperfine interaction on the luminescence of Pb^{2+} and Bi^{3+} centers in alkaline-earth chalcogenides .... See Entry 102939

63.20D Phonon states and bands, normal modes, and phonon dispersion

101876 Semiconductor dynamics from first principles: Phonons, forces, and dielectric properties. K.Kunc (Lab. de Phys. des Solides, Univ. Pierre et Marie Curie, Paris, France).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.559-68 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Recent applications of 'direct' methods for ab initio treatment of dynamical properties of semiconductors are summarized with emphasis upon the author's own results based on the local density functional. Extending beyond the 'frozen phonon' approach, the applications include treatment of forces (in perfect structures and crystals with substitutional defects) and a 'direct' study of certain dielectric properties. (19 refs.)

101877 Effect of nonrandomness on the phonons in mixed $InP_{1-x}As_x$. G.Ahuja, H.C.Gupta, L.M.Tiwari (Phys. Dept., Indian Inst. of Technol., New Delhi, India).
J. Chem. Phys. (USA), vol.79, no.3, p.1416-18 (1 Aug. 1983).
A concentration dependent model using the effect of nonrandomness has been investigated to demonstrate the two-mode behavior of mixed crystals of the type $AB_{1-x}C_x$ having zinc-blend structure. The mixed crystal shows two-mode behavior for all the composition range and the pure crystal behavior at exact $x=0$ and at $x=1.0$. The model has been applied to $InP_{1-x}As_x$ to investigate the phonon dispersion curves in the symmetry directions. The results for $x=0$, $x=0.22$, $x=0.78$, and $x=1.0$ are found to be in agreement with experiment. (17 refs.)

101878 Phonons in uranium antimonide and uranium arsenide. W.G.Stirling, G.H.Lander (Inst. Laue-Langevin, Grenoble, France), O.Vogt.
J. Phys. C (GB), vol.16, no.21, p.4093-101 (30 July 1983).
The phonon dispersion curves of two rocksalt-structure uranium pnictides, USb and UAs, measured by neutron inelastic scattering, are presented. Both materials display marked anomalies in the disposition of certain branches, similar to those observed in some intermediate-valence compounds. The data are compared with the prediction of simple lattice dynamical models. (20 refs.)

101879 The relation between various coupling schemes for calculating nonradiative multiphonon transition rates. M.G.Burt (BTRL, Martlesham Heath, Ipswich, England).
J. Phys. C (GB), vol.16, no.21, p.4137-49 (30 July 1983).
In an earlier paper (see ibid., vol.15, p.L381, 1982) the author gave a simple proof that the static, adiabatic and intermediate coupling schemes give the same nonradiative multiphonon transition rates to leading order in the off-diagonal part of the electron-phonon interaction. In that proof, the time dependence in the interaction picture of the matrices describing the transformation from one representation to another was neglected using a heuristic argument. In this paper it is shown explicitly that this time dependence can be neglected, hence firmly establishing the earlier result. The equivalence between the various coupling schemes is also established for the time rate of change of a general observable; for example the charge density. The present work is discussed in relation to the recent papers by Peuker et al. (1982) and by Wagner (1982). In particular it is shown that there is no contradiction between the present work and that due to Wagner. It is also shown that Wagner's alternative adiabatic base is none other than the base defined by Condon electronic wavefunctions and displaced lattice oscillators and that this result holds independently of the strength of the off-diagonal part of the electron-phonon interaction. (11 refs.)

101880 Sagittal elastic waves in infinite and semi-infinite superlattices. B.Djafari-Rouhani, L.Dobrzynski, O.Hardouin Duparc (Lab. d'Etude des Surfaces et Interfaces, CNRS, Lille, France), R.E.Camley, A.A.Maradudin.
Phys. Rev. B (USA), vol.28, no.4, p.1711-20 (15 Aug. 1983).
Elastic waves, polarized in the sagittal plane, are investigated in infinite and semi-infinite superlattices made from alternate layers of two isotropic media. By the use of a transfer-matrix method, the authors obtain explicit equations for the dispersion of the bulk modes as well as of the surface modes of a semi-infinite superlattice. They present a few illustrations of the theory for Al-W superlattices in which the relative thicknesses of the two media or the thickness of the layer at the surface are varied. (31 refs.)

101881 Prediction of structures and magnetic orientations in solid α-and β-O_2. R.D.Etters (Natuurkundig Lab., Univ. van Amsterdam, Amsterdam, Netherlands), A.A.Helmy, K.Kobashi.
Phys. Rev. B (USA), vol.28, no.4, p.2166-71 (15 Aug. 1983).
A quasiharmonic-lattice-dynamics method coupled with a pattern-recognition optimization scheme is used to determine the minimum energy structures and magnetic orientations of solid oxygen. It is shown that the magnetic interaction is responsible for the stability of α-O_2 with respect to β-O_2 at zero temperature and pressure. The calculated α-O_2 lattice parameters, magnetic orientations, and sublimation energy are in good agreement with experiment. Phonon dispersion curves are calculated at $k\neq0$ and the acoustic sound velocities are determined. The root-mean-square translational and orientational fluctuations from equilibrium are also calculated. The β-O_2 phase is described by constraining the magnetic moments so that the magnetic Hamiltonian preserves the hexagonal symmetry of the crystal. The calculated lattice parameters are in good agreement with the experiment and a three-sublattice, quasihelical magnetic orientation is predicted from structural and energetic considerations. (30 refs.)

101882 Interlayer force and Davydov splitting in $2H$-MoS_2. P.N.Ghosh, C.R.Maiti (Dept. of Phys., Univ. of Calcutta, Calcutta, West Bengal, India).
Phys. Rev. B (USA), vol.28, no.4, p.2237-9 (15 Aug. 1983).
The atom-atom interaction model has been extended to the case of $2H$-MoS_2 and it is shown that the observed vibrational frequencies can be satisfactorily reproduced by only three force constants. However, the calculation leads to a frequency reversal in the Davydov pair which is very similar to that found earlier for ϵ-GaSe and β-GaS. Since MoS_2 is somewhat less ionic than the two gallium compounds, the authors suggest that the frequency reversal may not be due to the long-range interactions proposed earlier. They discuss the possible role of short-range multipolar interactions. (14 refs.)

101883 Near degeneracy surfaces and other implications of extended symmetry for phonons in alkali halide and other crystals. B.Segall, L.L.Foldy (Dept. of Phys., Case Western Reserve Univ., Cleveland, OH, USA).
Solid State Commun. (USA), vol.47, no.8, p.593-6 (Aug. 1983).
The role of extended symmetry in isobaric alkali halide crystal dynamics is examined with respect to: (i) further evidence for its validity, (ii) the prediction of the existence of surfaces of near degeneracies between pairs of phonon branches (subsequently confirmed by computer model simulation), (iii) more efficient parametrizations of phenomenological models for their phonon dynamics, and (iv) its usefulness in 'understanding' the characteristic features of the dispersion relations of all alkali halides. It is possible that the symmetry may be a useful concept for other classes of crystals as well. (12 refs.)

101884 Phonon dispersion curves of $CeSn_3$ in the vicinity of the *R*-point. L.Pintschovius (Inst. fur Angewandte Kernphys. I, Kernforschungszentrum Karlsruhe, Karlsruhe, Germany), E.Holland-Moritz, D.Wohlleben, S.Stahr, J.Liebertz, W.Assmus, C.Stassis, C.-K.Loong, S.Zarestky, R.M.Nicklow.
Solid State Commun. (USA), vol.47, no.8, p.663-4 (Aug. 1983).
The phonon dispersion curves of the intermediate valence compound $CeSn_3$ have been studied to check for the possible occurrence of an anomaly at the point *R*. The authors do not find any indication for an anomaly at this point, in agreement with present theories. (9 refs.)

Pulsed Raman measurements of phonon populations: time reversal, correction factors, and all that .... See Entry 101768

Structural phase transitions and polaritons in low-frequency region .... See Entry 101951

Heat capacity and thermal conductivity of semiconducting $PtSb_2$ in the range 4.2-300K .... See Entry 102000

A comment on the W(001) surface stability and reconstruction .... See Entry 102136

Anomalous surface phonon dispersion relations for Ag(111) measured by inelastic scattering of He atoms .... See Entry 102147

Vibronic intensities in the electronic spectra of transition metal ions. I. Crystal field calculations for the $^2E_g \rightleftharpoons {}^4A_{2g}$ transitions of Cs_2MnF_6 ... See Entry 102331

Dispersion of superconducting gap excitations in layered charge density wave systems .... See Entry 102568

Lattice vibration spectra XXXIII. Far-infrared reflection spectra, TO and LO phonon frequencies, optical and dielectric constants, and effective charges of the spinel-type compounds MCr_2S_4 (M=Mn, Fe, Co, Zn, Cd, Hg), MCr_2Se_4 (M=Zn, Cd, Hg), and MIn_2S_4 (M=Mn, Fe, Co, Ni, Cd, Hg) .... See Entry 102873

63.20K Phonon-electron interactions

101885 Point-contact electron-phonon interaction spectra of pure metals. I.K.Yanson.
Fiz. Nizk. Temp. (USSR), vol.9, no.7, p.676-709 (July 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The physical grounds of the electron-phonon interaction (EPI) spectroscopy by means of metallic-point-contacts with dimensions less than the electron mean free path are presented. At low temperature the volt-ampere characteristic of such a contact is nonlinear, its second derivative being proportional to the EPI function of the metal. The methods of preparation and qualification of the contacts are discussed. The experimental point-contact EPI functions for 26 metals are presented and compared with the various relative EPI functions and (or) with the phonon density of states. Such a comparison enables one to correct the phonon peak positions for a number of metals and reveals a tendency of emphasizing the transverse phonons in point-contact spectra. The tendency is explained by the overwhelming contribution of backscattering which involves transverse phonons mainly due to U-processes. The detailed comparison of the experimental and calculated point-contact EPI functions also yields the possibility to correct the pseudopotential form-factor taken as the input data in the theory. By integrating the point-contact spectra the EPI parameters λ_{pc} are calculated. (85 refs.)

Intermediate infrared absorption of dianion $(2TCNQ)^{2-}$ .... See Entry 100373

The relation between various coupling schemes for calculating nonradiative multiphonon transition rates .... See Entry 101879

Absorption of ballistic phonons by the (001) inversion layer of Si: electron-phonon interaction in two dimensions .... See Entry 102481

63.20M Phonon-defect interactions

Lattice relaxation, radiative and non-radiative deexcitation at localized defects .... See Entry 101688

63.20P Localized modes

101886 Localized surface modes and resonances for vicinal surfaces: the (117) face of FCC crystals. G.Armand (Service de Phys. des Atomes et des Surfaces, CENS, Gif-sur-Yvette, France), P.Masri.
Surf. Sci. (Netherlands), vol.130, no.1, p.89-123 (July 1983).
Considering the (117) face of an FCC crystal, the dispersion relations of localized surface modes and resonances have been calculated using the method of generating coefficients of Green functions. The force between atoms is limited to the central force between the nearest neighbours. In the direction of propagation orthogonal to a step, for each wavevector value, a localized surface mode and two resonances have been found. Their polarization amplitude and width have been calculated. It is shown that these results can be qualitatively understood by folding three times the dispersion relation of the (001) face which is the crystallographic plane of the terrace. In the direction parallel to the step, the dispersion relations are obtained by the superposition of the sagittal and transverse dispersion relation of the (001) face. The (117) configuration introduces a coupling between these two polarizations and some resonances appear. A general rule which enables one to predict qualitatively the shape of the dispersion relation for any vicinal surface of type (11m) is expressed. (22 refs.)

On vibrational energy localization at high levels of excitation. Vibrational excitons .... See Entry 100360

Lattice relaxation, radiative and non-radiative deexcitation at localized defects .... See Entry 101688

Raman scattering of pure, singly- and doubly perturbed interstitial hydrogen atom centers in alkali halides .... See Entry 102889

Vibrational fluorescence of CN^- defects in KCl excited by coupling to optically pumped F centers .... See Entry 102940

63.50 VIBRATIONAL STATES IN DISORDERED SYSTEMS

101887 Lattice dynamics of polyacetylene as a one-dimensional system. I. The case of the trans perfect polymer. G.Zannoni, G.Zerbi (Dipartimento di Chimica Industriale e Ingegneria Chimica, Politecnico di Milano, Milano, Italy).
J. Mol. Struct. (Netherlands), vol.100, p.485-504 (July 1983).
The lattice dynamics of trans-polyacetylene as a perfect one-dimensional crystal is treated. Dispersion curves, density of states and vibrational displacements are calculated. The results of the calculations are used to propose a vibrational assignment for $(CH)_x$, $(CD)_x$ and $(^{13}CH)_x$. Calculations have been made with a quadratic simplified valence force field (SVFF). The relationship between SVFF and the electron-phonon coupling model for polyacetylene, generally adopted in the literature, is discussed. Comparison with the calculations of other authors is made. (71 refs.)

101888 Lattice dynamics of polyacetylene as a one-dimensional system. II. Doping-induced disorder. G.Zannoni, G.Zerbi (Dipartimento di Chimica Industriale e Ingegneria Chimica, Politecnico di Milano, Milano, Italy).
J. Mol. Struct. (Netherlands), vol.100, p.505-30 (July 1983).
For pt.I see ibid., vol.100, p.485 (1983). The quadratic valence force field derived in part I of this study for perfect trans-polyacetylene is used and adapted for the study of the doping-induced IR absorption of polyacetylene. The lattice dynamics of a one-dimensional disordered system is treated with the introduction of structural defects to represent the doping sites. Concentration, distribution, size of the defects and inhomogeneity of the doping are all considered. Two models for the defects are analyzed; one representing the 'soliton' and the other, equally acceptable on chemical grounds, representing centro-symmetric defects. It is concluded that the IR spectrum observed for doped polyacetylene does not provide unequivocal evidence for the existence of solitons. Alternative explanations are equally acceptable from the spectroscopic viewpoint. The structural information derived from lattice dynamics and spectra is discussed in detail. (55 refs.)

101889 Establishment of temperature in dielectric glasses below 1K. I.B.Levinson (L.D. Landau Inst. of Theoretical Phys., Acad. of Sci., Moscow, USSR).
JETP Lett. (USA), vol.37, no.3, p.190-3 (5 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.3, p.157-9 (5 Feb. 1983).
The process of establishing the temperature in a system of two-level centres+phonons is discussed. It is shown that the time for establishing the temperature is very large (at $T \simeq 0.2K$ it is about 10 ms). (14 refs.)

Selective nonlinear spectroscopy of inhomogeneously broadened phonon resonances in a disordered medium .... See Entry 100847

Low temperature properties of metallic glasses .... See Entry 101563

Silver sulfide based glasses. I. Glass forming regions, structure and ionic conduction of glasses in Ge_2-Ag_2S and GeS_2-Ag_2S-AgI systems . See Entry 101568

Atomic structure of SiS_2 and $SiSe_2$ glasses .... See Entry 101575

The Anderson-Gruneisen parameter of the liquid state and its relation with Rao's acoustical parameter .... See Entry 101994

The calculation of molecular interaction in phosphoryl chloride .... See Entry 102001

Calculation of the thermal conductivity of glasses .... See Entry 102085

Electrons and phonons in metallic glasses .... See Entry 102242

Thermal conductivity of amorphous iron alloys at low temperatures .... See Entry 102346

Intrinsic infrared absorption of halide glasses .... See Entry 102863

On the optical properties of trans-polyacetylene .... See Entry 102865

63.70 STATISTICAL MECHANICS OF LATTICE VIBRATIONS

(see also 65. Thermal properties of condensed matter, 66.70 Thermal conduction)

101890 Debye-Waller factors and the study of structural phase transitions: double quadratic chain. S.L.Mair (Div. of Chem. Phys., CSIRO, Clayton, Victoria, Australia).
J. Phys. C (GB), vol.16, no.24, p.4811-25 (30 Aug. 1983).
Expressions for the one-particle density function and Debye-Waller factor are derived for a chain of atoms, each atom sitting in a double quadratic one-particle potential, with adjacent atoms linked by strong harmonic coupling forces. Working within the framework of classical mechanics, exact numerical results are obtained and compared with analytical expressions which are exact at zero temperature but only approximate at finite temperature. It is shown that the pseudo-Schrodinger and transfer integral equations give essentially the same results at all temperatures. The one-particle density function at low temperature consists of two equally weighted gaussians, corresponding to phonon-like modes about the local minima in the potential. As the temperature increases a centrally placed soliton peak grows and dominates the distribution at high temperatures. The mean-square displacement is linear at high temperatures and linear extrapolation back to zero temperature gives a positive intercept on the mean-square displacement axis. These results are discussed in the context of the disorder model and experimental DWF data from structurally transforming crystals. (18 refs.)

Diffuse X-ray scattering near Bragg peaks from point defects in a general lattice .... See Entry 101505

Lattice parameters, thermal expansion coefficients, and vacancy density in solid CD_4 .... See Entry 101684

The compressibility measurements of ThO_2, Li_2O and 4H-CdI_2 by using a diamond-anvil pressure cell .... See Entry 101856

Lattice dynamics and interaction potentials in molecular crystals .... See Entry 101874

Heat capacity and thermal conductivity of semiconducting $PtSb_2$ in the range 4.2-300K .... See Entry 102000

63.75 STATISTICAL MECHANICS OF DISPLACIVE PHASE-TRANSITIONS

(for order-disorder and statistical mechanics of model systems, see 64.60; for crystallographic aspects of polymorphic and order-disorder transformations, see 61.50K)

Raman scattering study of the structural phase transitions in $RbAlF_4$ .... See Entry 102869

63.90 OTHER TOPICS IN LATTICE DYNAMICS AND CRYSTAL STATISTICS

101891 Frequency spectrum of a small particle. A.Tamura, T.Ichinokawa (Dept. of Appl. Phys., Waseda Univ., Tokyo, Japan).
J. Phys. C (GB), vol.16, no.24, p.4779-88 (30 Aug. 1983).
On the basis of an elastic body approximation, the frequency spectrum is derived for the small particle having a relaxed surface layer. Three quantities—the maximum angular momentum and two maximum eigenfrequencies defined for the spheroidal mode and the torsional mode—are introduced to reflect the atomicity of a real lattice structure. The calculated frequency spectrum for a small Ar particle is in good agreement with that obtained by the molecular dynamical method. The size dependence of the frequency spectrum shows that the relative importance of the surface modes to the inner

modes becomes large as the particle size decreases. The surface relaxation effect changes the peak positions of the frequency spectrum derived for the small particle without a relaxed surface layer. The present treatment is applicable to a small particle having a considerable number of atoms, more than 1000. (15 refs.)

Instability of the electron-hole plasma and its possible relation with melting .... See Entry 101770

Neutron scattering study on the structural transition of quasi-one-dimensional conductor $K_{0.3}MoO_3$ .... See Entry 101947

Proton tunnelling in KH_2PO_4 .... See Entry 102829

64.00 EQUATIONS OF STATE, PHASE EQUILIBRIA, AND PHASE TRANSITIONS

(see also 82.60 Chemical thermodynamics)

64.10 GENERAL THEORY OF EQUATIONS OF STATE AND PHASE EQUILIBRIA

Extrapolation and series acceleration procedures: hard spheres and discs as illustrations .... See Entry 99062

Phase equilibrium in nearly monodisperse fluids .... See Entry 101901

Cohesion, compound formation and phase diagrams from first principles .... See Entry 101913

64.30 EQUATIONS OF STATE OF SPECIFIC SUBSTANCES

(see also 65.70 Thermal expansion)

101892 Equation-of-state data for molecular hydrogen and deuterium at shock pressures in the range 2-76 GPa (20-760 kbar). W.J.Nellis, A.C.Mitchell, M.van Thiel, G.J.Devine, R.J.Trainor (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA), N.Brown.
J. Chem. Phys. (USA), vol.79, no.3, p.1480-6 (1 Aug. 1983).
Dynamic equation-of-state data for D_2 and H_2 were measured in the pressure range 2-76 GPa (20-760 kbar) using a two-state light-gas gun. Liquid specimens were shocked from initial states near the saturation curve at 20K. Maximum compression was sixfold over initial liquid density at a calculated temperature of 7000K for D_2. The data is discussed in terms of the theory of Ross et al. (1983) which includes an effective intermolecular pair potential, molecular vibration, free molecular rotation, and molecular dissociation. (33 refs.)

101893 The equation of state of molecular hydrogen at very high density. M.Ross, F.H.Ree, D.A.Young (Lawrence Livermore Nat. Lab., Univ.of California, Livermore, CA, USA).
J. Chem. Phys. (USA), vol.79, no.3, p.1487-94 (1 Aug. 1983).
In the preceding paper (Nellis et al., ibid., vol.79, no.3, p.1480, 1982) new shock-wave results were reported on liquid hydrogen and deuterium up to a pressure of 76 GPa (760 kbar). In the present paper an effective pair potential is determined from these results and used in calculations of fluid and solid isotherms, melting curves, and the metallic transition pressure. The agreement with available data is good and the metallic transition is predicted to be near 300 GPa (3 Mbar). (46 refs.)

101894 Reduced van der Waals equation of state and critical properties of rubbers. Th.Vilgis, H.-G.Kilian (Abteilung Experimentelle Phys., Univ. Ulm, Ulm/Donau, Germany).
Polymer (GB), vol.24, no.8, p.949-52 (Aug. 1983).
A reduced equation of state describing the deformation mode as simple elongation is derived for van der Waals networks, thus manifesting general relationships for molecular networks also embracing their stability characteristics and the occurrence of a phase transition. (20 refs.)

The equation of state for solids 1843-1926 .... See Entry 98712

Gold as a reliable internal pressure calibrant at high temperatures .... See Entry 99074

Valence charge in a solid at 0K viewed as a pressure-ionization effect .... See Entry 101858

Effect of the shell structure of atoms on the shock adiabats of aluminum and iron .... See Entry 101859

Linear equations of state for electrically polarized ceramics . See Entry 102823

Phase transitions and equations of state for the sodium halides: NaF, NaCl, NaBr, and NaI .... See Entry 104345

64.60 GENERAL STUDIES OF PHASE TRANSITIONS

(for critical phenomena in quantum fluids, superconductors, magnetic materials and ferroelectrics, see 67., 74.40, 75.40 and 77.80 respectively)

101895 Incommensurate crystal phases. A.Janner, T.Janssen (Inst. for Theoretical Phys., Univ. of Nijmegen, Nijmegen, Netherlands).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.665-75 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The authors explore how the superspace description of an incommensurate modulated crystal can be used for investigating crystal phase transitions. The superspace group approach is explained briefly. The relevant ideas and results of two specific one-dimensional microscopic models leading to phase diagrams involving incommensurate crystal structures are then briefly reviewed. The same models are subsequently considered again but in a superspace-adapted formulation, the advantage of the approach being more that of a symmetry-adapted formulation than that of a group-theoretical one of the crystallographic superspace symmetry occurring in these models. In order to investigate the latter aspect as well, the classical theory of Landau for continuous phase transitions is considered and extended to allow the use of superspace symmetry as present in incommensurate crystals. Such an extension is presented, which allows one to characterize second-order phase transitions involving incommensurate phases as well, even when different modulation dimensionalities (the so-called internal dimensions) or commensurate phases occur. (10 refs.)

101896 Commensurate-incommensurate phase transitions. V.L.Pokrovsky (Landau Inst. of Theoretical Phys., Chernogolovka, USSR).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.677-87 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Phase transitions from commensurate to incommensurate state (CIT) were observed in numerous physical systems, including: heliomagnets; helical ferroelectrics; chiral smectics; charge density waves; spin density waves; submonolayers of adsorbed atoms on crystal faces; atoms and molecules intercalated into graphite; reconstructed faces of crystals and interfaces; superconducting films with modulated thickness in transverse magnetic field and electrons on liquid He surface over a periodic electrode. The soliton interactions are discussed, as are the soliton structures in anisotropic and isotropic systems. Finally, point defects in commensurate and striped soliton structures in two dimensions, and the effects of discreteness are outlined. (35 refs.)

101897 Line effects in disk-shaped heterogeneous nucleation. G.Navascues, L.Mederos (Inst. de Fisica del Estado Solido, Univ. Autonoma de Madrid, Madrid, Spain).
J. Chem. Phys. (USA), vol.79, no.4, p.2006-8 (15 Aug. 1983).
The classical theory of the heterogeneous nucleation with disk-shaped nuclei is developed and discussed. The nonlinearity of the Pound plot can be understood with the present theory, in which line tension effects play an essential role. Experimental data on the nucleation of zinc depositing on glass is analyzed in the light of the theory; these data can be theoretically fitted for the first time over a full range of temperatures assuming plausible values for the unknown parameters. (17 refs.)

101898 Long-range interactions in commensurate-incommensurate phase transition. V.L.Pokrovsky (L.D. Landau Inst. for Theoretical Phys., Chernogolovka, USSR), A.Virosztek.
J. Phys. C (GB), vol.16, no.23, p.4513-25 (20 Aug. 1983).
The influence of long-range interactions between particles on the commensurate-incommensurate phase transition is investigated. The local theory (Landau theory, elasticity theory) is shown to be invalid at large distances. The effectiveness of different long-range interactions is examined. The electrostatic forces appear to be ineffective in three dimensions. A new resonance phenomenon is predicted for the longitudinal incommensurate structure. (18 refs.)

101899 The decay of correlation of the two-particle distribution function in a phase-separating layer and the possibility of spatial phase coexistence. M.Requardt (Inst. fur Theoretische Phys., Univ. Gottingen, Gottingen, Germany).
J. Stat. Phys. (USA), vol.31, no.3, p.679-89 (June 1983).
The author studies the decay of correlation of the two-particle distribution function in a plane phase separating layer (e.g. a liquid in coexistence with its vapor). It is argued that the decay may be poorer in this special case than in the more general situation of interfaces of arbitrary shape. The clustering is shown to be weaker than $|x-y|^{-(d-2)}$, d the space dimension, in contrast to the more general situation. In particular, it is shown that this poor clustering is entirely restricted to the interface itself. This stronger result allows one to prove as a by-product the nonexistence of a plane interface in two dimensions. Furthermore, the author makes some remarks concerning the physical consequences like, e.g., the degree of particle number fluctuations and the behavior of the compressibility in the interface. The results do hold for two-particle potentials of short range. (23 refs.)

101900 Flow of superfluid ^{3}He through micrometer-size channels. M.T.Manninen, J.P.Pekola (Low Temperature Lab., Helsinki Univ. of Technol., Espoo, Finland).
J. Low Temp. Phys. (USA), vol.52, no.5-6, p.497-525 (Sept. 1983).
Measurements of the critical mass current J_c through 0.8-μm-diameter channels in the superfluid phases of ^{3}He are reported. Experiments were made at pressures from 0 to 27.4 bar in zero external magnetic field. The pressure difference ΔP along the flow channels is immeasurable within the authors' resolution of ± 0.1 μbar for sufficiently low currents in both the A and B phases, implying small or zero dissipation. In the B phase ΔP grows rapidly with increasing current above J_c. At low pressures J_c behaves like $(1-T/T_{cyl})^{3/2}$, where T_{cyl} is interpreted as the reduced superfluid transition temperature inside the flow channels; $T_{cyl}/T_c=0.935$ at $P=0$. If the liquid in the channels is in the A phase, the behavior of ΔP vs. the mass current J_s depends on the phase A or B outside the channels. During warming a drop of about 30% in J_c is found at T_{BA}(cyl) and T_{BA}(cyl) is the reduced $B \rightarrow A$ transition temperature in the channels. Above T_{BA} a second dissipation mechanism, with a smaller $d(\Delta P)/dJ_s$, is observed at lower currents. These features indicate that in the A phase the ends of the channels have an important effect on the flow. (38 refs.)

101901 Phase equilibrium in nearly monodisperse fluids. J.M.Kincaid, G.Morrison, E.Lindeberg (Thermophys. Div., NBS, Washington, DC, USA).
Phys. Lett. A (Netherlands), vol.96A, no.9, p.471-4 (1 Aug. 1983).
The two-phase equilibrium and critical point conditions of a polydisperse fluid (a mixture with a continuous distribution of components) are solved by making power-series expansions about the properties of a single representative species. (8 refs.)

101902 Octahedrally coordinated cation superlattices in spinels. V.I.Mal'tsev, M.F.Zhorovkov (V.D. Kuznetsov Physicotech. Inst., Tomsk State Univ., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.11, p.1025-9 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.57-62 (Nov. 1982).
Static concentration waves have been used to determine all physically nonequivalent superlattices for octahedrally coordinated cations in spinels related to Lifshits (000) and {(100), (010), (001)} stars. These superlattice exhaust the types of cation ordering in the octahedral sublattice for spinels at present known. The nature of the order-disorder transition has been determined for these superlattices, and equilibrium equations have been derived that define the temperature dependence of the degree of long-range order. (9 refs.)

101903 Corresponding states correlations of the spinodal and homogeneous nucleation limits. J.H.Lienhard (Mech. Engng. Dept., Univ. of Houston, Houston, TX, USA).
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.379-81 (May 1982).
The scarcity of high-pressure specific volume and surface tension data that appear in predictions of homogeneous nucleation (or of the spinodal limit) in liquids, often makes their evaluation difficult or impossible. The author shows how these predicted limits can easily be developed from corresponding state correlations. (15 refs.)

101904 Phase diagram features associated with multicritical points in alloy systems. S.M.Allen (Dept. of Materials Sci. & Engng., MIT, Cambridge, MA, USA), J.W.Cahn.
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.195-210
Many features in the vicinity of critical points in phase diagrams can be illustrated using a Landau type free energy expansion as a power series in one or more order parameters and composition. This simple approach can be used with any solution model. It also predicts limits to metastability, and is useful for understanding mechanisms of phase change. The theory is applied to all the critical points that can occur in binary systems according to a Landau theory: critical consolute points, order-disorder transitions, tricritical points, critical end points, as well as to systems in which two transitions such as chemical and magnetic ordering occur. (22 refs.)

Sol-gel transition .... See Entry 99058

Critical behaviour of monatomic and symmetric charged liquids in approximate theories of structure .... See Entry 101517

Reduced van der Waals equation of state and critical properties of rubbers .... See Entry 101894

Theory of surface effects in binary alloys .... See Entry 101914

Small aggregates .... See Entry 101978

Multicritical behavior of polymers near an adsorbing wall .... See Entry 102156

Estimation of T_0-curves from existing phase diagrams .... See Entry 103110

The mutual influence of magnetic and chemical ordering .... See Entry 103117

64.70 PHASE EQUILIBRIA, PHASE TRANSITIONS, AND CRITICAL POINTS

(see also 81.30 Phase diagrams and microstructures developed by solidification and solid-solid phase transformations)

101905 Phase diagram of oxygen up to 13 GPa and 500K. T.Yagi, K.R.Hirsch, W.B.Holzapfel (Univ.-GH Paderborn, Paderborn, Germany).
J. Phys. Chem. (USA), vol.87, no.13, p.2272-3 (23 June 1983).
The phase diagram of oxygen has been determined to pressures of 13 GPa and at temperatures between 300 and 500K. The melting temperatures are higher than previously reported and the α' phase is found to extend to higher temperatures than expected from previous work. These differences are attributed to laser heating in the previous work. (9 refs.)

101906 The $TlCl/PbCl_2$ system. H.-L.Keller (Inst. fur Anorganische Chem., Christian-Albrechts-Univ. Kiel, Kiel, Germany).
J. Solid State Chem. (USA), vol.48. no.3, p.346-50 (15 July 1983). In German.
A reinvestigation of the *x-T* diagram was performed using DTA and X-ray techniques. Four compounds exist in the system of $TlCl/PbCl_2$. The transformations of Tl_3PbCl_5 and $TlPb_2Cl_5$ are discussed. The compound Tl_2PbCl_4 exists only within a temperature interval of about 20°C. A compound of the formula $Tl_7Pb_3Cl_{13}$ is reported for the first time. Crystallographic data of $TlPb_2Cl_5$, high and low Tl_3PbCl_5 and $Tl_7Pb_3Cl_{13}$ are presented. (20 refs.)

101907 Defect structures in the brannerite-type vanadates. V. Phase diagram of the pseudo-ternary MnV_2O_6-$LiVMoO_6$-MoO_3 system comprising the $Mn_{1-x-y}Li_yO_xV_{2-2x-y}Mo_{2x+y}O_6$ solid solution. J.Ziolkowski, K.Krupa, K.Mocala (Inst. of Catalysis & Surface Chem., Polish Acad. of Sci., Krakow, Poland).
J. Solid State Chem. (USA), vol.48, no.3, p.376-87 (15 July 1983).
For pt.IV see ibid., vol.39, p.271 (1982). The phase diagram of the pseudo-ternary MnV_2O_6-$LiVMoO_6$-MoO_3 system has been determined with DTA and X-ray phase analysis. Its outstanding feature is the very large range of stability of the quaternary solid solution α-MLØ described by the formula $Mn_{1-x-y}Li_y\O_xV_{2-2x-y}Mo_{2x+y}O_6$ (Ø=cation vacancy), and crystallizing in the monoclinic brannerite-type structure. In this solution y may vary between 0 and 1, which corresponds to the entire miscibility of MnV_2O_6 and $LiVMoO_6$; x may change between 0 and x_{max} depending on y (if, e.g., y equals 0.00, 0.40, 0.84, or 1.00, x_{max} is 0.45, 0.28, 0.16, or 0.00, respectively). Depending on composition, α-MLØ is stable up to 540-710°C. Other features of the diagram, including the liquidus, are described in detail. The dependence of unit cell dimensions on composition of α-MLØ has been determined On passing from MnV_2O_6 to $LiVMoO_6$, the lattice parameter b and unit cell volume increase, c and $c \sin \beta$ decrease, and a changes insignificantly. These changes are interpreted by taking into account the ionic radii of the components and the specific details of the brannerite-type structure. MLØ solid solutions were prepared using the amorphous citrate precursor method. (19 refs.)

101908 The system copper-tellurium. R.Blachnik, M.Lasocka, U.Walbrecht (Anorganische Chem., Univ. GH-Siegen, Siegen, Germany).
J. Solid State Chem. (USA), vol.48, no.3, p.431-8 (15 July 1983).
The system copper-tellurium was investigated by DTA, DSC, and X-ray methods. A phase diagram with the phases $Cu_{2-x}Te$ (33.5-36.2 mole% Te), $Cu_{3-x}Te_2$ (40-41 mole%), and CuTe was constructed. In the homogeneity ranges of the nonstoichiometric phases several superstructures were observed. The lattice parameters and d values of some of these phases are given. (22 refs.)

101909 Contribution to the study of Pb-Bi-Te. Study of the $PbTe$-Bi_2Te_3 system. R.Chami, G.Brun, J.-C.Tedenac, M.Maurin (Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
Rev. Chim. Miner. (France), vol.20, no.3, p.305-13 (1983). In French.
The system $PbTe$-Bi_2Te_3 was studied by DTA, microstructure and X-ray examination. The analysis of the diagram shows in the range $(PbTe)_{1-x}(Bi_2Te_3)_x$ $(0<x<0.12)$ the existence of a solid solution of PbTe structural type. $PbBi_2Te_4$ (PbTe, Bi_2Te_3) melts incongruently at 583°C and $PbBi_4Te_7$(PbTe, $2Bi_2Te_3$) decomposes before melting in to $PbBi_2Te_4+Bi_2Te_3$ at about 570°C, very near the eutectic reaction temperature. (7 refs.)

101910 SnS_2-Tl_2S section of the thallium-tin-sulphur system. A.-L.Ajavon, R.Eholie (Univ. de Cote-d'Ivoire, Abidjan, Ivory Coast), Y.Piffard, M.Tournoux.
Rev. Chim. Miner. (France), vol.20, no.3, p.421-25 (1983). In French.
The SnS_2-Tl_2S section of the Tl-SnS system has been studied by DTA and X-ray diffraction. Three new phases have been obtained: $Tl_4Sn_5S_{12}$, Tl_2SnS_3 and Tl_4SnS_4. The peritectic decomposition of $Tl_4Sn_5S_{12}$ is observed at 457±5°C. The congruent melting points of Tl_2SnS_3 and Tl_4SnS_4 are respectively 420±5°C and 450±5°C. The symmetry and cell dimensions of the three phases have been determined from single crystal photographs. (2 refs.)

101911 Heats of interaction of polyvinyl chloride with plasticizers, kinetics of swelling and phase equilibrium. A.A.Tager, Yu.S.Bessonov, T.V.Ikanina, T.A.Rodionova, A.I.Suvorova, S.A.El'boim.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.7, p.1444-50 (July 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The complete phase diagrams of PVC-dibutyl phthalate and PVC-tricresylphosphate systems have been obtained, their glass transition temperatures have been found and the heats of swelling of PVC in cyclohexane and six commercial plasticizers have been determined. At room temperature the interaction of PVC with plasticizers is accompanied by essential exothermic effects, decreasing in the 20-40° temperature range. This fact is in agreement with literature data on the temperature dependence of the elasticity modulus of these systems and confirms the concept of the relation of 'antiplasticization' with strong energetic interactions. (15 refs.)

101912 Ab-initio calculations of phase diagrams of binary simple-metal alloys. J.Hafner (Inst. fur Theoretische Phys., Tech. Univ. Wien, Wien, Austria).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.1-15
The combined application of electronic and thermodynamic perturbation theories allows for an ab-initio calculation of the phase diagrams of binary simple-metal alloys. (58 refs.)

101913 Cohesion, compound formation and phase diagrams from first principles. A.R.Williams, C.D.Gelatt,Jr., J.W.D.Connolly, V.L.Moruzzi (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.17-28
The physical picture of cohesion and compound formation provided by parameter-free self-consistent energy-band calculations is described. For transition-metal elements, the calculations allow one to 'see' which electrons are holding the solid together and which are holding it apart. For compounds, calculated heats of formation agree well with available measurements and are in general agreement with those given by Miedema's empirical formula. (The agreement with Miedema is paradoxical, in that Miedema's conception of the formation process differs qualitatively from that of the authors.) Preliminary, but very encouraging, results of efforts to extend the analysis to disordered materials and to the calculation of phase diagrams are described. (18 refs.)

101914 Theory of surface effects in binary alloys. J.L.Moran-Lopez (Dept. de Fisica, IPN, Mexico City, Mexico), L.M.Falicov.
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.29-42
The chemical, ordering and magnetic properties of binary alloys at the surface are examined in terms of a model of pairwise interacting atoms. Both the case of segregating alloys and the case of alloys which form intermetallic compounds are examined. Some surprising results about surface concentration and surface ordering are found. Applications to a number of systems, including ferromagnets, are presented. (44 refs.)

101915 Quantitative predictions from solid-state physics—what do phase diagram calculators want?. M.Rand (AERE, Harwell, Didcot, England).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.81-92
The types of information required for the calculation of phase diagrams are discussed by considering the computation of typical ternary sections from the constituent binary systems. Such calculations require knowledge of the Gibbs energy of transformation (lattice stabilities) and Gibbs energies of mixing of wholly metastable, as well as the stable phases in the binary systems. Similarly, the stabilities of metastable compounds such as Fe_7C_3 would be required for computations in the C-Cr-Fe system. These requirements are compared to the information provided by solid-state theoreticians. Essentially such calculations provide enthalpy values at 0K (or some unspecified temperature for semi-empirical models); however the lattice dynamics and configurational entropy of simple phases have been included in some recent computations. The importance of predicting the entropy and thus heat capacity of metallic phases—particularly metastable phases—is therefore emphasized. Identification of those contributions to the heat capacity which are responsible for the differences between metal polymorphs is discussed, particularly the formalism for magnetic and atomic ordering phenomena. (29 refs.)

101916 Structural maps and parameters important to alloy phase stability. R.E.Watson (Brookhaven Nat. Lab., Upton, NY, USA), L.H.Bennett.
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.99-104
Alloy properties are often summarized on two-dimensional maps. For instance, Darken and Curry related the terminal solubilities of alloy systems to two coordinates (the differences in electronegativities and in atomic radii of the alloy constituents). Maps are considered here which correlate the structures in which the compounds form as well as providing some indication of whether a compound forms at some given composition in the first place. This class of map involves one coordinate which is the difference in an atomic parameter (here it will be taken to be the electronegativity) while the other is an average (in this case the d-band hole count). This contrasts with Darken-Gurry maps and Giessen's maps related to glass-forming ability where both coordinates are differences. The situation for 50/50 transition metal alloys is reviewed and results are presented for system off 50/50 composition. (12 refs.)

Cohesive Properties of Semiconductors under Laser Irradiation. Proceedings of the NATO Advanced Study Institute .... See Entry 98653

Phase diagrams [of titanium alloys] .... See Entry 98665

On the structure and properties of beryllium fluoride glasses containing CoF_2 .... See Entry 101561

Calorimetric study of crystalline in $(GeSe_2)_x(GeTe_4)_{1-x}$ glasses .... See Entry 101571

Hydrogen solubility in $Pd_{100-x}Si_x$ metallic glasses and the phase diagram of Pd-Si-H glasses .... See Entry 101588

Evidence of strain-induced phase separation in isopropyl azodicarboxylate modified polybutadiene .... See Entry 101598

Electronic energy and short-range order in binary alloys .... See Entry 101624

Lattice energy functions for predictions of structural properties of alloy phases .... See Entry 101625

Concentrated aqueous sodium chloride solutions from 200 to 600°C and to 3000 bar. Phase equilibria and *PVT*-data .... See Entry 102002

The representation of thermodynamic properties in multicomponent alloys .... See Entry 102012

Mathematical representation of size and electronic factors .... See Entry 102014

A pair-wise interaction model for multi-sublattice phases .... See Entry 102015

Association model for liquid alloys .... See Entry 102016

Prediction of solid+liquid equilibrium diagrams for binary mixtures forming solid solutions with an extremum .... See Entry 102017

Phase relationships for adsorbed layers on surfaces .... See Entry 102143

Molecular dynamics simulations of phase transitions in physisorbed nobel gases .... See Entry 102157

Pressure-temperature phase diagrams of several $(TMTTF)_2X$ compounds: stabilisation of a highly conducting metallic state under pressure in $(TMTTF)_2Br$ .... See Entry 102362

Effects of coherency constraints on phase equilibria .... See Entry 103108

δ-γ phase equilibria in iron-rich iron-chromium-nickel alloys at temperatures between 1200 and 1350°C .... See Entry 103109

Computer calculation of ternary phase diagrams .... See Entry 103113

Simple solution approaches in phase diagram evaluation .... See Entry 103115

Coherent phase diagrams in the cluster variation approximation .... See Entry 103116

The mutual influence of magnetic and chemical ordering .... See Entry 103117

Magnetic ordering and phase separation in binary alloys with one magnetic component .... See Entry 103118

A thermodynamic approach to the calculation of the C-Cr-Nb-Ni-W phase diagram .... See Entry 103119

Calculation of quasibinary and quasiternary oxynitride systems .... See Entry 103125

Study of the $PbTe$-Tl_2Te system. Evidence of a phase derived from Tl_5Te_3 .... See Entry 103126

$V_{3.2}W_{1.8}O_{13}$ and studies of the V_2O_5-WO_3-VO_2 ternary system .... See Entry 103127

Phase equilibria in the Mn-Fe-O system in CO_2-H_2 mixtures .... See Entry 103128

Temperature-induced phase transition and structural changes in micellar solutions of sodium oleate observed by Raman scattering .... See Entry 103597

64.70D Solid-liquid transitions

(see also 81.30F Solidification)

101917 Pulsed neodymium: yttrium aluminum garnet laser (532 nm) melting of crystalline silicon: experiment and theory. D.H.Lowndes, R.F.Wood, R.D.Westbrook (Solid State Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Appl. Phys. Lett. (USA), vol.43, no.3, p.258-60 (1 Aug. 1983).
Time-resolved reflectivity measurements have been used to determine both the time of onset-of-melting and the duration of melting resulting from frequency-doubled neodymium: yttrium aluminum garnet (532 nm) pulsed-laser irradiation of crystalline silicon. Substantially shorter surface melt durations were obtained with increasing energy density E_1 than were reported earlier by others. Thermal melting model calculations, which take into account the temperature dependent optical and thermal properties of silicon, are in substantial agreement with the observed E_1 dependence of the onset of melting and surface melt duration. Inclusion of intensity dependent absorption in the modeling further improves this agreement. (17 refs.)

101918 Melting of two-dimensional solids. R.H.Morf (RCA Ltd., Zurich, Switzerland).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.743-54 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Experiments and computer simulation studies on two-dimensional melting are reviewed. Results are compared with predictions based on the theory of dislocation-mediated melting. (38 refs.)

101919 Freezing transition phenomena far from equilibrium. J.H.Bilgram (Lab. fur Festkorperphys., Eidgenossische Tech. Hochschule, Zurich, Switzerland).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.863-73 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The freezing transition of H_2O and salol has been studied in experiments where the solid-liquid interface is continuously driven into the melt. The dynamics of entropy fluctuations in a layer between the crystal and the melt are for H_2O about 5 orders of magnitude slower than in the bulk melt (for salol 6 orders of magnitude). Solidification rates are calculated, based on the Wilson-Frenkel model. They are determined by the same processes as the dynamics of entropy fluctuations in the interface layer. Decay rates of these fluctuations have been calculated using experimentally determined solidification rates. The calculated values agree with those determined in light-scattering experiments within the accuracy of the experiments. (12 refs.)

101920 Densities and partial molar volumes of supercooled aqueous solutions. C.M.Sorensen (Dept. of Phys., Kansas State Univ., Manhattan, KS, USA).
J. Chem. Phys. (USA), vol.79, no.3, p.1455-61 (1 Aug. 1983).
Density measurements of aqueous solutions of ethanol, *t*-butanol, and hydrazine in the temperature range from 50° down to nucleation are presented. From these data, solute partial molar volumes and temperatures of maximum density are determined. The partial molar volumes of the alcohol solutions at low concentration become small below -30°C, and the characteristic minimum in the partial molar volume vs concentration curve vanishes. The hydrazine solutions display similar behavior except no minimum is observed. It is also found that the temperature of maximum density washes out at finite concentrations and solutions with higher concentration do not seem to nucleate but may be forming glasses. These results are discussed in terms of a liquid clathrate structural model of water which becomes multiply connected to fill all space as the water is supercooled. (25 refs.)

101921 Pulsed RF emission during crystallization of water and certain dielectrics. L.G.Kachurin, S.Kolev, V.F.Psalomshchikov (Hydrometeorological Inst., Leningrad, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.937-9 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.347-50 (Nov. 1982).
The authors present a study of the electromagnetic radiation which accompanies thermodynamically irreversible crystallisation of water and other dielectrics. The apparatus used is an improved version of that used for measuring interphase crystallisation potentials. The electric and magnetic components of the RF field in the band from 20 Hz to 10 MHz. (8 refs.)

101922 Inward melting in a vertical tube which allows free expansion of the phase-change medium. E.M.Sparrow, J.A.Broadbent (Dept. of Mech. Engng., Univ. of Minnesota, Minneapolis, MN, USA).
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.309-15 (May 1982).
Experiments on the melting of a phase-change medium in a vertical tube yielded quantitative results both for the heat transfer and the timewise evolution of the melting front. The upper surface of the phase-change medium was bounded by an insulated air space, which accommodated the volume changes which accompany the melting process. Numerical solutions based on a pure conduction model were also performed for comparison purposes. It was found that the rate of melting and the heat transfer are significantly affected by fluid motions in the liquid melt induced by the volume change and by natural convection, with the former being significant only at early times. For melting initiated with the solid at the phase-change temperature, the experimentally determined values of the energy transfer associated with the melting process were about 50 percent higher than those predicted by the conduction model. Furthermore, the measured values of the energy stored in the liquid melt were about twice the conduction prediction. A compact dimensionless correlation of the experimental results was achieved using the Fourier, Stefan, and Grashof numbers. Initial subcooling of the solid substantially decreased the rate of melting, with corresponding decreases in the energy transfers for melting and sensible heat storage. (6 refs.)

101923 Transient freezing of a liquid in a convectively cooled tube. M.S.Sadeghipour, M.N.Ozisik, J.C.Mulligan (Dept. of Mech. & Aerospace Engng., North Carolina State Univ., Raleigh, NC, USA).
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.316-22 (May 1982).
The transient freezing of a liquid in laminar flow inside a circular tube subjected to convection heat transfer on the external surface is investigated analytically. The effects of Biot number, fluid inlet temperature, and the external ambient temperature on the length of this freeze-free zone are illustrated. The variation of the thickness of the freeze layer as a function of time and position along the tube is determined. (13 refs.)

101924 Pressure effect on nucleation during crystallization from the melt of oligoesters of various molecular mass. V.P.Privalko, A.N.Sharov.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.7, p.1419-25 (July 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The kinetics of volume crystallization from the melt of two samples of oligoethylene glycol adipate with various MM has been studied in the 15.8-112.4 MPa pressure range in the isobaric-isothermal regime. The increase of pressure is shown to retard the rate of crystallization due to the enhancing of the energetic barrier to nucleation. The mechanism of crystallization of oligoesters is discussed. (20 refs.)

101925 On the crystalline, liquid, glassy, gaseous, and superfluid states of simple substances. R.M.J.Cotterill (Dept. of Structural Properties of Materials, Tech. Univ. of Denmark, Lyngby, Denmark).
Physics of Superionic Conductors and Electrode Materials. Proceedings of a NATO Advanced Study Institute on the Physics of Superionics Conductors and Electrode Materials, Odense, Denmark, 4-22 Aug. 1980 (New York, USA: Plenum Press 1983), p.79-92
The objective of this brief review is to provide a commentary on some current developments in the quest to explain the different states of simple matter within the framework of a single approach. The article first touches briefly on some recent evidence against dislocation-mediated melting, in three dimensions, and then discusses the free volume and bifurcation approaches to the glass-liquid and crystal-liquid transitions. Contact is then made with the interesting limiting case of the hard sphere model, and the penultimate section includes a few qualitative remarks on the bifurcation theory of superfluidity. (31 refs.)

Alloy Phase Diagrams. Proceedings of a Symposium .... See Entry 98652

The existence and stability of regions with superheating in the classical two-phase one-dimensional Stefan problem with heat sources .... See Entry 101012

On the prediction of pipe freeze-shut in turbulent flow .... See Entry 101191

Amorphous Si, crystallization and melting .... See Entry 101560

Phase changes in copper halide photochromic glasses .... See Entry 101584

The morphology of poly(aryl-ether-ether-ketone) .... See Entry 101594

Influence of molar mass and catalysts on the kinetics of crystallization and on the orientation of poly(ethylene terephthalate) .... See Entry 101596

Solvent induced crystallization of syndiotactic poly(methyl methacrylate). Relation to the formation of polymer aggregates in solution. [NMR and IR spectra] .... See Entry 101597

Physical properties of high-pressure ethylene vinylacetate copolymers and their saponified derivatives .... See Entry 101600

Survey of the thermodynamics and kinetics of crystallization of Si and Ge .... See Entry 101611

Dopant incorporation during rapid solidification .... See Entry 101735

Ising model simulations of impurity trapping in silicon .... See Entry 101740

Impurity redistribution in ion implanted Si after picosecond Nd laser pulse irradiation .... See Entry 101741

Deposition of laser energy into inhomogeneous layer systems .... See Entry 101762

Picosecond time-resolved detection of plasma formation and phase transitions in silicon .... See Entry 101765

Femtosecond time resolved reflectivity of optically excited silicon .... See Entry 101766

Raman scattering with nanosecond resolution during pulsed laser heating of silicon .... See Entry 101767

Instability of the electron-hole plasma and its possible relation with melting .... See Entry 101770

Time-resolved study of silicon during pulsed-laser annealing .... See Entry 101771

Measurement of fast melting and regrowth velocities in picosecond laser heated silicon .... See Entry 101772

Time resolved measurements of interface dynamics during pulsed laser melting observed by transient conductance .... See Entry 101773

Ultra-high speed solidification and crystal growth in transiently molten semiconductor layers .... See Entry 101774

Nonlinear laser melting of indium antimonide and silicon .... See Entry 101776

Temperature characterization of pulsed laser annealing of semiconductors .... See Entry 101778

Transient conductivity measurements in pulsed ion beam melted silicon .... See Entry 101823

Response of liquid carbon disulfide to shock compression: equation of state at normal and high densities .... See Entry 101857

Ultrasonic absorption measurements near the critical point of a reactive binary mixture .... See Entry 101863

The equation of state of molecular hydrogen at very high density .... See Entry 101893

SnS_2-Tl_2S section of the thallium-tin-sulphur system .... See Entry 101910

Phase relations and properties of lithium via molecular dynamics .... See Entry 101959

Small aggregates .... See Entry 101978

Connection between the excess thermodynamic functions of glassy As_2S_3 and As_2Se_3 at absolute zero and their structural features .... See Entry 102011

On the law of the change of the quantum crystal heat capacity C_v near the melting point .... See Entry 102109

Melting and wetting behavior in oxygen films .... See Entry 102167

Phase transitions in adsorbed layers. IV. Thermodynamics of monolayer adsorption .... See Entry 102180

Search for two-dimensional melting in a lattice of superconducting vortices .... See Entry 102570

Time-resolved reflectivity measurements in silicon [with reply] .... See Entry 102839

An analysis of the ribbon formation process by the single roller rapid solidification technique .... See Entry 103085

Estimation of T_0-curves from existing phase diagrams .... See Entry 103110

Phase equilibria and thermodynamic data for the Cu-S system .... See Entry 103111

Precipitation in a Cu-20%Ni-8%Sn alloy and the phase diagram of the Cu-Ni rich Cu-Ni-Sn system .... See Entry 103112

Thermodynamic factors in the extension of solid solubility in Al-based alloys .... See Entry 103121

Crystal chemistry of metastable alloy phases .... See Entry 103122

Influence of melt flow on the growth directions of columnar grains and columnar dendrites .... See Entry 103129

Examination of M_7C_3 carbides in high chromium cast irons using thin foil transmission electron microscopy .... See Entry 103130

A schematic mechanism for striated growth of solid binary mixtures .... See Entry 103131

Computer simulation on the structure solidified by rapid cooling for Al-Pb alloys .... See Entry 103132

An analysis of the solidification of a binary eutectic system in consideration of both heat and solute diffusion .... See Entry 103133

Microstructural origin of the skeletal ferrite morphology of austenitic stainless steel welds .... See Entry 103134

Microstructure and mechanical properties of rapidly quenched $L1_2$ alloys in Ni-Al-X systems .... See Entry 103135

Influence of solidification parameters on mechanical properties and thermal stability of Fe-Ni-B metallic glasses .... See Entry 103136

Use of metastable phase diagrams in rapid solidification .... See Entry 103137

Metastable phases in rapidly solidified aluminum-rich Al-Fe alloys .... See Entry 103138

Phase stability in rapidly solidified iron and nickel-base alloys .... See Entry 103139

X-ray diffraction analysis at high temperature on two ceramic systems .... See Entry 103141

Interdendritic fluid flow normal to primary dendrite-arms in cubic alloys .... See Entry 103151

Computer simulation on the reduction of gravity segregation for Al-Pb alloys by the rapid solidification method .... See Entry 103159

Deformation behavior of a 16-8-2 GTA weld as influenced by its solidification substructure .... See Entry 103228

Role of iron sulfide in the formation of solidification cracks in welding of electrical steel .... See Entry 103395

64.70F Liquid-vapour transitions

101926 On the limit of superheat of cryogenic liquids. K.Nishigaki, Y.Saji (Kobe Univ. of Mercantile Marine, Kobe, Japan).
Cryogenics (GB), vol.23, no.9, p.473-6 (Sept. 1983).
In an effort to test the empirical law governing the scaled superheat-limit, the authors measured superheated neon and hydrogen with special emphasis on the critical superheat. Experimental results were compared with a Doring-Zeldovich-like nucleation theory and satisfactory agreement was found. Some deviation from the corresponding states of the scaled superheat-limit for classical fluids was apparent, thought to be caused by quantum effects on surface tension, and are appreciable for neon and hydrogen. (8 refs.)

101927 Vapour-phase studies of NaF-AlF_3 melts. I. The AlF_3-rich part. H.Kvande (Dept. of Chem., Univ. of Trondheim, Trondheim, Norway).
High Temp.-High Pressures (GB), vol.15, no.1, p.51-62 (1983).
Two experimental methods, the boiling point method and the transpiration method, have been used to determine total and partial vapour pressures and vapour compositions in the AlF_3-rich part of the system NaF-AlF_3. The measurements confirm the literature data by showing that the total pressure continues to increase with increasing AlF_3 content in the melt. The partial pressure of $NaAlF_4(g)$, which is the major vapour species in the system, has a maximum at the composition $NaAlF_4$. Thus, the results indicate the presence of the species $NaAl_2F_7(g)$ in the vapour phase at high AlF_3 contents. For the $NaAlF_4$ composition the data show that the vapour is richer in AlF_3 than is the melt, which then does not vaporize congruently. This is contrary to the literature data which suggest that the total vapour pressure is invariant at the $NaAlF_4$ composition. (23 refs.)

101928 Vapour-phase studies of NaF-AlF_3 melts. II. The NaF-rich part (cryolite). H.Kvande (Dept. of Chem., Univ. of Trondheim, Trondheim, Norway).
High Temp.-High Pressures (GB), vol.15, no.1, p.63-71 (1983).
For pt.I see ibid., vol.15, p.51-62 (1983). The total and partial vapour pressures and vapour compositions above molten cryolite (Na_3AlF_6) have been determined by use of the boiling point method and the transpiration method. The total pressures agree well with the literature data. The vapour is found to consist of ~90 mol.% $NaAlF_4(g)$; small amounts of $Na_2AlF_5(g)$ and NaF(g) are also present. Thus, the vapour contains more of the volatile component AlF_3 than does the melt. Revised versions of presure-composition diagram for the system NaF-AlF_3 are presented and discussed. (16 refs.)

101929 The evaporation coefficient of trans-diphenylethene at variable undersaturation: a new technique making use of special effusion cells. P.J.van Ekeren, M.H.G.Jacobs, J.C.A.Offringa, A.Schuijff, C.G.de Kruif (General Chem. Dept., State Univ. of Utrecht, Utrecht, Netherlands).
J. Chem. Phys. (USA), vol.79, no.4, p.2018-22 (15 Aug. 1983).
In the temperature range 325-40K the net evaporation coefficient $\alpha\gamma$ of trans-diphenylethene is measured. The authors describe a new technique that makes use of special effusion cells for variable undersaturation; the coefficient appears to be pressure independent, and is found to be $\alpha\gamma=1.03\pm0.03$. (14 refs.)

101930 Experimental results of homogeneous nucleation of supersaturated vapors. J.P.Garnier, P.Mirabel, H.Rabeony (Dept. de Chimie, Univ. Louis Pasteur, Strasbourg, France).
J. Chem. Phys. (USA), vol.79, no.4, p.2097 (15 Aug. 1983).
The authors have recently studied, in a diffusion cloud chamber, the homogeneous nucleation of several alcohol vapors, i.e. methanol, ethanol, n-propanol, and n-butanol over a large temperature range. In addition to the alcohols, they have also plotted recent results on acetone as well as older data obtained on 1,1,2,2-tetrachloroethane. These experimental results are compared with McGraw's theoretical predictions (ibid., vol.75, p.5514, 1981) for a simple fluid. The results confirm that alcohols, which are associated in the liquid phase, show critical supersaturation ratios less than those expected for a simple fluid. They confirm also that, when the degree of association of the alcohols decreases, i.e. when molecular weights increase, a tendency towards simple fluid behavior is observed. On the other hand, acetone shows good agreement with theory in reduced form while the results for 1,1,2,2-tetrachloroethane lie slightly above the theoretical curves, as it was already observed for other halogenated hydrocarbons studied in a diffusion cloud chamber. (4 refs.)

101931 Characteristics of the gas-liquid transition in a system of particles with finite lifetime. S.G.Tikhodeev (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.5, p.255-8 (5 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.5, p.216-18 (5 March 1983).
The temperature range $0<T<T_1$, in which the gas-liquid transition in a system of particles with finite lifetime occurs without the hysteresis characteristic of first-order phase transitions, is estimated. (10 refs.)

101932 Vapour-liquid equilibrium of (methanol+a heptanone) at 298.15K. R.G.Rubio, J.A.R.Renuncio, M.Diaz Pena (Dept. de Quimica Fisica, Univ. Complutense, Madrid, Spain).
J. Chem. Thermodyn. (GB), vol.15, no.8, p.779-83 (Aug. 1983).
Vapour pressures for methanol+2-heptanone, +3-heptanone and +4-heptanone at 298.15K are reported. Liquid-phase values of G_m^E have been determined from vapour pressures. Analysis using the maximum-likelihood principle leads to the variances of the calculated parameters, and the selection, between two or more fits, of the one providing a better representation of the results. (16 refs.)

101933 Vapour-liquid equilibria by theory of solution of groups model. D.Hoshino, K.Nagahama, M.Hirata (Dept. of Industrial Chem., Tokyo Metropolitan Univ., Tokyo, Japan).
Mem. Fac. Technol. Tokyo Metrop. Univ. (Japan), no.32, p.3221-32 (1982).
The solution of group model is one of the useful and important methods for the prediction of liquid phase activity coefficients in terms of the parameters associated with the pairs of structural groups of solution. There are no group parameters found in the literature which predict vapour-liquid equilibria of water-2-ethoxyethanol system with reasonable accuracy. To obtain suitable group parameters, isothermal vapour-liquid equilibria of the above system at 54.9°C, 69.9°C and 84.9°C were measured. Isobaric vapour-liquid equilibria at 760 mmHg were predicted by utilising that group parameters and the results showed good agreement with those of the experimental data. (21 refs.)

101934 Liquid-gas coexistence equation. W.H.Tanttila (Phys. Dept., Univ. of Colorado, Boulder, CO, USA).
Phase Transitions (GB), vol.3, no.4, p.309-16 (1983).
General expressions for the densities of a liquid and a gas in equilibrium are expanded in terms of the reduced densities and temperatures. The resulting expansions are subjected to nondifferentiability and symmetry requirements, and the gas density expansion is fitted to the Clapeyron-Clausius equation at low gas densities to achieve zero-parameter coexistence equations for the liquid and the gas. (11 refs.)

101935 Vertical fin efficiency with film condensation. L.C.Burmeister (Mech. Engng. Dept., Univ. of Kansas, Lawrence, KS, USA).
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.391-3 (May 1982).
Film condensation of a saturated vapor on a vertical rectangular fin whose lower end is maintained at a fixed temperature was recently analyzed by Nader (1978). Numerical methods were used to accurately determine the fin temperature distribution and efficiency, accounting for variable condensate thickness along the fin length, in terms of two dimensionless parameters F_1 and F_2. Although it was remarked that correlation required only a single dimensionless parameter F_1/F_2^4, the basis for this was not set forth. In an earlier study of broader scope, Lienhard and Dhir (1974) gave this basis and numerically solved the same equations with slightly less accuracy but over a wider range of parameters. The results of these prior studies are presented in tabular and graphical forms. In the following, a more convenient closed-form approximate solution is developed for fin efficiency. (4 refs.)

101936 Solder creams and vapour phase technology. W.Rubin (Multicore Solders Ltd., Hemel Hempstead, England).
Midcon/82 Conference Record, Dallas, TX, USA, 30 Nov.-2 Dec. 1982 (El Segundo, CA, USA: Electron. Conventions 1982), p.16/4/1-4
The vapour phase concept by Western Electric has introduced a new branch of soldering technology in which solder creams will play an important part. The main advantages of soldering in the vapour phase relate to the close control of temperature and heat input to the solder and joints, and under these conditions solder creams operate most effectively. Previously, solder rings, gaskets and washers were applied to back planes and similar assemblies, but solder creams are more versatile in application with their ability to sit closely on the parts to be connected, partially acting as an adhesive before reflow and, most importantly, helping the solder and flux combination to enable soldering to take place very quickly. (8 refs.)

Characteristics of nucleate pool boiling from porous metallic coatings .... See Entry 101018

Effects of pore diameters and system pressure on saturated pool nucleate boiling heat transfer from porous surfaces .... See Entry 101019

Pool boiling heat transfer from enhanced surfaces to dielectric fluids .... See Entry 101020

Critical heat flux in free convective flow through a uniformly heated vertical tube held in a large pool of saturated liquid .... See Entry 101230

Volumetric heat-transfer coefficients for direct-contact evaporation .... See Entry 101243

Critical heat flux during natural convective boiling in vertical rectangular channels submerged in saturated liquid .... See Entry 101244

Critical behaviour of monatomic and symmetric charged liquids in approximate theories of structure .... See Entry 101517

Small aggregates .... See Entry 101978

The excess enthalpies of (carbon dioxide+toluene) at 308.15, 385.15, and 413.15K from 7.60 to 12.67 MPa .... See Entry 102006

Thermodynamics of liquid (potassium+potassium bromide) at high temperatures .... See Entry 102007

Effects of mass flux, flow quality, thermal and surface properties of materials on rewet of dispersed flow film boiling .... See Entry 102127

The electret effect in water vapour condensates and phase transformation in ice .... See Entry 102801

Influence of an electric field on the evaporation of Fe-Si, Fe-Mn and Fe-Al melts in helium. Experimental investigation .... See Entry 103036

An observation on the Han-Villamizer critical pressure concept in thermoplastic foams .... See Entry 103605

64.70H Solid-vapour transitions

101937 Rate of evaporation of hydrocarbons from a hot surface: Nukiyama and Leidenfrost temperatures. A.A.Mills, J.D.Fry (Dept. of Phys., Univ. of Leicester, Leicester, England).
Eur. J. Phys. (GB), vol.3, no.3, p.152-4 (1982). [received: Aug. 1983]
The Nukiyama and Leidenfrost temperatures of the range of n-alkanes from pentane to hexadecane have been investigated, and their relationships to the standard boiling points determined. The Nukiyama temperatures prove to be only some 40°C above the latter, showing that maximum evaporation rates are produced by contact with surfaces not nearly so hot as might intuitively be expected. A temperature increase of only some 20-30°C beyond this point is sufficient to put the hydrocarbon into the slowly-evaporating Leidenfrost regime. (10 refs.)

Prediction of structures and magnetic orientations in solid α-and β-O_2 .... See Entry 101881

Reconsidering the existence of cubic sublimated P_4S_{10} .... See Entry 102891

64.70J Liquid-liquid transitions

101938 Evidence of a liquid-liquid-transition in *n*-tetracosane. The behavior of the specific volume. H.P.Grossmann, W.Dollhopf (Abteilung fur Angewandte Phys., Univ. Ulm, Ulm, Germany), J.K.Kruger.
Polym. Bull. (Germany), vol.9, no.12, p.593-7 (May 1983).
Dilatometric measurements of n-tetracosane from 330K up to 420K are reported. These experiments show evidence for a small kink in the specific volume-temperature curve. The correct statistical interpretation of the measured data yields a discrete transition temperature above the melting point at about 378K in close agreement with the results from other experimental methods. (22 refs.)

101939 The influence of a third constituent in binary solutions on critical properties studied by the nonlinear dielectric effect. J.Ziolo, Z.Ziejewska (Inst. Fizyki, Uniwersytet Slaski, Katowice, Poland), W.Pyzuk.
Phase Transitions (GB), vol.3, no.4, p.329-38 (1983).
Using the nonlinear dielectric effect studies have been made of the influence of a third constituent in a critical binary solution on the type of phase transition and on the value of the critical exponent defined by the relation $\Delta\epsilon/E^2 \sim 1/(T\text{-}T_c)^{\psi}$. Phase diagrams have been constructed indicating points of continuous phase transitions. (8 refs.)

101940 Mechanism of structural transformations in liquid metals. I.A.Novokhatskii, V.I.Arkharov, V.I.Lad'yanov (Polytech. Inst., Odessa, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.963-5 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.367-70 (Nov. 1982).
Studies polytherms of the kinematic viscosities ν of specially purified liquid aluminum, tin, lead, bismuth, indium, and cadmium at temperatures 400-1100 degrees above their melting points. The viscosity measurements were carried out in the isothermal holding regime by the method of torsional oscillations of the melt-containing crucible. Under equilibrium conditions, the temperature dependence of the viscosity and the activation energy for viscous flow for all the melts studied change discontinuously several times, at definite temperatures, and this indicates that polymorphic structural arrangements are occurring. (13 refs.)

Dimensions of poly(styrene) in the vicinity of the theta point .... See Entry 101530

64.70K Solid-solid transitions

(see also 61.50K Crystallographic aspects of polymorphic and order-disorder transformations, 81.30H, 81.30K, 81.30M Microstructures developed by solid-solid phase transformations)

101941 Algebraic investigations in Landau model of structural phase transitions. II. Orbits, strata and epikernels. V.Kopsky (Inst. of Phys., Czechoslovak Acad. Sci., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.7, p.720-44 (1983).
The author introduces the basic notions of the theory of permutation representations: stabilizers, orbits, stable subsets and strata. He considers the relation between permutation and linear representations which lead to some formulae connecting subduction coefficients, Clebsch-Gordan coefficients, and dimensions of stability spaces. This relation also leads to the concept of suborbits. Epikernels, the subgroups which are stabilizers of vectors of irreducible subspaces (either on the complex or on the real field)—are studied and several theorems about them are proved. Further he considers the relation between epikernels, stability spaces and strata for subspaces irreducible on the real field as compared with subspaces irreducible on the complex field. Finally, the exomorphism is defined with use of permutation representations. The vectors of irreducible subspaces and corresponding epikernels (their stabilizers) for real ireps (representations irreducible on the real) of the classical crystal point groups are given in the appendix. (12 refs.)

101942 Transformation processes in deformed Al-30 wt.% Zn alloy containing metastable precipitates. P.Bartuska, V.Synecek, M.Simerska (Inst. of Phys., Czechoslovak Acad. Sci., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.7, p.831-6 (1983).
The Al-30 wt.% Zn alloy containing metastable α_R' or α' precipitates was cold rolled to investigate the effect of plastic deformation on transformation processes during the subsequent ageing at 200°C. Transmission electron microscopy and X-ray diffraction studies proved that the deformation leads to the rapid decomposition of deformed α_R' and α' precipitates and enhances also the decomposition of α' precipitates formed from α_R' to α' transformation. The deformation does not, however, change the growth rate of α' particles. It leads, therefore, to the decrease of critical sizes of α' particles for the α' to β transformation. The increasing degree of deformation enhances the density of nucleation sites for the β formation on α/α' interfaces and leads to the decrease in sizes of stable β precipitates. The acceleration of transformation processes is associated with the partial relaxation of stresses introduced by the applied deformation. (5 refs.)

101943 New type of soliton solutions from a Landau potential describing the β-γ-δ-transitions in $(C_3H_7NH_3)_2MnCl_4$. P.Muralt, R.Kind (Lab. of Solid State Phys., Swiss Federal Inst. of Technol., Zurich, Switzerland).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.689-94 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The incommensurate γ-phase of the perovskite-type layer structure compound $(C_3H_7NH_3)_2MnCl_4$ is sandwiched between two phases (β,δ) which have the same structure. The Landau potential describing this behaviour reveals besides the plane-wave solution, new types of soliton solution which differ from the solutions of the sine-Gordon equation. (6 refs.)

101944 Critical dynamics of zero-temperature structural phase transitions. Y.T.Millev, D.I.Uzunov (Nadjakov Inst. of Solid State Phys., Bulgarian Acad. of Sci., Sofia, Bulgaria).
J. Phys. C (GB), vol.16, no.21, p.4107-12 (30 July 1983).
The critical dynamics of a class of displacive second-order phase transitions is studied in the limit $T_c \to 0$ (T_c being the critical temperature). Both the renormalisation-group recursion relations method and direct calculation are used for the derivation of the critical exponents up to order ε^2 ($\varepsilon = 3-d$). The static exponents remain, in some sense, universal, whereas the dynamic exponent has no ε corrections. (19 refs.)

101945 The incommensurate-commensurate transition in a random-field model. T.Nattermann (Sektion Phys., Humboldt-Univ. Berlin, Berlin, Germany).
J. Phys. C (GB), vol.16, no.21, p.4113-24 (30 July 1983).
The effect of random-field-induced domain wall wandering on the nature of the uniaxial incommensurate-commensurate (IC) transition is studied in the framework of a *d*-dimensional 'random-rod' model. In this model, the random field $h(\mathbf{r})$ couples linearly to the wall elongations. Both short- and long-range field correlations $\langle h(\mathbf{r})h(0)\rangle \sim |\mathbf{r}|^{-D+1}$ are considered. It is found that the domain wall density l^{-1} vanishes with the driving parameter δ (e.g. temperature, pressure) as $(\delta-\delta_c)^{\beta}$ with $\beta=(5-D)/2(D-3)$ for $3<D<5$. For $D>d$, D has to be replaced by d. If $D(d)$ is linear in d then $\beta\text{-}(d_R-d)/2(d-d_c^-)$ (*) for $d_c^- \leq d < d_R$—where d_R and d_c^- denote the upper critical dimensionality for the roughening transition and the lower critical dimensionality for the occurrence of a conventionally ordered phase, respectively—$D(d_R)=5$, $D(d_c^-)=3$. For $D\geq 5$ or $d\geq d_R$ the classical result $l^{-1}\sim \ln^{-1}(\delta-\delta_c)^{-1}$ applies; for $D\leq 3$ or $d\leq d_c^-$ there is no IC transition. The results for a corresponding bulk random-field model follow from the 'random-rod' model by means of the Villain relation $D(d)=(5+2d)/3$ for all d, i.e. from (*) with $d_R=5$, $d_c^-=2$. It is argued that the formula (*) applies for a variety of IC transitions with d_R and d_c^- specifying different universality classes. (33 refs.)

101946 Interface phenomenology, dipolar interaction, and the dimensionality dependence of the incommensurate-commensurate transition. T.Natterman (Sektion Phys., Humboldt-Univ. Berlin, Berlin, Germany).
J. Phys. C (GB), vol.16, no.21, p.4125-35 (30 July 1983).
Previous results on fluctuation-induced domain wall wandering in continuous systems and its influence on the nature of the uniaxial incommensurate-commensurate transition are unified in a phenomenological interface theory. A relation between the exponents β and ψ describing the vanishing of the domain wall density with the driving parameter δ, and the divergence of the effective wall width for vanishing pinning potential, respectively, is established. If ψ is linear in the dimensionality, d, we get for $d_R\geq d\geq d_c$, $\beta=(d_R-d)/2(d\text{-}d_c)$. The critical dimensionalities d_R and d_c depend on the model under consideration. The changeover from the weak to the strong fluctuation regime is characterised by the different behaviour of the wall correlation length $\xi_{\perp}$. If walls separate domains of opposite polarisation, dipolar interaction increases the stiffness of the walls and decreases d_R and d_c. Their values for thermal, quantum and random field fluctuations are calculated. In the dipolar case, frozen impurities lead to a lower critical dimensionality $d_c=2$ and $\beta={}^1/_2$ for $d=3$, in agreement with experiments. (32 refs.)

101947 Neutron scattering study on the structural transition of quasi-one-dimensional conductor $K_{0.3}MoO_3$. M.Sato, H.Fujishita, S.Hosnino (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
J. Phys. C (GB), vol.16, no.24, p.L877-82 (30 Aug. 1983).
Preliminary results of the neutron diffraction and inelastic scattering studies on the quasi-one-dimensional conductor $K_{0.3}MoO_3$ with a metal-insulator transition are reported. The temperature dependence of the intensity of the superlattice reflection is found to be approximately described by a simple equation. A phonon mode seems to have an almost complete softening at the transition temperature T_c. The existence of the large central peak in the inelastic spectra above T_c suggest that the local correlation between electrons is very strong. The wavevector of the charge density wave smoothly approaches the commensurate one, as the temperature is lowered and lock-in transition does not occur down to $T\simeq 6$K. (12 refs.)

101948 Incommensurate crystal phases in mean-field approximation. T.Janssen (Inst. for Theoretical Phys., Univ. of Nijmegen, Nijmegen, Netherlands), J.A.Tjon.
J. Phys. C (GB), vol.16, no.24, p.4789-810 (30 Aug. 1983).
A model for structural phase transitions in crystals in three dimensions is studied in a mean-field approximation. The forces between the particles are short-range (up to second neighbours) and non-linear. Contrary to formerly studied models the temperature dependence is explicitly taken into account in this way. The phase diagram shows incommensurate phases as well as superstructures. The form and properties of the states in this phase are discussed. It is found that in the incommensurate phase two regions can be distinguished, characterised by the form of the modulation. In one the modulation is smooth and nearly sinusoidal; in the other there are discommensurations and chaotic states. The dynamic properties are studied with an effective Hamiltonian which extends the mean-field approach. It is shown that the vibrations in the two incommensurate regions are qualitatively different: in

one region there is a zero-frequency phason, whereas in the discommensuration regime the phason is pinned and localised states occur. (20 refs.)

101949 The intralayer order-disorder transition in monoclinic $Cr_{3\pm x}Se_4$. T.Ohtani, R.Fujimoto, H.Yoshinaga, M.Nakahira (Lab. for Solid State Chem., Okayama Univ. of Sci., Okayama, Japan), Y.Ueda.
J. Solid State Chem. (USA), vol.48, no.2, p.161-7 (1 July 1983).
The $Cr_{3\pm x}Se_4$ shows an order-disorder transition from the monoclinic Cr_3Se_4 type to the CdI_2-type structure. This transition originates in the intralayer disordering of metal vacancies in the alternate partially filled metal layers along the *c* axis. The transition is reversible and of first order. The transition temperature vs. composition curve has a maximum (~900°C) at a stoichiometric composition of Cr_3Se_4. A statistical treatment of this phenomenon was attempted via the Bragg-Williams approximation. (11 refs.)

101950 Transition electron microscopic study of reduced Ca_2UO_5. V.Krasevec, A.Prodan, J.Holc, D.Kolar (J. Stefan Inst., E. Kardelj Univ., Ljubljana, Yugoslavia).
J. Solid State Chem. (USA), vol.48, no.2, p.300-5 (1 July 1983).
Structural changes of Ca_2UO_5 during reduction in hydrogen were studied by transmission electron microscopy. It was shown that monoclinic Ca_2UO_5 changes into triclinic $Ca_4U_2O_9$. They are related, respectively, to the fluorite and the C-M_2O_3 structures, so that the product is a superstructure of the latter. Reduction occurs along the $(100)_t$ planes originating from the $(006)_m$ planes of the parent structure by diminishing the coordination number of the Ca cation from 7 to 6. (8 refs.)

101951 Structural phase transitions and polaritons in low-frequency region. S.Kojima (Inst. of Appl. Phys., Univ. of Tsukuba, Ibaraki, Japan).
J. Spectrosc. Soc. Jpn. (Japan), vol.32, no.2, p.96-102 (1983). In Japanese.
Dispersion relations of low-frequency photon polaritons in the crystals, which undergo structural phase transitions, give important information about the mechanisms of the transitions. In this work, low-frequency polaritons have been measured by a combination of the double monochromator with concave holographic gratings and the optical system designed for this purpose. The results of measurements are given for the crystals BNN, $Sr_2Nb_2O_7$ and GMO. (21 refs.)

101952 Transition temperature—spontaneous strain—atomic displacement relationships in ferroelastics. W.I.F.David (Inorganic Chem. Lab., Oxford Univ., Oxford, England).
Mater. Res. Bull. (USA), vol.18, no.7, p.809-16 (July 1983).
The Abrahams-Kurtz-Jamieson relationship, derived for ferroelectrics, has been extended to ferroelastic materials. It is shown that such relationships often shed light on the structural mechanisms that cause ferroic distortions. The ferroelastic properties of the isostructural compounds $NdNbO_4$ and $NdTaO_4$ are considered, and it is shown that the ferroelastic transition temperatures and saturated spontaneous strain components are, respectively, proportional to the square of and linearly proportional to the saturated spontaneous displacements of the Nb^{5+} and Ta^{5+} ions. (16 refs.)

101953 Order-disorder transition in the deficient spinel $Ga_{1.33}Cr_4S_8$. H.Ben Yaich, J.-C.Jegaden, M.Potel, M.Sergent (Lab. de Chimie Minerale B, Univ. de Rennes-Beaulieu, Rennes, France), P.Huguet, G.Alquier.
Mater. Res. Bull. (USA), vol.18, no.7, p.953-60 (July 1983). In French.
The spinel compound $Ga_{1.33}Cr_4S_8$ may be prepared in two different varieties. The low-temperature α-form exhibits a well-defined gallium occupancy on the tetrahedral sites, while the high-temperature β-phase is a disordered form. Single-crystal structural studies show a continuous order-disorder transition between these two limits, as a function of the synthesis temperature. Magnetic studies have been done by statical and dynamical methods. (5 refs.)

101954 Order-disorder transition and magnetic transformation of $Fe_{0.8}Al_{0.2}$ alloy. J.A.A.Khan, M.A.Shaikh, N.Ahmad, N.M.Butt (Pakistan Inst. of Nuclear Sci. & Technol., Nilore, Pakistan).
Nucleus (Pakistan), vol.18, no.4, p.15-19 (Oct.-Dec. 1981).
The electrical resistance of 20 at.% Al in Fe has been measured on polycrystalline samples over a temperature range 30-700°C. The study revealed the existence of a mixture of ordered and disordered phases from 400-500°C; and an order-disorder transition at $T_0=500\pm3$°C which is in good agreement with the results obtained on the same specimen using neutron diffraction technique. The results also showed a magnetic transformation at $T_c=625\pm3$°C. (21 refs.)

101955 Evidence for a commensurate-incommensurate phase transition with an intermediate fluid phase: N_2 adsorbed on Ni(110). M.Grunze, P.H.Kleban, W.N.Unertl (Fritz-Haber-Inst., Max-Planck-Gesellschaft, Berlin, Germany), F.S.Rys.
Phys. Rev. Lett. (USA), vol.51, no.7, p.582-5 (15 Aug. 1983).
Low-energy electron diffraction and thermodynamic measurements are reported for molecular nitrogen weakly chemisorbed on a Ni(110) surface in the temperature region between 87 and 150K. A commensurate (2×1) phase transforms with increasing coverage into a sequence of smoothly varying incommensurate solid structures via a liquidlike intermediate phase. This is apparently the first experimental example of the commensurate-fluid-incommensurate phase sequence in uniaxial systems predicted by several recent theories. (11 refs.)

101956 A structural description for the FCC→BCC martensitic transformation in terms of $\{011\}\ \langle01\bar{1}\rangle_{fcc}$ simultaneous double shear. Relation with the atomic configuration in $\{3,15,10\}_{fcc}$ habit plane.. A.Le Lann, A.Dubertret (Centre d'Etudes de Chimie Metall., CNRS, Vitry-sur-Seine, France).
Phys. Status Solidi a (Germany), vol.78, no.1, p.309-21 (16 July 1983).
The model proposed allows a correlation to be established between the main experimental results and the movement of atoms during the transformation. This movement is defined with respect to the $\langle01\bar{1}\rangle_{fcc}\rightarrow\langle\bar{1}11\rangle_{bcc}$ close-packed rows which are 'strain invariant rows' of the transformation. The homogeneous and heterogeneous part of the deformation result from the same kind of atom movement which can be described by $\{011\}\langle01\bar{1}\rangle_{fcc}$ transverse waves. A simple atomic configuration is proposed for the $\{\bar{2}25\}_{fcc}$ and $\{3,15,10\}_{fcc}$ habit plane. The habit plane structure is correlated with the Kurdjumov-Sachs or Nishiyama orientation relations and to the symmetry conditions during the transformation. (46 refs.)

101957 Calculation of high-pressure phase transitions in solid N_2 and the pressure dependence of intramolecular mode frequencies. V.Chandrasekharan (Lab. des Interactions Moleculaires et Hautes Pressions, Univ. Paris-Nord, Villetaneuse, France), R.D.Etters, K.Kobashi.
Phys. Rev. B (USA), vol.28, no.2, p.1095-8 (15 July 1983).
A calculation that minimizes the energy of solid N_2 with respect to a rhombohedral distortion of the *Pm*3*n* structure shows that the low-temperature phase transition occurs into the *R*3*c* calcite structure at $P\approx19.2$ kbar with a volume change of 0.125 cm^3/mole. This transition agrees with recent Raman scattering measurements. Another transition from *R*3*c* into *R*3*m* is predicted at $P\simeq67.5$ kbar, with a volume change of 0.1 cm^3/mole. The pressure dependence of the intramolecular mode frequencies for the *R*3*c* structure are in reasonably good agreement with the two main branches observed experimentally. (12 refs.)

101958 High-pressure phase transitions in potassium and phase relations among heavy alkali metals. K.Takemura, K.Syassen (Phys. Inst. III, Univ. Dusseldorf, Dusseldorf, Germany).
Phys. Rev. B (USA), vol.28, no.2, p.1193-6 (15 July 1983).
The optical reflectivity (0.5 eV$\leq\hbar\omega\leq$5 eV) of potassium metal has been measured to 380 kbar at room temperature. Two phase transitions occur at 114 and 188 kbar, respectively. By comparison to the high-pressure optical properties of Cs and Rb the phase K-II has FCC structure. At 188 kbar, K undergoes a considerable change in its optical response indicating the occurrence of a complicated Fermi-surface topology. The phase transitions in K, together with recent experimental investigations of Rb and Cs, reveal systematic trends in the phase stability of heavy alkali metals under pressure. (22 refs.)

101959 Phase relations and properties of lithium via molecular dynamics. R.G.Munro (Inorganic Materials Div., Center for Materials Sci., NBS, Washington, DC, USA), R.D.Mountain.
Phys. Rev. B (USA), vol.28, no.4, p.2261-3 (15 Aug. 1983).
The phase diagram of lithium in the region $295\leq T\leq600$K and $0\leq p\leq12$ GPa has been studied theoretically with the use of the recently developed molecular dynamics formalism of Parrinello and Rahman (1980). Excellent agreement between theory and experiment has been obtained for (1) the room-temperature BCC-FCC structural phase transition; (2) the temperature dependence of the BCC-FCC phase boundary; (3) the room-temperature compression curves for the BCC and FCC phases; and (4) the BCC-liquid melting curve. Additionally, a theoretical prediction has been made for the isobaric thermal expansion from 400 to 600K at GPa pressure. (11 refs.)

101960 Phase transitions in 3,5-dichloropyridine. F.Romain, P.Tougard, B.Pasquier, N.Le Calve, A.Novak (Lab. de Spectrochimie Infrarouge et Raman, Thiais, France), A.Peneau, L.Guibe, J.Ramakrishna.
Phase Transitions (GB), vol.3, no.4, p.259-74 (1983).
Structural phase transitions in 3,5-dichloropyridine crystal have been studied by calorimetry (150-300K), X-ray diffraction (300K), ^{35}Cl and ^{14}N nuclear quadrupole resonance (75-300K) and vibrational spectroscopy (20-300K). Three phases have been shown to exist: phase I, between 338 and 287.5K, phase II, between 287.5 and 167.5K, and phase III, below 167.5K. Phase I is characterised by the space group $P2_1/m$ and $Z=2$ whereas phases II and III remain centrosymmetric but double the unit cell. All the phases are ordered and contain crystallographically equivalent molecules. The I⇄II transition is of first order and probably of the reconstructive type while the II⇄III transition is believed to be displacive. Both transitions are monitored by predominantly R'_x and R'_z librational motions. (12 refs.)

101961 Time-dependent strains near the 105K transition in $SrTiO_3$. A.Okazaki, N.Ohama (Dept. of Phys., Kyushu Univ., Fukuoka, Japan), B.T.M.Willis, Y.Iwata, H.J.Scheel, K.A.Mueller.
Phase Transitions (GB), vol.3, no.4, p.339-45 (1983).
Reports the temperature dependence of the neutron diffraction intensities of flux-grown nearly dislocation-free $SrTiO_3$ crystals, upon cooling and heating through the structural phase transition at 105K, for both the fundamental and the superlattice reflections. The results suggest that the transition is strongly controlled by macroscopic strains when the crystal is kept in the tetragonal phase and then warmed up, i.e. a time-dependent memory effect is observed. (13 refs.)

101962 The fast-ion transition in FCC silver iodide. J.L.Tallon, R.G.Buckley (Phys. & Engng. Lab., DSIR, Lower Hutt, New Zealand).
Solid State Commun. (USA), vol.47, no.7, p.563-6 (Aug. 1983).
An analysis of previously reported data on electrical conductivity, adiabatic temperature change with pressure, and sound velocity confirms that the FCC phase of AgI has a fast-ion type II transition. This results in a steepening of the FCC/α-phase boundary which probably cusps in to a triple point at the α-phase order/disorder transition. Thermal expansion, compressibility and heat capacity are calculated for the FCC phase. (13 refs.)

101963 Phase transitions and order parameters. R.M.White (Xerox Palo Alto Res. Centers, Palo Alto, CA, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.327-35
The usefulness of the concept of an order parameter in describing phase transitions is discussed. Examples of order parameters are given in the context of broken symmetries and defects in the order parameters are classified in terms of these symmetries. (17 refs.)

Hydrodynamics of a subsonic vapor jet in subcooled liquid ...See Entry 101308

Metallic glass formation diagrams ....See Entry 101589

Polymorphism and superconductivity of $LaIr_2Si_2$ ....See Entry 101616

Temperature dependence of lattice parameters and FCC/FCT/FCO transformations in some Mn-base metastable γ-phase alloys ....See Entry 101637

Crystallographic study of mixed oxides Sr_2MWO_6 ....See Entry 101639

Observations on the structure, stability and transformations of the graphite: $SbCl_5$ intercalate ....See Entry 101643

Investigation of the structural description of the endothermic decompositions of solid 1 to solid 2+gas. III. Case of reaction $BaC_2O_4,2H_2O$ to BaC_2O_4,H_2O+H_2O: comparison of crystal structures of the two hydrates and X-ray analysis of the pseudomorphs ....See Entry 101650

Investigation of the structural description of the endothermic decompositions solid 1 to solid 2+gas. IV. Core of reaction $BaC_2O_4,2H_2O$ to BaC_2O_4,H_2O+H_2O characteristics of structural rearrangement ....
....See Entry 101651

The synthesis and crystal structure of α-Ca_3UO_6 ....See Entry 101659

Isomorphism among commensurate and incommensurate high-temperature phases of A_2BO_4 compounds ....See Entry 101665

Inheritance of twin boundaries as a mechanism of the shape memory ....
....See Entry 101715

Disordering kinetics in neutron and electron irradiated Fe-Co alloy ....
....See Entry 101800

Ion mass effects on bombardment-induced disordering of γ'-Ni_3Si ....
....See Entry 101806

Compositional changes in Fe-Cr-Ni alloys under proton bombardment at elevated temperatures ....See Entry 101807

Effects of pulsed dual-ion irradiation on phase transformations and microstructure in Ti-modified austenitic alloy ....See Entry 101809

Debye-Waller factors and the study of structural phase transitions: double quadratic chain ....See Entry 101890

Reduced van der Waals equation of state and critical properties of rubbers .....
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Octahedrally coordinated cation superlattices in spinels ... See Entry 101902

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Synchrotron-radiation studies of the transition of hydrogenated amorphous carbon to graphitic carbon ... See Entry 102245

Kinetic and electronic properties of $Ni_3(Fe_{1-x}Ta_x)$ and $Ni_3(Fe_{1-x}V_x)$ alloys ... See Entry 102358

Determination of the equilibrium $US_{2\alpha} \rightleftarrows US_{2\beta}$ and variations of the electrical properties of these two sulfides as function of sulfur pressure between 600 and 1000°C ... See Entry 102375

Electrical conductivity and phase transitions of the solid electrolyte system $(Cs_{1-y}Rb_y)Cu_4Cl_3(I_{2-x}Cl_x)$ ... See Entry 102383

Solid-gas interaction influence on the conductivity of molybdenum sulphides in the vicinity of an order-disorder transition ... See Entry 102390

Superconductivity and structural transformation in HfRuAs ... See Entry 102553

The Pd-Pt-H system: phase transformations at high pressure and superconductivity ... See Entry 102555

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Muons and muonium in solids ... See Entry 102794

The electret effect in water vapour condensates and phase transformation in ice ... See Entry 102801

Raman scattering study of the structural phase transitions in $RbAlF_4$ ... See Entry 102869

Excitation of lines in the infrared spectrum of Hg_2Cl_2 crystals due to cell doubling with a phase transition ... See Entry 102872

High-pressure optical spectra of condensed oxygen ... See Entry 102905

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Microstructural origin of the skeletal ferrite morphology of austenitic stainless steel welds ... See Entry 103134

Influence of various forming treatments of the metastable austenite on the transformation behaviour of steels with high carbon content in bainite and martensite ... See Entry 103140

X-ray diffraction analysis at high temperature on two ceramic systems ... See Entry 103141

Phase transformation and magnetic properties of Mn-Al-C permament magnets ... See Entry 103142

Influence of microstructure on the alpha-gamma transformation of iron ... See Entry 103143

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Thermodynamic condition for the formation of athermal martensite ... See Entry 103145

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Effects of a pulsed high magnetic field on the M_s temperature and martensite morphology in an Fe-31.7 at.% Ni alloy ... See Entry 103147

Cooperative effects between γ'_1 and β'_1 martensites in a Cu-15.0 at.% Sn alloy ... See Entry 103148

Microstructural changes in an aged Cu-15 at.% Sn shape memory alloy ... See Entry 103149

New aspects on the appraisal of the cooling process during hardening of steel ... See Entry 103167

A peculiar austenite stabilization phenomenon in an ausaged Fe-Ni-Ti alloy ... See Entry 103187

Flow stress of low carbon steels in the $(\gamma \rightarrow \alpha)$-transformation region ... See Entry 103208

Role of retained austenite of the deformation of an Fe-0.07 C-1.8 Mn-1.4 Si dual-phase steel ... See Entry 103234

Role of internal stress for continuous yielding of dual-phase steels ... See Entry 103236

Tempered martensite embrittlement in Fe-Mo-C and Fe-W-C steel ... See Entry 103310

Stress corrosion cracking susceptibility of SUS 304 stainless steel cathodically precharged with hydrogen ... See Entry 103379

Phase transitions and equations of state for the sodium halides: NaF, NaCl, NaBr, and NaI ... See Entry 104345

64.70M Transitions in liquid crystals

101964 About the phase transition in the smectic A phase of a liquid crystal. D.F.Aliev, Ch.G.A.Khundov, A.Kh.Zeinally, T.Z.Kulieva.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.6, p.91-3 (1982). In Russian.
The phase transition smectic $A \rightarrow$ isotropic liquid was investigated. The phenomenon of electrohydrodynamic instability has been detected and studied. (6 refs.)

101965 Phase transitions in polypeptide liquid crystals: a reentrant isotropic phase. R.Subramanian, R.J.Wittebort, D.B.DuPre (Dept. of Chem., Univ. of Louisville, Louisville, KY, USA).
Mol. Cryst. & Liq. Cryst. (GB), vol.97, no.1-4, p.325-36 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
Optical and C-13 NMR examinations of concentrated solutions of poly-γ-benzyl-L-glutamate (PBLG) in a mixed solvent system containing a denaturant acid, show that this polymer liquid crystal has both a low and high temperature isotropic phase. The latter is due to thermal disruption of long range orientational order of the elongated macromolecules. The former reentrant isotropic phase is a result of an intramolecular helix to random coil transition, which leads to a macromolecular conformation inconsistent with liquid crystallinity. (15 refs.)

101966 The metabolemeter. II. Detection of mesogenic polymorphism under pressure using small quantities. J.M.Buisine, B.Soulestin (Lab. de Dynamique des Cristaux Moleculaires, Univ. des Sci. et Tech. de Lille, Villeneuve d'Ascq, France), J.Billard.
Mol. Cryst. & Liq. Cryst. (GB), vol.97, no.1-4, p.397-406 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
Every first order phase transition for mesogens can be detected by the continuous recording, as a function of temperature, of the pressure of the sample enclosed in a metallic cell. Studies of a compound (octylcyanobiphenyl) exhibiting several transformations (crystal-smectic A, smectic A-nematic, nematic-liquid) show that this barometric method is convenient to detect polymorphism from one thermobarogram, and to draw the Clapeyron phase diagram; the smectic A-nematic transition involving small enthalpy and volume changes is clearly observable and this method is very sensitive. Moreover, the enthalpies and volumes of transition can be deduced from the pressure changes. Lastly, pressure and temperature are intensive data, and very little sample (1.3 mm^3) may be used. (18 refs.)

101967 Scaled particle theory of a system of spherocylinders: extension of calculations to high pressures. K.L.Savithramma, N.V.Madhusudana (Raman Res. Inst., Bangalore, India).
Mol. Cryst. & Liq. Cryst. (GB), vol.97, no.1-4, p.407-15 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
The authors have refined the scaled particle theory calculations on a system of spherocylinders by improving the evaluation of the angle dependent term in the expansion for the excluded volume. They present calculations on the nematic-isotropic transition properties for a hard rod system as well as a system superposed with an attractive potential of the Maier-Saupe type and subjected to different external pressures. The results are compared with the experimental data on para-azoxyanisole. (16 refs.)

101968 Nematic-isotropic transition in some lattice models for rigid cores having semiflexible tails: segmental Lennard-Jones interactions. F.Dowell (Chem. Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Phys. Rev. A (USA), vol.28, no.2, p.1003-15 (Aug. 1983).
Two average-environment simple cubic lattice models—a refined model and a simple model, both having site-site (segmental)-pair Lennard-Jones (LJ) interactions—for molecules composed of rigid cores having semiflexible tails are presented. The calculated values of the following properties at the nematic-isotropic transition for rigid rods of varying length are compared with relevant experimental data for PAA (*p*-azoxyanisole, or 4,4′-dimethoxyazoxybenzene): temperature, core orientational order parameter, nematic density and volume, relative density change, and relative entropy change. The temperature change as a function of volume change at constant order parameter is also discussed. In general, both LJ models give considerably better quantitative agreement with experiment, especially for the temperature and the relative density change, than do the earlier lattice models with hard repulsions, with or without constant segmental pair interaction energies. In most aspects, these LJ models give good quantitative agreement with experiment. These LJ models elucidate the importance of realistic intermolecular potentials, especially the role of soft repulsions, in describing an order-disorder transition between two condensed phases. (37 refs.)

101969 Landau theory of cholesteric blue phases. H.Grebel, R.M.Hornreich, S.Shtrikman (Dept. of Electronics, Weizmann Inst. of Sci., Rehovot, Israel).
Phys. Rev. A (USA), vol.28, no.2, p.1114-38 (Aug. 1983).
A detailed presentation of the Landau theory of the cholesteric blue phase (BP) is given with emphasis on the comparison of model predictions with reported experimental data. The basic model, which is asymptotically exact in the high-chirality limit, leads to the prediction of a body-centered cubic (bcc) O^5 ($I432$) structure for the BP. However, the model can be systematically extended to physical chiralities and used to calculate the free energies of more complex cubic structures. In particular, BCC O^8 ($I4_132$) and simple-cubic O^2 ($P4_232$) structures are analyzed and their optical and thermodynamic properties, as well as those of O^5, are compared with those reported for the two observed phases, BPI and BPII. It is shown that, in general, the known properties of these phases are consistent with a structure assignment of O^8 for BPI and O^2 for BPII. Some promising lines for future investigation are indicated. (28 refs.)

101970 Phase studies of a liquid crystalline polymer: hydroxypropyl cellulose. M.J.Seurin, A.ten Bosch, P.Sixou (Lab. de Phys. de la Matiere Condensee, CNRS, Nice, France).
Polym. Bull. (Germany), vol.9, no.8-9, p.450-6 (March 1983).
Phase diagrams for the isotropic-anisotropic phase transition in solutions of a thermotropic cellulose derivative, hydroxypropyl cellulose are presented. The effect of the molecular weight is demonstrated. A comparison to the theory of semi-rigid liquid crystalline polymers is given. (17 refs.)

101971 Density studies in *N*(*p*-*n*-heptyloxy benzylidene)*p*-*n*-butyl aniline across S_G-S_C, S_C-S_A, S_A-N and N-I phases. N.V.S.Rao, V.G.K.M.Pisipati (Faculty of Phys. Sci., Nagarjuna Univ., Nagarjuna Nagar, India).
Phase Transitions (GB), vol.3, no.4, p.317-28 (1983).
The density ρ of *N*(*p*-*n*-heptyloxy benzylidene) *p*-*n*-butyl aniline (HYBBA) is measured as a function of temperature from the isotropic liquid to the smectic-G phase. The compound is tetramorphic exhibiting three smectic phases S_G, S_C, S_A and a nematic phase. The density changes across the phase transformations and the calculated thermal expansion coefficient confirm the order of the S_G-S_C, S_A-N and N-I transitions as first-order, with S_C-S_A transition as weakly first or second-order. The first-order S_A-N phase transformation in this compound, which is weakly polar, is in agreement with McMillan's theoretical predictions (1971), and is different from other polar compounds. (35 refs.)

A systematic density functional approach to the mean field theory of smectics ... See Entry 101539

Surface order in nematics ... See Entry 101545

Computer simulation of molecular dynamics of anisotropic fluids ... See Entry 101546

Field-induced order in nematic liquid crystals ... See Entry 101550

Induced smectic mesomorphism in binary mixtures of cholesteryl chloride and 4,4′-diheptyloxyazoxybenzene ... See Entry 101551

Anisotropic propagation of ultrasound in the nematic phase of *N*-*p*-butoxybenzylidene-*p*-butylaniline with varying thermodynamic state parameters ... See Entry 101866

Unusual glassy smectic-G liquid crystal: heat capacity of N-p-n-pentyloxybenzylidene-p′-n-butylaniline between 11 and 393K .... See Entry 101995

Inter and intramolecular contributions to the proton dipolar and rotating frame spin-lattice relaxation times in the nematic phase of the liquid crystal $5CB\text{-}d_{11}$ .... See Entry 102771

64.70P Glass transitions

101972 Comparative study of diluent effects on the glass transition of polyvinylchloride and phenolphthalein. M.Pizzoli, M.Scandola, G.Ceccorulli, G.Pezzin (Istituto Chimico 'G. Ciamician', Bologna Univ., Bologna, Italy).
Polym. Bull. (Germany), vol.9, no.8-9, p.429-36 (March 1983).
Some binary polymer-diluent systems showed an 'unusual T_g-concentration dependence'. In order to investigate the relevance of the polymeric nature of the high-T_g component in determining this 'anomaly', two series of mixtures having the same diluent (di-n-Butylphthalate or Tricresylphosphate) and, as the high-T_g component, either a polymer (PVC) or a low-molecular weight substance (Phenolphthalein), have been examined. A discontinuity is found, as expected. In the 'polymeric' systems PVC-di-n-Butylphthalate and PVC-Tricresylphosphate, as well as in phenolphthalein-di-n-butylphthalate mixtures where, however, the deviations from the calculated T_g-composition curve are much less marked. It is concluded that the presence of a polymer is not a necessary requirement for the occurrence of the above mentioned 'anomaly'. (11 refs.)

101973 The effect of sequence distribution on glass transition of donor-acceptor copolymer systems. H.A.Schneider, H.N.Neto (Inst. fur Makromolekulare Chem., Univ. Freiburg, Freiburg, Germany).
Polym. Bull. (Germany), vol.9, no.8-9, p.457-63 (March 1983).
T_g studies on copolymers of methyl methacrylate and of butyl methacrylate with N-(2-hydroxyethyl) carbazolyl methacrylate as electro-donor and respective with methacryloyl-β-hydroxy-ethyl-3,5-dinitrobenzoate as electro-acceptor comonomer have shown that the glass transition behaviour can only be explained by the effect of triad sequences. Introduction of the electro-donor (or electro-acceptor) group into a methacrylate triad always increases the T_g contribution of the homopolymer triad, whilst the introduction of a methacrylate group into the electro-donor (acceptor) triad decreases the respective T_g contribution. (6 refs.)

101974 Characteristics of polynorbornene and ethylene-propylene terpolymer blends. C.S.Wang (Polymers Dept., General Motors Res. Labs., Warren, MI, USA).
Polym. Eng. & Sci. (USA), vol.23, no.9, p.530-3 (June 1983).
In this study characteristics of polynorbornene (PNR) and ethylene-propylene terpolymer (EPDM) blends were examined in terms of compatibility, cocuring, and ozone resistance. For most of the blend compositions, two glass transition temperatures (T_g) at about −30 and −50°C were observed from differential scanning calorimetry data for both uncured and cured samples. The transitions correspond to the T_gs of the component polymers, suggesting that the blends are microheterogeneous. The two-phase blends are difficult to cocure as evidenced by the fact that tensile strengths of the blends, when plotted as a function of blend composition, deviate from the linear or additive behavior. Improved cocuring of the blends, however, can be achieved by matching the cure rates of the components. The ozone resistance of the blends containing 25 percent or more EPDM was substantially improved as compared with that of PNR. Therefore, the newly developed PNR can be used for applications requiring ozone resistance by properly blending it with EPDM. (8 refs.)

Preparation of new fluoride glasses in ZrF_4-BaF_2-TlF system .... See Entry 100868

Fluorozirconate glasses with improved viscosity characteristics for fibre drawing .... See Entry 100912

Effect of water on the crystallization of Li_2O-SiO_2 glasses and gels .... See Entry 101586

Heats of interaction of polyvinyl chloride with plasticizers, kinetics of swelling and phase equilibrium .... See Entry 101911

On the crystalline, liquid, glassy, gaseous, and superfluid states of simple substances .... See Entry 101925

Unusual glassy smectic-G liquid crystal: heat capacity of N-p-n-pentyloxybenzylidene-p′-n-butylaniline between 11 and 393K .... See Entry 101995

Entropy of glassy and crystalline lithium acetate in relation to the Kauzmann paradox .... See Entry 102010

Ionic conduction of sulphide-based glasses in the systems M_2S-GeS_2-MI (M=Li,Ag) .... See Entry 102043

Transport studies of S-Se amorphous semiconductors .... See Entry 102384

Relationships between phase diagrams, the T_0 and T_n temperatures, cooling rates and glass forming ability .... See Entry 103120

Dynamic mechanical and thermomechanical properties of silicone-polycarbonate block copolymers .... See Entry 103200

64.75 SOLUBILITY, SEGREGATION, AND MIXING

101975 Thermodynamic analysis of miscibility gap due to ordering in ternary systems. T.Nishizawa, S.M.Hao, M.Hasebe, K.Ishida (Dept. of Materials Sci., Tohoku Univ., Sendai, Japan).
Acta Metall. (USA), vol.31, no.9, p.1403-16 (Sept. 1983).
Effect of ordering on the formation of miscibility gap in ternary systems has been investigated. A simple and explicit treatment for expressing the Gibbs energy change due to ordering has been developed on the basis of the Gorsky-Bragg-Williams approximation. An advantage of the present model is to permit the authors to calculate easily the miscibility gap in the whole range of ternary system. It has been found that the ordering plays a key role on the miscibility gap and the summit point is raised to a much higher temperature than expected by the regular solution model. The miscibility gap is not simple helmetlike, but has a peculiar ridge along the order-disorder transition line. The overlapping of magnetic transition and ordering causes complexity in the miscibility gap. (29 refs.)

101976 Statistical modelling of isomorphous precipitation. Yu.I.Paskal', V.E.Domrachev (V.D. Kuznetsov Siberian Physicotech. Sci.-Res. Inst., State Univ., Tomsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1051-7 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
Statistical modelling of isomorphous precipitation of a binary solid solution is carried out in a wide range of temperatures in order to determine qualitative changes in the nature of the kinetics of this process as a result of cooling. The Monte Carlo method is applied to a two-dimensional triangular rigid Ising lattice of 60×60 site dimensions with periodic boundary conditions. An allowance is made for the interatomic interaction only in the immediate vicinity of a given site. The calculations are carried out for the concentration of the second component $c_0=0.067$ (240 atoms out of 3600) and the results indicate that in a certain range of temperatures there is a qualitative change in the precipitation kinetics and at temperatures below this range the process has the characteristics of spinodal precipitation. (21 refs.) *A.T.*

101977 Anomaly of the solubility of hydrogen in ferromagnetic metals near the Curie point. V.I.Shapovalov, L.V.Boiko (Metallurgical Inst., Dnepropetrovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1220-1 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of the solubility of hydrogen in iron, cobalt, and nickel near their Curie temperatures. The solubility was determined by the method of equilibrium saturation and quenching, followed by vacuum outgassing during heating. The results were not reproducible because of the formation of cracks quenched from temperatures in the paramagnetic state. An anomalous increase in the solubility of hydrogen above the Curie point was attributed to the absence of domain walls. (7 refs.) *A.T.*

101978 Small aggregates. J.Friedel (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.507-20 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Small aggregates, from a few to about 1000 atoms constitute a specific domain, which differs both from the simple atomic or molecular gases and from macroscopic condensed matter. The author concludes that all nucleation processes must be very carefully studied, on an atomic and electronic scale, and that each specific case must be analyzed for itself. This refers to first order transitions, either condensation from vapours or liquids—the case of ice is of interest to meteorologists and astrophysicists—or in condensed matter, where the early example of GP zones shows the importance of the elastic stresses developed. It also refers to kinetics of reactions, especially radiolysis or recovery of radiation damage in solids. (no refs.)

101979 Thermodynamic models of alkali-metal vapor transport in silicate systems. J.W.Hastie, W.S.Horton, E.R.Plante, D.W.Bonnell (Chem. Stability & Corrosion Div., US NBS, Washington, DC, USA).
High Temp.-High Pressures (GB), vol.14, no.6, p.669-79 (1982). [received: June 1983] (International Conference on Chemistry of Materials at High Temperatures, Harwell, Oxon., England, 7-10 Sept. 1981).
A thermodynamic data base for liquid and solid mixtures containing K_2O, Al_2O_3, and SiO_2 has been developed and is described. This data base together with the hypothesis of ideal mixing of complex phases (IMCP) reproduces experimental activity data over a wide range of composition and temperature. (21 refs.)

101980 Surface spinodals and extended wetting in fluids and polymer solutions. H.Nakanishi (Inst. for Theoretical Phys., Univ. of California, Santa Barbara, CA, USA), P.Pincus.
J. Chem. Phys. (USA), vol.79, no.2, p.997-1003 (15 July 1983).
A novel concept of 'surface' spinodal decomposition is introduced in the context of wetting and prewetting first order transitions for simple fluids in contact with a bounding wall. Qualitative and semiquantitative discussions are made within the framework of a phenomenological Landau theoretical model for semi-infinite systems with a (short-ranged) wall potential. A concept of 'extended wetting' is also proposed, whereby even for $T<T_w$ (the wetting temperature) a macroscopically thick 'wetting' layer can form near the wall upon rapidly quenching the solution into the coexistence region. These ideas are carried over to polymer solutions and blends near their consolute points where the characteristic time scales should be more manageable. (22 refs.)

101981 The simulation of spinodal decomposition in two dimensions: a comparison of Monte Carlo and Langevin dynamics. P.Meakin (Inst. for Theoretical Phys., Univ. of California, Santa Barbara, CA, USA), H.Metiu, R.G.Petschek, D.J.Scalapino.
J. Chem. Phys. (USA), vol.79, no.4, p.1948-54 (15 Aug. 1983).
Langevin dynamics and Monte Carlo methods have recently been developed for the simulation of spinodal decomposition. In the paper the authors show, using the central limit theorem, that the Monte Carlo method (in the limit of small step sizes) is equivalent to Langevin dynamics (in the high friction limit). In this limit an exact relationship is established between the number of trials in a Monte Carlo simulation and Langevin dynamics time. The relationship between the Monte Carlo and Langevin dynamics methods is demonstrated for practical simulations and the effects of deviations from the small step size limit in the Monte Carlo simulation is a linear distortion of the effective time scale, provided the step size is not too large. The equivalence of the Monte Carlo and Langevin dynamics methods (in the appropriate limits) are demonstrated for the case of spinodal decomposition in two dimensions. However, their theoretical analysis is quite general and is not restricted to spinodal decomposition or two-dimensional systems. (11 refs.)

101982 Some observations on oxygen precipitation/gettering in device processed Czochralski silicon. H.R.Huff, H.F.Schaake, J.T.Robinson, S.C.Baber, D.Wong (Texas Instruments Inc., Dallas, TX, USA).
J. Electrochem. Soc. (USA), vol.130, no.7, p.1551-5 (July 1983).
Several results of the authors' experimental program studying the relationship between the properties of the silicon starting material and N-channel MOS dynamic RAM circuit performance is described. The thermal history and oxygen and carbon concentrations control the silicon material properties and much of the subsequent circuit performance. The beneficial effect of intrinsic gettering due to precipitation of oxygen in the bulk of MOS dynamic RAM refresh performance is shown. Equivalent thermal processes result in similar circuit performance only when the silicon material is equivalent. Some circumstantial evidence is also presented for a degrading effect of high concentrations of carbon in the starting material. (29 refs.)

101983 On the solubilities of pleochroic dyes in liquid crystalline phases. J.K.Foitzik, W.Haase (Inst. fur Phys. Chem., Tech. Hochschule Darmstadt, Darmstadt, Germany).
Mol. Cryst. & Liq. Cryst. (GB), vol.97, no.1-4, p.231-40 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
Solubilities of pleochroic dyes in the liquid crystalline phases ZLI-1565, PCH-5, PCH-7 and CCH-5 are reported. The dyes used were 1,4- and 1,5-

disubstituted anthraquinones. The authors found rather different values for the anthraquinones studied and also noteworthy temperature dependences. The enthalpies of solution were calculated. The influence of the structures of the dyes as well as of the liquid crystalline phases on the solubility and its temperature dependence is discussed. (23 refs.)

101984 Metastable two-liquid tie lines in the soda-lime-silica system. Z.Strnad (Res. & Dev. Inst. for Industrial Glass, Prague, Czechoslovakia), P.W.McMillan.
Phys. & Chem. Glasses (GB), vol.24, no.3, p.57-64 (June 1983).
A thermodynamic approach based on equating the chemical potentials of the components in the equilibrium liquid phases is applied to the calculation of metastable two-liquid tie lines and spinodal curves in the soda-lime-silica system. The calculated two-liquid tie lines in the system are compared with experimental data. The results show some disagreement between the present data and other sources concerning the composition of silica rich phase, which is generally considered as nearly pure SiO_2 at any temperature. (11 refs.)

101985 Contribution to the study of tetragonal and rhombohedral phase coexistence in the $PbZrO_3$-$PbTiO_3$ system. T.Kala (Res. Inst. of Electrotech. Ceramics, Hradec Kralove, Czechoslovakia).
Phys. Status Solidi a (Germany), vol.78, no.1, p.277-82 (16 July 1983).
Some new experimental results of the X-ray diffraction analysis of $Pb(Zr,Ti)O_3$ solid solutions with 1.5 mol.% of MnO_2 additions and the experimental data of other authors are used for the proposal of a new conception of the interpretation of the tetragonal-rhombohedral phase coexistence in the $PbZrO_3$-$PbTiO_3$ system in the vicinity of the morphotropic phase boundary. It suggests the internal stress relaxation as the primary reason of the phase coexistence. The internal stresses may arise due to the contraction or dilatation during temperature changes, due to the influence of external electric or mechanical fields, and other variables, too. (7 refs.)

101986 Monotonic and alternating surface segregation profiles in binary alloys. L.Z.Mezey, O.Nishikawa, J.Giber (Inst. of Phys., Budapest Tech. Univ., Budapest, Hungary).
Phys. Status Solidi a (Germany), vol.78, no.1, p.323-31 (16 July 1983).
A complex calculation method of the characteristics of surface segregation has been recently developed. The sufficient conditions of monotonic and alternating surface segregation profiles are established using the method. Then the monotonic profiles are related to the preference for pair formation from like atoms while the alternating ones are related with that from unlike atoms. The applicability of the conditions deduced is shown for some binary solid alloys. (16 refs.)

101987 Magnetic susceptibility and solubility limits of dilute Mn in liquid Se. J.A.Gardner (Dept. of Phys., Oregon State Univ., Corvallis, OR, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2222-4 (15 Aug. 1983).
The magnetic susceptibility of dilute mixtures of Mn in Se was measured up to 1100°C. These results indicate that the solubility of Mn in liquid Se is very small, rising to only 0.19 at.% at 895°C and 0.52 at.% at 965°C. In the temperature range 900-1100°C, where the Mn solubility is large enough to permit accurate measurements, the Mn susceptibility is found to be approximately that of a free $^5/_2$ spin. The effective magnetic moment appears to be reduced only slightly by *s-d* interaction. The susceptibility of $MnSe_2$ was measured between room temperature and 950°C in the course of this work and is found to follow a Curie-Weiss temperature dependence. The effective Mn magnetic moment in $MnSe_2$ is approximately the same as a free $^5/_2$ spin. (10 refs.)

101988 Relative solubility trends in transition-metal alloys. D.A.Goodman, L.H.Bennett (NBS, Washington, DC, USA), R.E.Watson.
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.43-52
Describes the relative solubilities of the transition metals in one another. After discussing the problem of defining an appropriate measure of solubility for the transition-metal alloys which have any intermediate phases, the authors present a map of relative solubilities for the transition metals. From this map, they delineate the trend which occurs. Both the Engel-Brewer theory and d-band transition-metal alloy theory are consistent with this trend. (25 refs.)

101989 Coherent precipitate formation in pulsed-laser and thermally-annealed, ion-implanted Si. B.R.Appleton, J.Narayan, O.W.Holland, S.J.Pennycook (Solid State Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.281-6
It is shown that under suitable conditions ion implanted impurities in Si can precipitate and grow coherently within the single crystal lattice during recrystallization induced by pulsed laser or thermal annealing. Ion channeling and transmission electron microscopy (TEM) were used to characterize such precipitates in Si implanted with Sb and B and thermally annealed, and in Si implanted with Tl and annealed with a pulsed ruby laser. The orientations of these precipitates were determined from TEM and detailed angular scans using ion scattering channeling. The nucleation and precipitation processes are discussed in terms of differences in the liquid and solid phase regrowth mechanisms. (18 refs.)

101990 Segregation and crystallization phenomena in germanium. G.J.Clark (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA), A.G.Cullis, D.C.Jacobson, J.M.Poate, M.O.Thompson.
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.303-10
While many studies have been made of liquid phase epitaxy impurity trapping and segregation in Si little is known about the equivalent processes in Ge. In this paper the authors have laser annealed Ge⟨100⟩ and ⟨111⟩ crystals implanted, at liquid nitrogen temperature, with 200 keV ^{210}Bi ions to doses of 2×10^{15} and 10^{16} ions cm^{-2}. The samples were annealed with Q-switched ruby lasers and an XeCl excimer laser. They have observed (1) velocity and orientation dependence of the Bi segregation coefficient, (2) interface instability and cell formation resulting from constitutional supercooling, and (3) amorphization and defect production at high velocities. The phenomena are shown to be analogous to those seen in Si. (15 refs.)

Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors .... See Entry 98632

Phase changes in copper halide photochromic glasses .... See Entry 101584

Hydrogen solubility in $Pd_{100-x}Si_x$ metallic glasses and the phase diagram of Pd-Si-H glasses .... See Entry 101588

Structure of small defects in nonstoichiometric WO_{3-x} .... See Entry 101691

Electron-microscopic investigation of α-planar defects formed by boron in alloys of refractory metals with the BCC lattice .... See Entry 101706

Dislocation motion in a dispersion hardened Al-Zn-Mg alloy and its plastic properties .... See Entry 101707

Nature of defects in heavily Te-doped GaAs .... See Entry 101710

Iron-ion—implantation effects in MgO crystals .... See Entry 101730

Dopant incorporation during rapid solidification .... See Entry 101735

Impurity redistribution in ion implanted Si after picosecond Nd laser pulse irradiation .... See Entry 101741

Impurity distribution profiles and surface disorder after laser induced diffusion .... See Entry 101742

Precipitate dissolution by high energy collision cascades .... See Entry 101752

Theory of helium transport and clustering in materials under irradiation .... See Entry 101756

Compositional changes in Fe-Cr-Ni alloys under proton bombardment at elevated temperatures .... See Entry 101807

Effect of irradiation on phosphorus segregation .... See Entry 101816

Role of impurity precipitates in microhardness of NaCl:Sr^{2+} crystals .... See Entry 101851

Corresponding states correlations of the spinodal and homogeneous nucleation limits .... See Entry 101903

SnS_2-Tl_2S section of the thallium-tin-sulphur system .... See Entry 101910

Theory of surface effects in binary alloys .... See Entry 101914

Structural maps and parameters important to alloy phase stability .... See Entry 101916

The excess enthalpies of (carbon dioxide+toluene) at 308.15, 385.15, and 413.15K from 7.60 to 12.67 MPa .... See Entry 102006

An estimation of the thermodynamic data of liquid transition metal based alloys .... See Entry 102009

The sublattice model .... See Entry 102013

Diffusion of boron into polycrystalline silicon from a single crystal source .... See Entry 102063

Effect of cold working on the hydrogen trapping phenomena in pure iron .... See Entry 102068

Interaction of Pb-Er alloys with silicon .... See Entry 102075

Cation valencies and surface segregation in copper ferrites under X-ray photoelectron spectroscopy conditions .... See Entry 102131

Thermal self-decoration of GeS crystals .... See Entry 102132

Growth of metastable $Cu_{1-x}Cr_x$ solid solutions by ion mixing during bias-sputter deposition .... See Entry 102189

Theory of surface core-level shifts in metals .... See Entry 102476

Flux pinning in interdiffusing thin films .... See Entry 102596

Spinodal decomposition and magnetic properties of Fe-Cr-12Co permanent magnet alloys .... See Entry 102707

Anomalous backscattering of optical radiation in a stratified solution .... See Entry 102896

Optical spectra of Pb^{2+} to monitor the precipitation behavior of NaCl:Cd .... See Entry 102914

Luminescence of silver halides. I. Influence of precipitation parameters on the delayed luminescence of silver bromide microcrystals .... See Entry 102930

On the 430 nm emission band in the NaCl:Pb^{++} system .... See Entry 102942

A positron study of Guinier-Preston zones and precipitates in Al-Zn alloys having Mg or Ge additions .... See Entry 102990

Kinetics of nitrogen dissolution in high-chromium melts of the iron chromium system .... See Entry 103107

Precipitation in a Cu-20%Ni-8%Sn alloy and the phase diagram of the Cu-Ni rich Cu-Ni-Sn system .... See Entry 103112

Calculation of the partial molar properties of ternary alloys from binary data using the shortest distance composition path .... See Entry 103114

Magnetic ordering and phase separation in binary alloys with one magnetic component .... See Entry 103118

Thermodynamics of Na_2CO_3-$CaCO_3$-CaO slags for use in hot metal refining .... See Entry 103124

Examination of M_7C_3 carbides in high chromium cast irons using thin foil transmission electron microscopy .... See Entry 103130

An analysis of the solidification of a binary eutectic system in consideration of both heat and solute diffusion .... See Entry 103133

Microstructural changes in an aged Cu-15 at.%Sn shape memory alloy .... See Entry 103149

Hydride precipitation in α/β zirconium alloys .... See Entry 103150

Interdendritic fluid flow normal to primary dendrite-arms in cubic alloys .... See Entry 103151

Discontinuous coarsening reaction in lamellar precipitated Cu-Be alloys .... See Entry 103152

On the precipitation of β phase from α Cu-Be solid solution .... See Entry 103153

On solution-reprecipitation processes during liquid phase sintering of WC-Co .... See Entry 103155

X-ray diffraction investigation of the single-phase stage of precipitation of martensite .... See Entry 103156

On the kinetics of discontinuous precipitation in Cu-Mg alloys .... See Entry 103158

Computer simulation on the reduction of gravity segregation for Al-Pb alloys by the rapid solidification method .... See Entry 103159

The influence of cobalt, iron and aluminium on the precipitation of metastable phases in the Ni-Ta system .... See Entry 103160

Discontinuous γ' coarsening in a Ni-Al-Mo base superalloy . See Entry 103161

Ageing study of magnesium oxide precipitates in a silver matrix .... See Entry 103162

Coarsening process of Co precipitates in Cu-Co alloys .... See Entry 103163

Electron microscopy study of microstructural changes in a Ti-1.6 at.%N alloy .... See Entry 103164

Control of the steady creep in Ag-2.7 wt.% Al by dissolution-enhanced diffusion .... See Entry 103225

High temperature strength of SUS 316 stainless steel subjected to creep damage .... See Entry 103298

The micro-mechanisms of tempered martensite embrittlement in 4340-type steels .... See Entry 103304

Fatigue of Cu-1 pct Cd .... See Entry 103305

The influence of the $M_{23}(C,N)_6$ compound on the mechanical properties of type 422 stainless steel .... See Entry 103311

Low cycle fatigue of Ti-Mn alloys: microstructural aspects of fatigue crack growth .... See Entry 103316

Thermal formation of SiO_2 films over NiSi, $NiSi_2$ and $CoSi_2$ via silicide decomposition .... See Entry 103363

On the electrochemical behavior of anodic oxide films on tungsten in phosphate solutions .... See Entry 103370

The influence of structure on the corrosion of glassy copper-zirconium alloys .... See Entry 103371

Thermodynamics of unsymmetrical electrolyte mixtures. Enthalpy and heat capacity .... See Entry 103572

Thermodynamics of the unsymmetrical mixed electrolyte HCl-$LaCl_3$ .... See Entry 103573

The role of surface phenomena in the interactions of reactive metals with gases .... See Entry 103590

A quantitative atom-probe field-ion microscope study of the compositions of dilute Co(Nb) and Co(Fe) alloys .... See Entry 103625

64.80 OTHER PHASE PROPERTIES OF SYSTEMS

101991 Homogeneity of semi-insulating GaAs substrates for GaAs IC. S.Miyazawa (Nippon Telegraph & Telephone Public Corp., Musashino, Japan).
Oyo Buturi (Japan), vol.52, no.3, p.227-31 (March 1983). In Japanese.
Impressive attention has been given to, as a new substrate material after Si, the GaAs compound, for the reason that it is high (about 6 times) in electron mobility more than 10^7 Ω.cm. Considerable research has been done on the development of large-diameter (2 to 3 inches) GaAs substrates using the liquid encapsulated Czochralski technique. The LEC crystal has its characteristic uniformity in the dislocation density distribution. This review introduces results of the recent research on the correlation between the nonuniformity and crystal quality or FET characteristics and articulates that the uniform distribution of the dislocation density is indispensible for GaAs integrated-circuit fabrication. (20 refs.)

101992 Star patterns and dissociation of interfaces without spontaneous strain compatibility between orientation domains in ferroelastic crystals. Case of a monoclinic rare earth sesquioxide. C.Boulesteix (Lab. de Microscopie Electronique Appl., Faculte des Sci., Marseille, France), B.Yangui.
Phys. Status Solidi a (Germany), vol.78, no.1, p.303-8 (16 July 1983).
In some cases no interface with a strain compatibility (permissible interface) can occur between orientation domains in ferroelastic crystals. Non-permissible interfaces may then occur. Such interfaces are observed in monoclinic Sm_2O_3 at the external point of star patterns which can be observed in ferroelastics occurring with the loss of a triad axis. It is shown that such non-permissible interfaces can dissociate into two twins which is at the origin of the formation of star patterns. This dissociation, similar to the dissociation of antiphase boundaries or dislocations, occurs because it reduces the total free energy of the crystal. (12 refs.)

101993 On the dynamics of low-temperature domains above T_c in lead phosphate. C.N.W.Darlington (Dept. of Phys., Univ. of Birmingham, Birmingham, England).
Phase Transitions (GB), vol.3, no.4, p.283-92 (1983).
Results derived from the scattering of Mossbauer γ-rays from lead phosphate, $Pb_3(PO_4)_2$, at temperatures above the transition temperature (180°C) are consistent with the idea that the crystal contains regions which have the symmetry of the low-temperature, ferroelastic phase. These microdomains are either very long-lived, a result which is inconsistent with findings from neutron scattering experiments reported in the literature, or have lifetimes which are considerably shorter than 10^{-7} seconds. (9 refs.)

A neutron powder diffraction study of α- and β-PbO_2 in the positive electrode material of lead-acid batteries .... See Entry 101646

Contribution to the study of Pb-Bi-Te. Study of the PbTe-Bi_2Te_3 system .... See Entry 101909

One-dimensionality in glassy carbon .... See Entry 102365

On the relation between T_c measurements and structure inhomogeneity of Nb_3Ge superconductor .... See Entry 102545

Microstructure and superconducting properties of helium-saturated niobium-titanium alloy .... See Entry 102548

Infrared characterization of α- and β-crystalline silicon nitride .... See Entry 102867

65.00 THERMAL PROPERTIES OF CONDENSED MATTER

(see also 05.70 Thermodynamics, 63. Lattice dynamics; for thermal conduction in nonmetallic liquids, see 66.60; for thermal conduction in nonmetallic solids, see 66.70; for electronic thermal conduction. see 72.15, 72.20 and 74.30E; for thermodynamic properties of quantum fluids, see 67.40, 67.50, and 67.60; for thermal properties of solid helium, see 67.80)

65.20 HEAT CAPACITIES OF LIQUIDS

101994 The Anderson-Gruneisen parameter of the liquid state and its relation with Rao's acoustical parameter. B.K.Sharma (Dept. of Phys., Regional Coll. of Education, Bhubaneswar, India).
Acustica (Germany), vol.53, no.3, p.152-8 (July 1983).
The significance of and the distinction between the microscopic Gruneisen parameter and the thermodynamic Gruneisen parameter is discussed. By demonstrating the similarity of these parameters in case of simple liquids, an expression for the heat capacity ratio of liquids has been obtained. The study of the isothermal and the adiabatic Gruneisen parameter is extended to the liquid state and their relationships whith the microscopic Gruneisen parameter and the Rao acoustical parameter are established by taking into consideration the contribution due to the temperature dependence of the adiabatic compressibility and the heat capacity ratio. It is shown that values of Rao's acoustical parameter are found around 2 and those of the Anderson-Gruneisen parameters around 5 for simple liquids. The values of the isothermal and the adiabatic Anderson-Gruneisen parameters are very close, differing by about 10% only in case of simple liquefied gases. These parameters are found temperature dependent and decrease with rise of temperature, like the microscopic Gruneisen parameter for liquids. (62 refs.)

101995 Unusual glassy smectic-G liquid crystal: heat capacity of N-p-n-pentyloxybenzylidene-p′-n-butylaniline between 11 and 393K. M.Sorai, K.Tani, H.Suga (Dept. of Chem., Osaka Univ., Osaka, Japan).
Mol. Cryst. & Liq. Cryst. (GB), vol.97, no.1-4, p.365-86 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
The heat capacities of the title compound ($C_5H_{11}O$-C_6H_4-CH=N-C_6H_4-C_4H_9, abbreviation 5O.4) with a purity of 99.92 mole percent have been measured with an adiabatic-type calorimeter between 11 and 393K. The transition temperature and the enthalpy and entropy of phase transition for stable crystal→S_G, S_G→N and N→isotropic liquid were $T_c=299.69K/\Delta H=22.68$ kJ $mol^{-1}/\Delta S=75.70$ J K^{-1} mol^{-1}, 325.72/7.11/21.79 and 342.48/1.78/5.22, respectively. The crystal which melts at 285.5K is a metastable modification. The S_A phase hitherto reported in between S_G and N does not exist. The glassy S_G state was realized by rapid cooling of the specimen from the S_G phase. The molar enthalpy of the glassy S_G state at 0K was by (10.1 ± 0.1) kJ mol^{-1} higher than that of the stable crystalline state and the residual entropy of the glassy state was (9.40 ± 0.83) J K^{-1} mol^{-1}. The relaxational heat-capacity anomaly was observed from as low as 100K and double glass transition phenomenon occurred around 200K; a quite unusual phenomenon which has never been observed for the glassy states of nematic and cholesteric liquid crystals. (28 refs.)

Computer simulation of molecular dynamics of anisotropic fluids .... See Entry 101546

65.40 HEAT CAPACITIES OF SOLIDS

(for specific heat of superconductors, see 74.30E; for specific heat of magnetic systems, see 75.40)

101996 Calculation of electronic specific heat by the collective electron oscillations in metals and their different phases. O.K.Harsh, Y.D.Kaushik, R.P.Sharma (Dept. of Post-graduate Studies & Res. in Phys., Feroze Gandhi Coll., Rae Bareli, India).
Indian J. Phys. Part B, vol.57B, no.1, p.92-4 (Feb. 1983).
An interesting method is proposed to calculate the electronic specific heat of metals using collective behaviour of electrons. The present method explains first time the specific heat of the different phases of the same metal and it also calculates the specific heat of those metals for which the calculations have not been performed so far. The calculated values are in excellent agreement with the observed value. (5 refs.)

101997 Heat capacity of the solid electrolyte $Ag_{26}I_{18}W_4O_{16}$. P.G.Hall, D.A.Armitage, R.G.Linford (School of Chem., Leicester Polytech., Leicester, England).
J. Phys. C (GB), vol.16, no.23, p.L835-7 (20 Aug. 1983).
The heat capacity of the solid electrolyte $Ag_{26}I_{18}W_4O_{16}$ has been determined between 78 and 300K by adiabatic calorimetry. Three transitions occur, two first order (198.5 and 248.6K) and another more gradual transition producing a lambda-shaped peak at 275.6K. The results agree well with those of an earlier study by differential scanning calorimetry. (8 refs.)

101998 Influence of thermal treatments on the low temperature specific heat of Suprasil-W vitreous silica. M.Grosmaire-Vandorpe, J.C.Lasjaunias, G.Penn (Centre de Recherches sur les Tres Basses Temperatures, CNRS, Grenoble, France).
J. Non-Cryst. Solids (Netherlands), vol.57, no.1, p.157-66 (Aug. 1983).
The authors report specific heat results between 0.04 and 4K in Suprasil-W vitreous silica submitted to thermal treatments at 1100 and 1300°C, on samples of different sizes. In the very low temperature range, i.e. below 0.5K, the specific heat mainly due to the two-level systems is only slightly sensitive to the annealing. On the contrary, the large anomaly localized at 1-2K is very sensitive to the conditions of the thermal treatments and to the shape of samples. Comparison is made with a similar anomaly induced in crystalline quartz by fast neutron irradiation at moderate doses. (28 refs.)

101999 Specific-heat measurements of Pd in magnetic fields to 20 T. G.R.Stewart (Los Alamos Nat. Lab., Los Alamos, NM, USA), B.L.Brandt.
Phys. Rev. B (USA), vol.28, no.4, p.2266-7 (15 Aug. 1983).
The authors report accurate measurements of the specific heat of zone-refined, high-purity Pd between 6 and 17K in fields of 10, 15, and 20 T. The change of the specific heat of this Pd in 20 T, averaged over the 14 different temperatures of measurement, compared with zero-field measurements at the same temperatures, is +1.0%. Within the limits of error (±2%), the results directly contradict previous specific-heat results on Pd in fields to 11 T by Hsiang et al. (Phys. Rev. Lett. 47, 523, 1981). (12 refs.)

102000 Heat capacity and thermal conductivity of semiconducting $PtSb_2$ in the range 4.2-300K. J.P.Kundrotas, A.Dargyys (Inst. of Semiconductor Phys., Acad. of Sci., Lithuanian SSR).
Sov. Phys.-Collect. (USA), vol.22, no.2, p.56-62 (1982). Translation of: *Litov. Fiz. Sb. (USSR)*, vol.22, no.2, p.74-82 (1982).
The thermal conductivity and heat capacity of the narrow-band semiconductor $PtSb_2$ has been measured at constant pressure, from room to liquid-helium temperatures. It is found that the Debye temperature is close to 300K and varies only slightly with the lattice temperature. It is established that in some single crystals (impurity concentration 10^{17} cm^{-3}) the thermal conductivity attains its maximum value of 4 W/(cm.K) at around 20K. Comparison of theory and experiment yields the conclusion that at low temperatures phonons are scattered by impurities; with increasing temperature the thermal conductivity is due to three-phonon scattering, while at room temperature it is due to both phonons and current carriers, whose contribution amounts to around 25% of the overall thermal conductivity $\lambda_{800}=0.4$ W/(cm.K). (20 refs.)

Exact results for a linear chain planar EQQ model .... See Entry 99063

Low temperature properties of metallic glasses .... See Entry 101563

Lattice parameters, thermal expansion coefficients, and vacancy density in solid CD_4 .... See Entry 101684

Response of liquid carbon disulfide to shock compression: equation of state at normal and high densities .... See Entry 101857

The fast-ion transition in FCC silver iodide .... See Entry 101962

Unusual glassy smectic-G liquid crystal: heat capacity of N-p-n-pentyloxybenzylidene-p′-n-butylaniline between 11 and 393K .... See Entry 101995

Entropy of glassy and crystalline lithium acetate in relation to the Kauzmann paradox .... See Entry 102010

Connection between the excess thermodynamic functions of glassy As_2S_3 and As_2Se_3 at absolute zero and their structural features .... See Entry 102011

Thermophysical properties of quartz glass .... See Entry 102083

On the law of the change of the quantum crystal heat capacity C_v near the melting point .... See Entry 102109

Melting and wetting behavior in oxygen films .... See Entry 102167

Exact solution of Anderson Hamiltonian .... See Entry 102226

Nonlinearities of laser heating of metals .... See Entry 103006

The mutual influence of magnetic and chemical ordering ...... See Entry 103117

65.50 THERMODYNAMIC PROPERTIES AND ENTROPY

102001 The calculation of molecular interaction in phosphoryl chloride. S.S.Bhatti (Dept. of Phys., Guru Nanak Dev Univ., Amritsar, India).
Acustica (Germany), vol.53, no.3, p.166-8 (July 1983).
Presents results of certain acoustical and thermodynamical parameters calculated for liquid phosphoryl chloride on the basis of a hard-sphere model with attractive interactions as proposed by Sharma (1979). The pseudo-Gruneisen parameter $\Gamma_G(=u^2\alpha/Cp)$ is compared with the microscopic (lattice) Gruneisen parameter $\Gamma(x)$, and the β-value directly obtained ultrasonically is compared with that calculated from the above model. In addition, surface tension (S), surface energy (E) Eotvos constant (K_E), disorder (δ) and viscosity coefficients (η) and the change in entropy ($\Delta\phi$) have been derived. The variation of free volume (V_f) and the relative association (RA) also have been studied. (20 refs.)

102002 Concentrated aqueous sodium chloride solutions from 200 to 600°C and to 3000 bar. Phase equilibria and *PVT*-data. M.Gehrig, H.Lentz, E.U.Franck (Inst. fur Phys. Chem. und Elektrochem., Univ. Karlsruhe, Karlsruhe, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.7, p.597-600 (July 1983).
The specific volume of aqueous sodium chloride solutions with 6, 10, and 20 weight percent salt was measured from 200°C to 600°C and from 100 bar to 3000 bar. The uncertainty of the data is below 0.5%. Data are given of temperature, presssure, volume and composition at 24 points on the two-phase boundary surface. About 230 values for the one-phase region are presented. The critical curve for the binary system runs from 374°C and 220 bar for pure water to 500°C and nearly 600 bar for a solution with 12% salt. The specific volume at this point is $2.0\ cm^3\ g^{-1}$. At 600°C, 3000 bar and 20% salt a volume of $1.163\ cm^3\ g^{-1}$ was found. The apparatus and procedure, which uses an autoclave with variable volume and a sapphire window is described. (22 refs.)

102003 An investigation into individual activity coefficient in electrolyte solution. II. The evaluation of individual ionic activity coefficient in mixed electrolyte solution. Huang Rui-he, Teng Teng, Li Yi-gui (Dept. of Chem. & Chem. Engng., Tsinghua Univ., China).
J. Tsinghua Univ. (China), vol.23, no.1, p.73-80 (1983). In Chinese.
For pt.I see ibid., vol.22, no.4, p.33 (1982). By using the measured individual ionic activity coefficient data in the previous paper and the experimental mean ionic activity coefficient data in a single electrolyte solution (1-1 valence), a method for evaluating the individual ionic activity coefficient of any ion mixed electrolyte solution (such as Na^+, K^+, Cl^- and Br^-) is developed. (5 refs.)

102004 A note on the entropy of the disordered harmonic chain. S.Baer (Dept. of Phys. Chem., Hebrew Univ. of Jerusalem, Jerusalem, Israel).
J. Phys. C (GB), vol.16, no.21, p.4103-6 (30 July 1983).
It is shown that in the classical limit the entropy of disorder in the harmonic chain of particles with masses M_i and nearest-neighbour force constants $K_i(\langle K/M\rangle=1)$ is given by $S_{dis}=-Nk_B\langle\log(K/M)^{1/2}\rangle$ (average over chain) compared with the standard expression $S_{dis}=-Nk_B\langle\log\ \omega\rangle$ (average over normal modes). (10 refs.)

102005 A thermodynamic study of (magnesium oxide+silicon dioxide) by mass spectrometry. S.Kambayashi, E.Kato (Dept. of Metall. Engng., Waseda Univ., Tokyo, Japan).
J. Chem. Thermodyn. (GB), vol.15, no.8, p.701-7 (Aug. 1983).
The thermodynamic activities of $\{(1-x)MgO+xSiO_2\}$ were measured at 1873K by high-temperature mass spectrometry. The standard molar Gibbs free energies of formation of $MgSiO_3(l)$ and $Mg_2SiO_4(s)$ from $SiO_2(s)$ and $MgO(s)$ at 1873K were determined to be $-(31.5\pm0.6)\ kJ\times mol^{-1}$ and $-(56.8\pm0.6)\ kJ\times mol^{-1}$, respectively. A liquid phase was observed for $x=0.448$ to 0.565 at 1873K. (13 refs.)

102006 The excess enthalpies of (carbon dioxide+toluene) at 308.15, 385.15, and 413.15K from 7.60 to 12.67 MPa. C.Pando, J.A.R.Renuncio, R.S.Schofield, R.M.Izatt, J.J.Christensen (Dept. of Chem. Engng., Brigham Young Univ., Provo, UT, USA).
J. Chem. Thermodyn. (GB), vol.15, no.8, p.747-55 (Aug. 1983).
The excess molar enthalpies ${H_m}^E$ for $\{xCO_2+(1-x)C_6H_5CH_3\}$ were measured in the vicinity of their critical locus and in the supercritical region. Mixtures at 308.15K and at 7.60 MPa show very exothermic mixing and a region where ${H_m}^E$ varies linearly with x, while at 10.64 and 12.67 MPa they show only moderately endothermic and exothermic mixing in the toluene-rich and carbon-dioxide-rich regions, respectively. Mixtures at 358.15 and 413.15K and at all pressures studied have an exothermic section in the toluene-rich region, a linear section (corresponding to a two-phase region) which starts at an x corresponding very closely to that at the minimum value of ${H_m}^E$ (maximum exothermic mixing), and an endothermic section in the carbon-dioxide-rich region. The ${H_m}^E$ values were used to determine the equilibrium phase compositions in the two-phase region. These compositions were found to be in excellent agreement with those obtained by a non-calorimetric procedure. The changes observed in the excess enthalpy with both pressure and temperature are discussed in terms of liquid-vapor equilibrium and critical constants for (carbon dioxide+toluene). (12 refs.)

102007 Thermodynamics of liquid (potassium+potassium bromide) at high temperatures. P.Kozoulia, J.P.Bros, M.Gaune-Escard (Lab. de Dynamique et Thermophys. des Fluides, Univ. de Provence, Marseille, France).
J. Chem. Thermodyn. (GB), vol.15, no.8, p.757-71 (Aug. 1983).
The vapour pressure above $\{xK+(1-x)KBr\}(l)$ was measured at the mole fractions $x=0.1$, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7 and 0.8, and at temperatures higher than the critical temperature ($1000K<T<1065K$). The activities of K and of KBr were obtained in this temperature range; hence, the thermodynamic excess molar functions ${G_m}^E$ and ${H_m}^E$ were derived. The experimental activities of K were found to be in good agreement with those, obtained in a more limited composition range, by Smirnov et al. The excess molar Gibbs free energies can be compared with those deduced from a phase-diagram analysis. Moreover, the value obtained for the limiting molar enthalpy of solution of K supported the estimate given by Pitzer from an F-centre model. (22 refs.)

102008 Thermodynamic investigation of (a transition metal+germanium or silicon). II. (Palladium+silicon) alloys. R.Castanet, R.Chastel, C.Bergman (Centre de Thermodynamique et de Microcalorimetrie, CNRS, Marseille, France).
J. Chem. Thermodyn. (GB), vol.15, no.8, p.773-7 (Aug. 1983).
For pt.I see ibid., vol.14, p.639 (1982). The molar enthalpy of formation $\Delta_f H_m$ of the liquid alloys $\{xPd+(1-x)Si\}$ at 1723K was measured by direct reaction calorimetry (drop method) using a very high-temperature Seteram calorimeter. The molar entropy of formation was deduced by combining $\Delta_f H_m$ with the molar Gibbs free energy of formation obtained by (Knudsen effusion+mass spectrometry) and published elsewhere. (9 refs.)

102009 An estimation of the thermodynamic data of liquid transition metal based alloys. A.Pasturel, P.Hicter (Lab. de Thermodynamique et Phys.-Chimie Metallurgiques, Ecole Nat. Superieure d'Electrochimie et d'Electrometallurgie de Grenoble, St. Martin d'Heres, France), D.Mayou, F.Cyrot-Lackmann.
Scr. Metall. (USA), vol.17, no.7, p.841-6 (July 1983).
The thermodynamic data of transition metal-polyvalent metal alloys is interpreted from the filling of the d-band of the transition metal as it is alloyed with polyvalent metal. The alloying effect being essentially a chemical effect, a rigid band model is used in first approximation. The sp electrons are described by the free electron model while the d electrons are described in the tight binding approximation; more precisely, the density of d states was described using various geometrical models in conjunction with a moments technique. This approach enables the entropy and the enthalpy of mixing of these alloys to be determined simultaneously; it is shown, though the topological effect is of minor importance in these alloys, that the entropy of mixing is very sensitive to the shape of the density of d states. (14 refs.)

102010 Entropy of glassy and crystalline lithium acetate in relation to the Kauzmann paradox. N.O.Gonchukova (I.V. Grebenshchikov Inst. of Silicate Chem., Acad. of Sci., Leningrad, USSR).
Sov. J. Glass Phys. & Chem. (USA), vol.8, no.4, p.291-5 (July-Aug. 1982). Translation of: *Fiz. & Khim. Stekla (USSR)*, vol.8, no.4, p.429-34 (July-Aug. 1982). [received: May 1983]
On the basis of the results from measurements of the thermal capacity of lithium acetate the behavior of the entropy of a glass-forming liquid in the region of T_0, the temperature below which the extrapolated entropy becomes less than that of a crystal (Kauzmann's paradox), has been studied. It has been established that the entropy of the liquid decreases monotonically with temperature but remains greater than that of the crystal. (13 refs.)

102011 Connection between the excess thermodynamic functions of glassy As_2S_3 and As_2Se_3 at absolute zero and their structural features. S.V.Nemilov (S.I. Vavilov State Optical Inst., Leningrad, USSR).
Sov. J. Glass Phys. & Chem. (USA), vol.8, no.4, p.320-5 (July-Aug. 1982). Translation of: *Fiz. & Khim. Stekla (USSR)*, vol.8, no.4, p.465-71 (July-Aug. 1982). [received: May 1983]
The data on the thermal capacity of crystalline As_2S_3 above 300K, the values of the heat of the phase change in As_2S_3 at 471K, and the heat of melting have been refined. Using the data obtained in the literature and extrapolating the thermal capacities of As_2S_3 and As_2Se_3 to 0K in accordance with the thermal quantum theory of the thermal capacity of chain structures, the values of the entropy excess in relation to the crystal and of the free energy of As_2S_3 and As_2Se_3 glasses at 0K have been calculated. It is established that in the structural and energetic senses, glassy As_2S_3 is closer to the crystalline state than As_2Se_3. The latter circumstance is in good agreement with te results of an X-ray study and can be explained by the greater destruction of the layers in glassy As_2Se_3 than in As_2S_3. It is shown that the case of glassy B_2O_3, As_2S_3, and As_2Se_3 there is a correlation between the thermodynamic parameters ξ and λ which determine the closeness of the structure and energy in a glass and crystal, on the one hand, and the ratio of the free activation energies of viscous flow of these glasses below T_g to the rupture energy of the bridging bonds (E_η^*, T_g/E_d) which determine the degree of spatial branching of the framework, on the other. It is suggested that the greater retention in the glass structure of the laminar formations characteristic of a crystal correspond to larger ξ and λ and to smaller E_η^*, T_g/E_d. (29 refs.)

102012 The representation of thermodynamic properties in multicomponent alloys. I.Ansara (Lab. de Thermodynamique et Phys.-Chimie Metall., ENSEEG, Saint Martin d'Heres, France).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.107-14
In addition to theoretical models which have been developed to interpret the interactions in metallic systems, polynomials of different types have been used to represent the thermodynamic properties of solution phases. Ternary and higher order systems have been described by adding the properties of the limiting binary systems, using various summation methods; interaction parameters specific to the multicomponent systems can be derived from sufficiently precise experimental measurements. (25 refs.)

102013 The sublattice model. B.Sundman, J.Agren (Div. of Phys. Metall., Royal Inst. of Technol., Stockholm, Sweden).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.115-27
A thermodynamic model, based on the regular solution approximation is presented and a formalism, suitable for phases with an arbitrary number of elements and sublattices is described. A new concept, the component array, is introduced in order to simplify the analytical expressions for the Gibbs energy. The mathematical complexity of the model has been solved by the implementation of the model as a part of a general software system for thermochemical and phase diagram calculations by computer. The sublattice model is suitable for describing phases where the difference in size, charge or electronegativity causes a deviation from random mixing of the atoms in a manner which can be described as long range order. This is the case for interstitial solutions and many intermetallic phases, but also for ionic liquids and slag systems. The application of the model to several alloy systems is described. (11 refs.)

102014 Mathematical representation of size and electronic factors. L.Brewer (Dept. of Chem., Univ. of California, Berkeley, CA, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.129-34
The relative sizes of the atoms and their electronic configurations are important factors in determining the thermodynamic properties of metallic phases. The regular solution model provides for an asymmetric excess Gibbs energy when they is a size difference, but the actual degree of asymmetry does not correspond to crystallographic sizes. This is due in part to the effect of electronic configurations upon the asymmetry of the Gibbs energy. The Hume-Rothery Rules indicate that the BCC, HCP, and CCP structures are associated with characteristic outer-shell electron per atom concentrations. The electronic factors require modification of the usual definition of internal

pressure as used in the regular solution theory. Rather than using the energy of vaporization to the ground atomic state, the energy of vaporization to the valence state atom, which has the same electronic configuration as in the condensed state, is a more appropriate measure of the degree of cohesion and the internal pressure. The problems of providing mathematical expressions that accommodate the contributions of internal pressure, electronic factors, and size factors are discussed. (18 refs.)

102015 A pair-wise interaction model for multi-sublattice phases. J.N.Pratt, I.P.Jones (Dept. of Metall. & Materials, Univ. of Birmingham, Birmingham, England).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.135-48
The use of simple nearest neighbour pair-wise interaction models for the description of the thermodynamic properties of ordered alloys is reviewed and extended to the treatment of phases containing several sublattices. Employing individual sublattice occupation parameters to define atomic distributions, enthalpies corresponding to these are described by the summation of pair-wise interaction energies over all the resulting first coordinate shell neighbours. Invariant like and unlike bond energies are assumed, their respective values being estimated using heats of vaporisation of the elements and a heat of formation of the phase at a single composition. Combination of the enthalpies with corresponding configurational entropies yields an expression for the free energy of the phase which may be minimised with respect to variation of the sublattice occupation parameters. This leads to the prediction of the stable atomic distributions and the variation of these and the thermodynamic properties with composition. The application of the model to sigma phases and other multi-sublattice structures is discussed. (42 refs.)

102016 Association model for liquid alloys. F.Sommer (Max-Planck-Inst. fur Metallforschung, Stuttgart, Germany).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.163-73
The concentration and the temperature dependence of thermodynamic mixing functions of liquid alloys with compound formation tendency, which often exhibit large deviations from a regular behaviour, can be calculated according to an association model using only a few parameters which have a definite physical significance. The results obtained for binary and ternary alloy melts with one or more, simultaneously occurring, binary or ternary associates are in good accordance with the experimental values. For the calculation of phase diagrams, the association model enables a correct extrapolation into concentration and temperature regions for which no experimental results are available. The occurrence and the borderline of miscibility gaps in liquid alloys with strong compound forming tendency can be quantitatively described. (19 refs.)

102017 Prediction of solid+liquid equilibrium diagrams for binary mixtures forming solid solutions with an extremum. W.Brostow, M.A.Macip (Dept. of Materials Engng., Drexel Univ., Philadelphia, PA, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.217-22
Convenient methods of correlation and prediction of S+L diagrams exist only for systems forming eutectics. To deal with solid solutions, the model of strictly regular solutions of Guggenheim (1966) was adopted. The key assumption is that values of the Gibbs function of interchange w are different in the two coexisting phases: w_S and w_L. The assumption is based on the fact that the average interatomic distances $\bar{R}$ are also different, and this affects the averages of the interatomic (or intermolecular) potentials. The input parameters are enthalpies and temperatures of melting of pure components and any pair of experimental points on the diagram. For a number of binary alloy systems the agreement with the experiment is good. Calculations have also been made for organic mixtures, again with good results. (17 refs.)

102018 The calculation of free energies using computer simulation. N.Quirke (Dept. of Chem., Royal Holloway Coll., Egham, England).
Physics of Superionic Conductors and Electrode Materials. Proceedings of a NATO Advanced Study Institute on the Physics of Superionics Conductors and Electrode Materials, Odense, Denmark, 4-22 Aug. 1980 (New York, USA: Plenum Press 1983), p.197-210
For most constraints of interest, the thermodynamic potential or free energy of a system cannot be expressed as an average of a function of the microscopic variables and cannot therefore be calculated from a computer simulation in the same manner as the energy or pressure. Nevertheless, methods can be devised that enable free energies to be calculated from the results of computer simulations and the article briefly reviews some aspects of current work in this field. (30 refs.)

Alloy Phase Diagrams. Proceedings of a Symposium	See Entry 98652
Thermochemical properties [of titanium, its compounds and alloys]	See Entry 98664
A study of equilibrium points with application to constitutive modelling	See Entry 99055
Parametrization of the radial distribution function and thermodynamic properties of the restricted primitive model of electrolyte solutions	See Entry 101510
The chemical potential in non-ideal liquid mixtures. Computer simulation and theory	See Entry 101516
Thermodynamics and structure of simple dense fluids	See Entry 101519
Perturbation theory for equilibrium properties of a binary mixture of hard discs	See Entry 101520
Computer simulation of molecular dynamics of anisotropic fluids	See Entry 101546
Correspondence between the results of structural and thermodynamic studies of vitreous silica	See Entry 101581
Ab-initio calculations of phase diagrams of binary simple-metal alloys	See Entry 101912
Quantitative predictions from solid-state physics—what do phase diagram calculators want?	See Entry 101915
Freezing transition phenomena far from equilibrium	See Entry 101919
Evidence for a commensurate-incommensurate phase transition with an intermediate fluid phase: N_2 adsorbed on Ni(110)	See Entry 101955
Phase transitions and order parameters	See Entry 101963
Landau theory of cholesteric blue phases	See Entry 101969
Thermodynamic analysis of miscibility gap due to ordering in ternary systems	See Entry 101975
Unusual glassy smectic-G liquid crystal: heat capacity of N-p-n-pentyloxybenzylidene-p′-n-butylaniline between 11 and 393K	See Entry 101995
Atomic transport in dilute alloys containing interstitial defects	See Entry 102074
Theory of surface core-level shifts in metals	See Entry 102476
Kinetics of nitrogen dissolution in high-chromium melts of the iron chromium system	See Entry 103107
Phase equilibria and thermodynamic data for the Cu-S system	See Entry 103111
Calculation of the partial molar properties of ternary alloys from binary data using the shortest distance composition path	See Entry 103114
Coherent phase diagrams in the cluster variation approximation	See Entry 103116
A thermodynamic approach to the calculation of the C-Cr-Nb-Ni-W phase diagram	See Entry 103119
Thermodynamic factors in the extension of solid solubility in Al-based alloys	See Entry 103121
Paraequilibrium and other restricted equilibria	See Entry 103123
Thermodynamics of Na_2CO_3-$CaCO_3$-CaO slags for use in hot metal refining	See Entry 103124
Physical aging in polystyrene: comparison of the changes in creep behavior with the enthalpy relaxation	See Entry 103185
Temperature- and strain-rate dependence of the flow stress of ultrapure niobium single crystals in cyclic deformation	See Entry 103207
Analysis of the strength of copper over wide ranges of temperature and strain rate	See Entry 103248
Note on the prediction of the enthalpy of formation of solid compounds of the transition and noble metals with chalcogens and halogens	See Entry 103570
Thermodynamics of unsymmetrical electrolyte mixtures. Enthalpy and heat capacity	See Entry 103572
Thermodynamics of the unsymmetrical mixed electrolyte HCl-$LaCl_3$	See Entry 103573
Isopiestic studies of aqueous solutions at elevated temperatures. VII. $MgSO_4$ and $NiSO_4$	See Entry 103584
The CdS-$CuInSe_2$ solar cell interface: thermodynamic considerations	See Entry 103696

65.70 THERMAL EXPANSION AND THERMOMECHANICAL EFFECTS

(see also 64.30 Equations of state; for electronic thermal conduction, see 72.15 and 72.20; for thermal conductivity of superconductors, see 74.30E; for pyroelectric and electrocaloric effects, see 77.70)

102019 The effect of moisture on the expansion behaviour and thermal strains in GRP. F.R.Jones, M.Mulheron (Dept. of Metall. & Materials Technol., Univ. of Surrey, Guildford, England).
Composites (GB), vol.14, no.3, p.281-7 (July 1983). (Symposium on Environmental Effects on Fibre-Reinforced Plastics, London, England, 12-13 July 1983).
The temperature dependence of the linear expansion coefficients in the longitudinal (α_l) and transverse directions (α_{t1} and α_{t2}) of unidirectional glass fibre laminates and their matrix resins have been studied. A moisture phenomenon in the form of peaks in the $\alpha_m\ (T)/T$, $\alpha_t(T)/T$ and $\tan \delta/T$ curves for fully cured polyester resins and laminates has been identified. This observation accounts for the higher experimental thermal strains in polyester crossply laminates. An epoxy resin based laminate was insensitive to water within the timescale of the experiments. A difference between $\alpha(t_1)$ and $\alpha(t_2)$ has also been observed for partially cured polyester laminates, which is also perturbated by the presence of water. Both moisture effects are considered to result from a two-phase polyester matrix which continues to cure below the softening point of the resin. (12 refs.)

102020 Isobaric expansivity of liquids and its dependence on temperature. W.Brostow (Dept. of Materials Engng., Drexel Univ., Philadelphia, PA, USA), E.M.del Rocio Enriquez, A.L.Espiritu.
Mater. Chem. & Phys. (Switzerland), vol.8, no.6, p.541-52 (June 1983).
A number of relations between the isobaric expansivity α and temperature T have been studied, including the original Mendeleiev equation (1860), a modification of it proposed by the authors, and two versions of the Guggenheim-Lu-Ruether equation. Reliable experimental data for argon, mercury and a series of paraffins have been used for testing the relations. The generalized Mendeleiev formula provides satisfactory results. Even better ones are obtained from the Guggenheim-Lu-Ruether equation, provided the two parameters of the equation are not related to the acentric factor. Changes of these two parameters in the paraffin series related to chain conformations are discussed. (30 refs.)

102021 Anomalies of thermal expansion of solid solutions of iron in α-manganese. I.A.Nikanorova, A.S.Ilyushin (M.V. Lomonosov State Univ., Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1215-17 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of thermal expansion in the temperature range 15-300K in order to determine the relationship between the thermal properties, on the one hand, and the magnetic properties and long-range order on the other. A correlation was found between the Neel temperature and the long-range order coefficient representing the local distribution of iron atoms in the complex structure of α-manganese. (13 refs.) *A.T.*

102022 Thermal expansion anomalies of solid argon due to oxygen impurities. A.M.Tolkachev, V.G.Manzhelii, E.A.Kosobutskaya, A.N.Aleksandrovskii.
Fiz. Nizk. Temp. (USSR), vol.9, no.7, p.737-44 (July 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The linear expansion coefficients (LEC) of solid argon with 0.5, 1.0 or 3.0% O_2 are measured in the temperature range of 2 to 12K. The analysis of the concentration dependence of LEC indicates that in the concentration range between 1.85 and 3.4% O_2 there exists a two-phase region (supposedly a FCC-HCP one). Temperature dependences of an excess LEC ($\Delta\alpha$) in the FCC-phase are given by Schottky's curves with two-fold degenerate upper level and the splitting equal to 4.0 and 4.4K for solutions with 0.5 and 1%O_2, respectively. At low temperatures, the values of $\Delta\alpha$ appear to be unusually large, an order of magnitude larger than would be expected from the analysis of the energy spectrum of an oxygen molecule being in a cubic crystalline field. Using the temperature dependence of LEC in the two-phase region, the excess LEC of the HCP-phase is calculated. (22 refs.)

102023 X-ray study of the thermal expansion in $CuAlS_2$, and $CuGaS_2$, and $CuInS_2$ compounds over the temperature range from 90 to 650K. I.V.Bodnar, N.S.Orlova (Inst. of Phys. of Solids & Semiconductors, Acad. of Sci., Minsk, Belorussian SSR).
Phys. Status Solidi a (Germany), vol.78, no.1, p.K59-63 (16 July 1983).
The authors investigate the temperature dependence of the lattice parameters a and c, of the c/a axial ratio and determine the principal coefficients of thermal expansion for the $CuAlS_2$, $CuGaS_2$, and $CuInS_2$ compounds. (6 refs.)

Gold as a reliable internal pressure calibrant at high temperatures ....See Entry 99074

A mechanism of anode initiation of vacuum breakdown ....See Entry 101498

Study of structural relaxation of $ni_{78}Si_8B_{14}$ metallic glass by electrical resistivity and thermal expansion ....See Entry 101570

Effect of the third component on the technical and elastic properties of phosphorus-containing glasses ....See Entry 101585

Lattice parameters, thermal expansion coefficients, and vacancy density in solid CD_4 ....See Entry 101684

Thermoelastic analysis of hybrid fabric composites ....See Entry 101832

Phase relations and properties of lithium via molecular dynamics ....See Entry 101959

The fast-ion transition in FCC silver iodide ....See Entry 101962

Density studies in *N*(*p*-*n*-heptyloxy benzylidene)*p*-*n*-butyl aniline across S_G-S_C, S_C-S_A, S_A-*N* and *N*-*I* phases ....See Entry 101971

Compensation temperature in low density polyethylene β and γ relaxations as determined by thermally stimulated depolarization measurements ....See Entry 102811

Youngs modulus and linear expansion coefficient anomalies in 18Cr8Ni and 18Cr25Ni alloys at low temperatures ....See Entry 103190

Temperature dependence of mechanical and thermal expansion properties of T300/5208 graphite/epoxy ....See Entry 103191

Dynamic mechanical and thermomechanical properties of silicone-polycarbonate block copolymers ....See Entry 103200

Elastic moduli, hardness and thermal expansion of CaO-P_2O_5 and MgO-P_2O_5 glasses ....See Entry 103205

Local exothermic effects during failure of rubber ....See Entry 103334

65.90 OTHER TOPICS IN THERMAL PROPERTIES OF CONDENSED MATTER

Spin coated amorphous chalcogenide films: thermal properties ....See Entry 102217

Nonlinearities of laser heating of metals ....See Entry 103006

66.00 TRANSPORT PROPERTIES OF CONDENSED MATTER (NONELECTRONIC)

66.10 DIFFUSION AND IONIC CONDUCTION IN LIQUIDS

102024 A statistical mechanical theory of the self-diffusion coefficient of simple ions in electrolyte solutions. Chung Yuan Mou (Dept. of Chem., Nat. Taiwan Univ., Taipei, Taiwan), T.S.Thacher, Jeong-long Lin.
J. Chem. Phys. (USA), vol.79, no.2, p.957-63 (15 July 1983)
A statistical mechanical theory of the self-diffusion coefficient of ions in solutions of simple electrolytes has been developed. Beginning with a generalised Langevin equation the self-diffusion coefficients of ions may be evaluated at the zero-frequency limit of the Laplace transform of the random force correlation function. The authors assume that the random force acting on the tagged ion may be separated into contributions from the solvent part, due to the surrounding solvent molecules and an ionic part due to all the other ions. Further, they assume that the evolution of the ionic random force is governed by the Smoluchowski operator. With these assumptions and using the Debye-Huckel pair correlation function, the Onsager limiting law may be derived. Numerical calculations using the HNC pair correlation function shows that the authors' theory can describe experimental data of moderately concentrated solutions adequately. (18 refs.)

102025 Diffusion and mixing of passive impurities in a linear velocity field. V.P.Kabashnikov, A.A.Kurskov (Inst. of Phys., Acad. of Sci., Minsk, Belorussian SSR).
J. Eng. Phys. (USA), vol.43, no.6, p.1343-9 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.6, p.924-31 (Dec. 1982).
The mixing process is described by a Lagrangian Green's function. The latter is obtained at both the dynamical and the statistical levels, which permits application of the results to turbulent media. (14 refs.)

102026 Temperature dependence of self diffusion in liquid metals. R.P.Chhabra (Dept. of Chem. Engng., Univ. Coll. of Swansea, Swansea, Wales), T.Sridhar.
Phys. & Chem. Liq. (GB), vol.13, no.1, p.37-46 (1983).
After presenting a brief summary of previous work, Hildebrand's fluidity model (1977) for the liquid state has been combined with a general equation for self diffusion in liquids to elucidate the temperature dependence of self diffusion in liquid metals. The analytical form for the temperature dependence presented herein is obeyed by the sixteen metals for which experimental values of self diffusion coefficient at various temperatures are available in literature. A method for predicting self diffusion in liquid metals is suggested. (27 refs.)

102027 Algorithm for eliminating the systematic error in measuring the diffusion coefficient in liquid metals. S.L.Gol'dshteyn, S.P.Raspopin, G.B.Smirnov.
Russ. Metall. (GB), no.4, p.70-5 (1981). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.4, p.80-5 (1981). [received: June 1983]
An algorithm is proposed for eliminating from experimentally determined diffusion coefficients those with a considerable convection component. The algorithm is based on the assumption that the diffusion coefficients, both in the case of purely molecular-atomic and, in the case of convection diffusion has a normal distribution, as well as a knowledge of their range of possible values. Use of this algorithm gives unique information on the hydrodynamic state of the phase of the liquid metal. The effectiveness of the algorithm is illustrated by examples of the analysis of experimental data obtained for the Ce-Al, V-Zn, Mn-Zn systems. (4 refs.)

102028 Relationship between electrical conductivity, self-diffusion coefficients and ionic composition of alkali metal halide melts. V.A.Khokhlov, M.V.Smirnov (Inst. of Electrochem., Acad. of Sci., Sverdlovsk, USSR).
Sov. Electrochem. (USA), vol.18, no.10, p.1221-5 (Oct. 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.10, p.1373-8 (Oct. 1982).
Relationships are proposed which connect electrical conductivity and the self-diffusion coefficients of the component units of alkali metal halide melts with their ionic composition. The self-diffusion coefficients and transference numbers of the component units calculated on the basis of the auto-complex model of the structure of alkali metal halide melts from the experimental values of their electrical conductivity are in better agreement with the experimentally determined values than those found on the assumption of the simple ionic composition of these melts. (27 refs.)

102029 Diffusion of hydroxyl in alkali borate melts. P.I.Buler, T.A.Lisina, G.A.Toporishchev (S.M. Kirov Urals Polytech. Inst., Sverdlovsk, USSR).
Sov. J. Glass Phys. & Chem. (USA), vol.8, no.4, p.330-4 (July-Aug. 1982). Translation of: *Fiz. & Khim. Stekla (USSR)*, vol.8, no.4, p.478-83 (July-Aug. 1982). [received: May 1983]
A chronopotentiometric method has been used to determine the diffusion coefficient of hydroxyl (D_{OH}) in potassium, sodium, and lithium borate melts at 850-950°C. It is shown that the diffusion mobility of the hydroxyl depends largely on the composition of the melt; with 20-25 mole% R_2O there is a sharp increase in D_{OH}. The activation energy of diffusion increases with a decrease in the cation radius of the alkali metal and is 120-180 kJ/mole. The connection between the viscosity of the melt and the diffusion coefficients of the hydroxyl are more complex than the Stokes-Einstein equation requires. With 10-15 mole% K_2O and Na_2O, D_{OH} increases together with viscosity. The experimental data suggest that the hydroxyl diffuses in the form of autonomous OH groups. (12 refs.)

Nonequilibrium molecular dynamics via Gauss's principle of least constraint ....See Entry 101518

Computer simulation of molecular dynamics of anisotropic fluids ....See Entry 101546

Molecular weight and temperature dependence of self-diffusion coefficients in polyethylene and polystyrene melts investigated using a modified NMR field-gradient technique ....See Entry 102777

Prototropic charge migration in water. I. Rate constants in light and heavy water and in salt solution from oxygen-17 spin relaxation ....See Entry 103514

Prototropic charge migration in water. II. Interpretation of nuclear magnetic resonance and conductivity data in terms of model mechanisms ....See Entry 103515

66.20 DIFFUSIVE MOMENTUM TRANSPORT
(inc. viscosity of liquids)

102030 Comparisons between experimental argon and Lennard-Jones 12:6 shear viscosities. D.Fincham (DAP Support Unit, Queen Mary Coll., Univ. of London, London, England), D.M.Heyes.
Chem. Phys. (Netherlands), vol.78, no.3, p.425-41 (1 Aug. 1983).
A detailed description of the methodology for obtaining the shear viscosity of model liquids by nonequilibrium molecular dynamics computer simulation is made. This includes the choice of the algorithm for integrating the translational equations of motion. The method of virtual trajectories for obtaining the linear ('zero shear rate') shear viscosity is outlined. There is good agreement with recent measurements of the experimental shear viscosity of argon and the corresponding Lennard-Jones equivalent fluid, at high density and temperature. This data is combined with the self-diffusion coefficients via the Stokes-Einstein relationship and it suggests an increasing effective flow unit diameter with decreasing density. Insights into the detailed microscopic origins for this are provided by velocity and force autocorrelation functions, radial distribution and fluctuation functions, and structure factors. The use of fluctuation expressions for the shear moduli and viscosities compare unfavourably in statistical accuracy with those furnished by nonequilibrium molecular dynamics. (34 refs.)

102031 The viscidity of amorphous dysprosium-impure selenium. E.G.Akhundova.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.6, p.94-6 (1982). In Russian.
The viscidity of amorphous dysprosium-impure (0.05, 0.10, 0.50 weight per cent) selenium at 40, 45, 50, 61°C was investigated. The minimum values of the concentration dependence curves are obtained, which are supposedly assigned to the chain termination of selenium. (6 refs.)

102032 Kinematic viscosity of As_xSe_{1-x} glass forming liquids. A.Kadoun, G.Chaussemy, J.Fornazero (Lab. des Semiconducteurs non Critallins, Univ. Claude Bernard, Lyon I, Villeurbanne, France), J.M.Mackowski.
J. Non-Cryst. Solids (Netherlands), vol.57, no.1, p.101-8 (Aug. 1983).
The kinematic viscosity behaviour of As_xSe_{1-x} molten chalcogenides is relatively well described by an Arrhenius equation, $\nu=\nu_0\exp(W/k,T)$, for x betweeen 0 and 0.8. The $\nu(x)$ and $W(x)$ evolutions suggest that these liquids represent a polymeric structure even outside the easy glass forming region. The tendency of atoms to form separate molecules, previously observed in the As-S system, remains small and only cuses a slight inflexion in the $\nu(x)$ and $W(x)$ isotherm curves near $x=0.5$. (14 refs.)

102033 Temperature dependence of melt viscosity of polymers. V.E.Dobrescu, C.Radovici (Res. Inst. for Chem., ICECHIM, Bucharest, Rumania).
Polym. Bull. (Germany), vol.10, no.3-4, p.134-40 (July 1983).
The temperature dependence of steady-state melt viscosity of several polymers-semicrystalline and amorphous—in a broad temperature range has been studied. In many cases this dependence can not be expressed by an Arrhenius type equation. Breaks and slope changes have been observed. The influence of polymer morphology and molecular weight and the influence of pressure are presented. (11 refs.)

102034 Aspects of dispersion and flow in thermoplastic-elastomer blends. H.P.Schreiber, A.Olguin (Dept. of Chem. Engng., Ecole Polytech., Montreal, Quebec, Canada).
Polym. Eng. & Sci. (USA), vol.23, no.3, p.129-34 (Feb. 1983). [received: July 1983]
Polypropylene, polystyrene, EP (ethylene/propylene) rubber, and bromobutyl rubber were blended under standardized conditions and the sizes of minor phase domains determined by Quantimet analysis. Dispersion effectiveness

was found to depend on the melt viscosities of components under mixing conditions and on their 'compatibility' as inferred from surface-tension data. Dispersion was optimized when components wet readily at contact surfaces and when melt viscosities were similar. Shear heating during dispersion appeared to offer an empirical index of component compatibility. Apparent melt viscosities of the blends further reflected the component compatibility factor. (15 refs.)

102035 Flow birefringence and viscosity of chitozane solutions in acetic acid at various ionic power. S.Ya.Lyubina, I.A.Strelina, L.A.Nud'ga, Ye.A.Plisko, I.N.Bogatova.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.7, p.1467-72 (July 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The solutions of chitozane samples with MM ranging from 1×10^4 to 5×10^5 have been studied by viscometry and flow birefringence methods with variation of ionic power I of the solution. In isoionic solutions the linear dependence of reduced viscosity on the concentration of chitozane is observed in the 100-fold range of I values. The intrinsic viscosity is a linear function of $I^{-0.5}$. Unfolding of molecular chain during polyelectrolyte swelling results in 2-3-fold increase of optical anisotropy of the segment related with increasing of the length of the Kuhn segment. In the solutions under study chitozane macromolecules have the conformation of the swelled coil with dimensions and rigidity dependent on the I value. (15 refs.)

Symposium on the Rheological Properties of Polymers. 65th Chemical Conference of the Chemical Institute of Canada ....See Entry 98641

Shear modification of polymers ....See Entry 101163

Pressure dependence of Newtonian viscosity ....See Entry 101164

Highly elastic-constant viscosity fluids ....See Entry 101165

Solution properties of poly(N-butyl methacrylamide) ....See Entry 101531

Multiplexible liquid crystalline broad range systems ....See Entry 101547

Effect of the third component on the technical and elastic properties of phosphorus-containing glasses ....See Entry 101585

Mechanism of structural transformations in liquid metals ....See Entry 101940

The calculation of molecular interaction in phosphoryl chloride ....See Entry 102001

A theory on the electroviscous effect: a method for the estimation of the viscosity of dispersions of charged spherical colloidal particles ....See Entry 103594

66.30 DIFFUSION IN SOLIDS

102036 Diffusion of liquids into resins and composites. J.M.Marshall (Manchester Polytech., Manchester, England), G.P.Marshall, R.F.Pinzelli.
Chemtech (USA), vol.13, no.7, p.426-32 (July 1983).
How well plastics keep things in or out is vitally important in packaging. Life expectancy of polymers depends on the environment in which they are used. Consequently, it is important to be able to predict how materials move through plastics. The authors have developed a technique that uses radiolabeled diffusants to study the diffusion of liquids into thick sections of polymer and glass-fiber-reinforced laminates. This technique allows construction of concentration profiles of diffusants in the polymer at any time and calculation of diffusion coefficients from short-term data. (13 refs.)

Diffusion [in titanium and its alloys] ....See Entry 98668

Development and application of growth models for grain boundary allotriomorphs of a stoichiometric compound in ternary systems ....See Entry 103106

An analysis of the solidification of a binary eutectic system in consideration of both heat and solute diffusion ....See Entry 103133

Control of the steady creep in Ag-2.7 wt.% Al by dissolution-enhanced diffusion ....See Entry 103225

Thermal formation of SiO_2 films over NiSi, $NiSi_2$ and $CoSi_2$ via silicide decomposition ....See Entry 103363

Carbide-dispersion carburizing of Fe-Ni alloys containing titanium and vanadium ....See Entry 103377

66.30D Theory of diffusion and ionic conduction in solids

102037 Interstitial diffusion in the presence of substitutional traps. D.Farkas (Dept. of Materials Engng., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
Scr. Metall. (USA), vol.17, no.7, p.837-9 (July 1983).
Due to the technological interest of the diffusion process of interstitial species (H, C, N) in substitutional solutions several models have been developed. The assumptions underlying the different models are analysed. (13 refs.)

102038 Electronic model of fianites. V.V.Osiko, A.L.Shimkevich, B.A.Shmatko (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.939-41 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.351-4 (Nov. 1982).
Develops the theory of solid electrolytes with oxygen-ionic conductivity by describing their properties within the framework of the band theory of solids. It follows from the electron model of fianites that the EMF of an open galvanic circuit, first, is determined by the difference of Fermi levels at the boundaries of the oxide electrolyte and, secondly, is limited by the ratio of the band-gap width to the electronic charge. Since the Fermi level is in a linear relation with the work function χ_e, having experimentally determined the parameters ϵ_g, χ_e, and η_e the authors can establish the position of the Fermi level ε_F in the band-gap of the electrolyte and predict the change in the electron-hole conductivity of fianites when the thermodynamic properties of the environment change. (12 refs.)

Relaxations and high frequency diffusional processes in condensed media ....See Entry 99048

X-ray and dilatometric investigation of defect structure in strontium chloride ....See Entry 101689

Status of solid polymer electrolyte fuel cell technology and potential for transportation applications ....See Entry 103681

66.30F Self-diffusion in metals, semimetals, and alloys

102039 Diffusion of chromium and silicon in nickel solid-solution alloys of the Ni-Cr-Si system. G.R.Johnston (Defence Sci. & Technol. Organization, Dept. of Defence, Maribyrnong, Victoria, Australia).
High Temp.-High Pressures (GB), vol.14, no.6, p.695-707 (1982). [received: June 1983] (International Conference on Chemistry of Materials at High Temperatures, Harwell, Oxon., England, 7-10 Sept. 1981).
The diffusion of chromium and silicon in nickel-rich Ni-Cr-Si solid-solution alloys has been studied using both binary ($1323K \leq T \leq 1523K$) and ternary (1523K) diffusion-couple experiments. A new method has been used to represent diffusion in ternary alloys. 'Pseudo-binary' coefficients, Φ_{Cr} and Φ_{Si}, determined solely from the concentration profiles of the respective solutes, are plotted on three-dimensional diagrams to provide graphic illustrations of the concentration dependences of diffusion rates in ternary alloys. The two binary (D_{Cr} and D_{Si}) and the four ternary (D_{CrCr}, D_{SiSi}, D_{CrSi}, and D_{SiCr}) coefficients are generally consistent with predictions from existing diffusion models. Silicon was found to have a strong influence on its own diffusion rate, as well as on the diffusion rate of chromium. The significance of this work to the development of nickel-based alloys and coatings that are resistant to high-temperature corrosion is discussed. (35 refs.)

102040 One-dimensional-particle kinetics in a multicomponent alloy. The asymptotic time dependence of the mean-square displacement. R.A.Tahir-Kheli (Dept. of Phys., Temple Univ., Philadelphia, PA, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2257-60 (15 Aug. 1983).
The mean-square displacement, $\langle r^2(t)\rangle$, of a labeled particle hopping on a linear chain through a multicomponent dynamic background with vacancy concentration v is evaluated in the limit of extremely long times. The author finds $\langle r^2(t)\rangle = [2va^2/(1-v)^{1/2}](Jt/\pi)^{1/2}$, where J is a collective hopping rate given by $(\Sigma_\lambda x^\lambda/J^\lambda)^{-1}$. Here J^λ is the hopping rate and x^λ the concentration of the λth atomic species in the background. (22 refs.)

102041 Volume and intergranular self-diffusion of ^{59}Fe in CFC iron sulphur alloys. D.Treheux (Lab. Metall. Phys.-Materiaux, Ecole Centrale de Lyon, Ecully, France).
Scr. Metall. (USA), vol.17, no.7, p.933-6 (July 1983). In French.
The presence of sulphur gave rise to a diminution of the diffusion coefficients of the iron and to an important segregation of the sulphur in intergranular diffusion. Expressed in weight percent the alloys contained between 10.5×10^{-4} and $120\times10^{-4}\%$ of sulphur and between 8×10^{-4} and $10\times10^{-4}\%$ of carbon. For autodiffusion throughout the volume of the iron the Arrhenius equation was obeyed for the iron in the FCC FeS alloys. For the apparent intergranular self-diffusion of the iron in FeS alloys $10.5\times10^{-4}\%$ of sulphur had practically no effect, whereas lower diffusion coefficients were obtained with the higher sulphur concentrations. There was some indication that the types of segregation, pre-precipitation and precipitation of sulphur, are probably different at the grain boundaries of CC iron from those at the grain boundaries of FCC. (15 refs.) *R.S.*

Baroplastic effect in superplasticity ....See Entry 101847

Diffusion of Al-Cu alloy castings in homogenization ....See Entry 103178

66.30H Self-diffusion and ionic conduction in nonmetals

102042 Influence of oxygen partial pressure on the electrical conductivity of binary oxides CeO_2-HfO_2. E.Debray, P.Malou, B.Chappey (Univ. Paris-Val-de-Marie, Creteil, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.16, p.1239-41 (2 May 1983). In French.
The electrical conductivities of binary oxide CeO_2-HfO_2 containing 0,4,8,12,16, or 20 moles per cent of HfO_2, are measured at 1000-1400°C. They vary as the -1/n power of oxygen partial pressure, between 1 and 10^{-5} atm. Nevertheless, the coefficient, n, depends at the same time, on temperature and composition. The results for high contents of HfO_2, are consistent with formation of doubly ionized anionic vacancies at the time of reduction, but they are not generalizable for pure CeO_2 or low contents of HfO_2. (4 refs.)

102043 Ionic conduction of sulphide-based glasses in the systems M_2S-GeS_2-MI (M=Li,Ag). B.Carette (Lab. de Chimie des Materiaux, Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
Glass Technol. (GB), vol.24, no.3, p.157-60 (June 1983). (Symposium on Halide and other Nonoxide Glasses, Cambridge, England, 23-26 March 1982).
GeS_2 forms stable glasses with M_2S and MI (M=Li, Ag) over a large range of compositions: $1\text{-}z(xM_2S\text{-}(1\text{-}x)GeS_2)\text{-}zMI$ with $0<x<0.5$ and $0<z<0.5$. Measurements of glass transition temperature and Raman investigations show that the iodide anions remain outside the macromolecular chains. The electrical conductivity of these glasses has been measured from −40 to +100°C by the complex impedance method. The conductivity reaches a maximum value of 1.2×10^{-4} $(\Omega\ cm)^{-1}$ for lithium glasses and 6×10^{-3} $(\Omega\ cm)^{-1}$ for silver glasses at ambient temperature. The ionic transference number was found to be 1, showing that these materials are pure ionic conductors. (14 refs.)

102044 Electrical switching effects in Na_2O/SiO_2 glasses. E.E.Khawaja, M.N.Khan (Phys. Dept., Univ. of Petroleum & Minerals, Dhahran, Saudi Arabia), C.A.Hogarth.
Int. J. Electron. (GB), vol.55, no.2, p.303-5 (Aug. 1983).
A range of specimens in the form of thin blown films is shown to exhibit memory switching at an applied voltage of 8-10 V. (5 refs.)

102045 The migration energy of point defects in $Cd_{0.2}Hg_{0.8}Te$. A.V.Ghorshkov, F.A.Zaitov, F.K.Isaev, G.M.Shalyapina.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.5, p.91-3 (1982). In Russian.
The measurement of the activation energy for Hg selfdiffusion in $Cd_{0.2}Hg_{0.8}Te$ by interknot and vacancy mechanisms is shown. On the base of obtained data the approximate values of the migration energy for single and double charged interknot atoms and vacancies of Hg are given. (6 refs.)

102046 Field-assisted thermally stimulated current of mobile ions in a dielectric layer of a metal-oxide-semiconductor structure. T.Changhua, H.Mingzhen, W.Yangyuan (Dept. of Computer Sci. & Technol., Peking Univ., Peking, China).
J. Appl. Phys. (USA), vol.54, no.8, p.4398-404 (Aug. 1983).
A field-assisted thermally stimulated ionic current method has been used to investigate the transient currents associated with mobile ions in dielectric layers of metal-oxide-semiconductor (MOS) structures. Assuming Poole-Frenkel effect, an interface trapping model has been used to analyze *J-V* curves. Using a ramp voltage, analytic expressions for normalized *J-V* curves are obtained. The single energy model and distributed energy model have been analyzed. The most probable trapping depth of mobile ions, attempt-

to-escape frequency and trapping energy distribution of mobile ions may be determined from *J-V* curves. The experimental results are consistent with theoretical calculations. (9 refs.)

102047 **^{55}Fe diffusion in magnetite crystals at 500°C and its relevance to oxidation of iron.** A.Atkinson, M.L.O'Dwyer, R.I.Taylor (Materials Dev. Div., AERE Harwell, Didcot, England).
J. Mater. Sci. (GB), vol.18, no.8, p.2371-9 (Aug. 1983).
A computer-controlled sputter-sectioning apparatus is described which is particularly useful for self diffusion studies at 'low' temperatures (D in the range 10^{-12} to 10^{-19} cm^2 sec^{-1}). The technique has been applied to measure the diffusion coefficient of ^{55}Fe in the magnetite lattice as a function of oxygen activity at 500°C. The results are in broad agreement with an extrapolation of pre-existing high temperature diffusion data ($T>900$°C). The low temperature data have been used to estimate the rate constant for magnetite formation on iron in CO_2+1 vol.% CO at 500°C and this is found to be 250 times smaller than the experimentally measured value. This disagreement is probably attributable to diffusion along oxide grain boundaries during oxidation. The rate constant for the formation of magnetite during the oxidation of iron in oxygen has also been calculated from the diffusion data and is compared with the measured rate constant for temperatures between 325 and 1100°C. (20 refs.)

102048 **Ionic conductivity of Li_4SiO_4 solid solutions in the system Li_2O-Al_2O_3-SiO_2.** K.Jackowska, A.R.West (Dept. of Chem., Univ. of Aberdeen, Aberdeen, Scotland).
J. Mater. Sci. (GB), vol.18, no.8, p.2380-4 (Aug. 1983).
In the system Li_2O-Al_2O_3-SiO_2, Li_4SiO_4 forms two limited ranges of solid solutions: $Li_{4+x}Si_{1-x}Al_xO_4$: $O<x\lesssim0.4$, containing interstitial Li^+ ions and $Li_{4-3y}Al_ySiO_4$: $0\leq y\lesssim0.06$, containing Li^+ vacancies. The AC conductivity of polycrystalline samples of several compositions was measured over a range of frequency (2×10^2 to 5×10^4 Hz) and temperature (25 to 500°C). Both solid solutions, especially the Li^+ interstitial ones, have markedly higher conductivity than has stoichiometric Li_4SiO_4. This is due to an increase in the number of mobile ions and a decrease in the activation energy for conduction in the solid solutions. (19 refs.)

102049 **Electrical conductivity of the Li_2SO_4-Li_2CO_3 system.** V.K.Deshpande, K.Singh (Dept. of Phys., Nagpur Univ., Nagpur, India).
J. Power Sources (Switzerland), vol.10, no.2, p.191-5 (July 1983).
With a view to improving the electrical conductivity of Li_2SO_4 at the lowest possible temperature, Li_2CO_3 was added in the ratios of 10-90 mol.% and its conductivity was measured. The system LI_2SO_4-Li_2CO_3 has its eutectic at a composition of 60:40 mol.%; this composition has the maximum conductivity of the series, 2.43×10^{-3} (ohm cm)$^{-1}$ at 723K. The high conductivity may be due to the quasiliquid state of the mobile species within the sublattice. Further, the addition of 5 mol.% of LiCl to the eutectic gave rise to an increase in the conductivity, 1.13×10^{-3} (ohm cm)$^{-1}$ at 553K. This may be suitable as an electrolyte for application to power sources. (15 refs.)

102050 **Charge transport in $Sr_{1-x}La_xF_{2+x}$ solid solutions. An ionic thermocurrent study.** J.Meuldijk, H.W.Den Hartog (Solid State Phys. Lab., Univ. of Groningen, Groningen, Netherlands).
Phys. Rev. B (USA), vol.28, no.2, p.1036-47 (15 July 1983).
A comprehensive study of the relaxation of space charges in solid solutions of the type $Sr_{1-x}La_xF_{2+x}$ will be reported. In this investigation the authors have employed the ionic thermocurrent technique. LaF_3 concentrations between 0.01 and 42 mol.% have been used. They have paid attention to the resemblance between space-charge relaxation and ionic conductivity in heavily rare-earth-doped fluorite-type solid solutions. They will show that the enhancement of the conductivity and the shift of the space-charge relaxation band to lower temperatures with increasing rare-earth concentration can be explained with the same mechanism. Charge transport is supported by two kinds of interstitial jumps: free interstitial jumps occurring relatively far from a rare-earth ion and energetically more favorable dipolelike jumps of interstitial fluoride ions in the neighborhood of a rare-earth ion. They will also discuss the influence of the defect concentration on the degree of dissociation of the dipoles present and the effect of the concentration on the defect structure of the $Sr_{1-x}La_xF_{2+x}$ solid solutions. It will be made clear that the charge transport in rare-earth-doped fluorite-type ionic crystals is supported by a percolation mechanism. (47 refs.)

102051 **Superionic conduction in the solid-solution electrode $AgCrS_2$.** N.L.Sharma (Dept. of Phys. & Astron., Univ. of Georgia, Athens, GA, USA), T.Tanaka.
Phys. Rev. B (USA), vol.28, no.4, p.2146-51 (15 Aug. 1983).
The ionic conductivity of a mixed electron and ion conductor $AgCrS_2$ which undergoes an order-disorder phase transition is investigated with the use of a lattice-gas Hamiltonian with a weak-hopping term for its interacting-ion system. Exact results for the ionic conductivity obtained by making use of the exact Ising spin correlations on a half-filled honeycomb lattice agree very well with the known experimental results. (19 refs.)

102052 **Relations between crystal structures and ionic conductivity.** H.Schulz (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
Physics of Superionic Conductors and Electrode Materials. Proceedings of a NATO Advanced Study Institute on the Physics of Superionics Conductors and Electrode Materials, Odense, Denmark, 4-22 Aug. 1980 (New York, USA: Plenum Press 1983), p.5-26
High ionic conductivity combined with very low electronic conductivity has been observed in several crystals. Crystal structure analysis and the interpretation of diffuse X-ray scattering have been successfully applied in the investigation of the ionic conduction mechanism in such crystals. Ions may move easily and rapidly in crystals if their ionic radius fits into the cross sections of the conducting paths and if these paths connect regular lattice sites. The crystal field potential shows a rather weak variation along these diffusion paths. The regular lattice sites form local but shallow potential minima in such paths. These sites are not allowed to be completely occupied. The amount of underoccupancy ranges from about 1% to more than 50%. (28 refs.)

102053 **Thermodynamic and transport properties of superionic conductors and electrode materials.** J.H.Harding (Theoretical Phys. Div., AERE Harwell, Didcot, England).
Physics of Superionic Conductors and Electrode Materials. Proceedings of a NATO Advanced Study Institute on the Physics of Superionics Conductors and Electrode Materials, Odense, Denmark, 4-22 Aug. 1980 (New York, USA: Plenum Press 1983), p.27-40
The authors have considered the hopping model as a possible description of superionic conductors. It is clear that it is an idealisation; in many cases it may be adequate to consider groups of associated defects as a method of correcting for high defect concentrations but beyond this it seems necessary to move into some lattice gas type of model. The advantage, however, of the hopping model is that all the parameters it requires are calculable or can, in the case of the defect concentration, be estimated from experiment. This gives it a considerable advantage over the parameterised thermodynamic models in that one has a much clearer ability to test the assumptions built into the calculation against experiments. (20 refs.)

102054 **Molecular dynamics studies of superionic conductors.** A.Rahman, P.Vashishta (Argonne Nat. Lab., Argonne, IL, USA).
Physics of Superionic Conductors and Electrode Materials. Proceedings of a NATO Advanced Study Institute on the Physics of Superionics Conductors and Electrode Materials, Odense, Denmark, 4-22 Aug. 1980 (New York, USA: Plenum Press 1983), p.93-142
Structural and dynamical properties of superionic conductors AgI and CuI are studied using molecular dynamics (MD) techniques. The model of these superionic conductors is based on the use of effective pair potentials. To determine the constants in these potentials, cohesive energy and bulk modulus are used as input; in addition one uses notions of ionic size based on the known crystal structure. Salient features of the MD technique are outlined. Methods of treating long range Coulomb forces are discussed in detail. This includes the manner of doing Ewald sum for MD cells of arbitrary shape. Features which can be incorporated to expedite the MD calculations are also discussed. (68 refs.)

102055 **Monte Carlo study of solid electrolytes.** Y.Hiwatari (Dept. of Phys., Faculty of Sci., Kanazawa Univ., Kanazawa, Japan), A.Ueda.
Physics of Superionic Conductors and Electrode Materials. Proceedings of a NATO Advanced Study Institute on the Physics of Superionics Conductors and Electrode Materials, Odense, Denmark, 4-22 Aug. 1980 (New York, USA: Plenum Press 1983), p.211-19
A simple version of the soft-core model for simple liquids for superionic conductors is proposed. That is, the model potential is composed of only the soft-core and Coulomb potentials, Monte Carlo simulations for two solid electrolytes, α-AgI and CaF_2, are made using a fine-grained lattice for a 108-ion system and 324- or 96-ion systems, respectively, at several temperatures. For both systems the authors have observed sublattice disordering over an appropriate temperature range. They have obtained the partial pair distribution functions, one body distribution of ions and mean square displacement of ions as a function of the Monte Carlo time-step. Their results compare satisfactorily with experiments and molecular dynamics calculations. It is found for CaF_2 that as the temperature increases the fraction of anions in the tetrahedral locations shows a drop in magnitude over a narrow temperature range, and that results obtained for the fluctuations of potential energies in the superionic phase have a rather large system-size-dependency. (18 refs.)

102056 **Application of irreversible thermodynamics to mass transport in ionic conductors.** F.H.Horne (Dept. of Chem., Michigan State Univ., East Lansing, MI, USA).
Physics of Superionic Conductors and Electrode Materials. Proceedings of a NATO Advanced Study Institute on the Physics of Superionics Conductors and Electrode Materials, Odense, Denmark, 4-22 Aug. 1980 (New York, USA: Plenum Press 1983), p.257-71
Despite the almost universal acceptance of the non-equilibrium, or irreversible, thermodynamics (NET) of Onsager, most of the published research concerning ion transport relies on the Nernst-Planck equations. The Nernst-Planck equations ignore cross-effects due to both equilibrium and non-equilibrium interactions. However, cross-effects cannot be ignored in complete treatments of ion transport. In this paper, transport properties of binary electrolyte solutions are discussed. This discussion leads to explicit statements about the range of validity of the Nernst-Planck equations and of other approximations. Some analytical and numerical approaches to solving the isothermal transport equations for various boundary conditions are also considered; and the extension of the transport equations to nonisothermal systems is presented. (19 refs.)

102057 **Ion transport boundary conditions.** F.H.Horne, J.H.Leckey (Dept. of Chem., Michigan State Univ., East Lansing, MI, USA), J.W.Perram.
Physics of Superionic Conductors and Electrode Materials. Proceedings of a NATO Advanced Study Institute on the Physics of Superionics Conductors and Electrode Materials, Odense, Denmark, 4-22 Aug. 1980 (New York, USA: Plenum Press 1983), p.273-7
In theoretical studies of ion transport in heterogeneous systems it is convenient to employ kinetic boundary conditions of the form $j_i=k_{if}c_{i0}-k_{ib}c_{i\delta}$, for the flux j_i of ion i through an interface of thickness δ. The forward and reverse rate constants are k_{if} and k_{ib}, and c_i is the ion concentration. The purpose of this article is to determine the assumptions required for validity of boundary conditions of this type. (4 refs.)

Physics of Superionic Conductors and Electrode Materials. Proceedings of a NATO Advanced Study Institute on the Physics of Superionics Conductors and Electrode Materials .... See Entry 98655

Silver sulfide based glasses. I. Glass forming regions, structure and ionic conduction of glasses in Ge_2-Ag_2S and GeS_2-Ag_2S-AgI systems . See Entry 101568

X-ray diffraction study of the structure of silicate glasses. II. Alkali disilicate glasses .... See Entry 101573

Evaluation and meaning of ionic and dipolar lattice sums ...... See Entry 101627

Boundary conditions in the simulation of ionic systems .... See Entry 101630

Effect of impurities on the diffusion-controlled creep activation energy in MgO .... See Entry 101848

The fast-ion transition in FCC silver iodide .... See Entry 101962

Heat capacity of the solid electrolyte $Ag_{26}I_{18}W_4O_{16}$ .... See Entry 101997

Electronic model of fianites .... See Entry 102038

The influence of triazaindolisine on the microwave photoconductivity of AgBr emulsion grains .... See Entry 102453

Effect of hydrogen pressure on the nature of the conductivity of solid lithium hydride .... See Entry 102471

The $o\rightleftharpoons e$ light scattering during the flow of ionic current in α-$LiIO_3$ single crystals .... See Entry 102900

Silver sulfide based glasses. II. Electrochemical properties of GeS_2-Ag_2S-AgI glasses: transference number measurement and redox stabiity range .... See Entry 103535

Beta-alumina for sodium-sulphur batteries .... See Entry 103674

X-ray photoelectron spectroscopy studies of copper diffusion behaviour and related degradation phenomena in thin film CdS:Cu_2S solar cells .... See Entry 103698

66.30J Diffusion, migration, and displacement of impurities

102058 Analysis of moisture gradients in service and in the laboratory. E.C.Edge (Warton Div., British Aerospace plc, Preston, England).
Composites (GB), vol.14, no.3, p.189-95 (July 1983). (Symposium on Environmental Effects on Fibre-Reinforced Plastics, London, England, 12-13 July 1983).
Theoretical equations are presented for the direct calculation of moisture gradients. Using the given model, the effect and importance of the input frequency is shown. Spot values of the moisture gradient are calculated under typical conditioning regimes and under service conditions. The analysis appears to have potential, allowing choice of optimum laboratory methods to accelerate moisture uptake and the determination of typical moisture profiles. However, the work lacks experimental verification, which, for the larger, more transient moisture gradients, is beyond current measuring techniques. (8 refs.)

102059 Diffusion of small molecules in polymers. H.L.Frisch (Dept. of Chem., State Univ. of New York, Albany, NY, USA), S.A.Stern.
CRC Crit. Rev. Solid State & Mater. Sci. (USA), vol.11, no.2, p.123-187 (1983).
Reviews and discusses the phenomenology, theories, and methods of measurement of diffusion of small molecules in polymers. Both rubbery and glass penetrant-polymer systems are considered. The literature is surveyed through Spring 1980. (193 refs.)

102060 Oxygen transport through silica surface layers on silicon-containing ceramic materials. J.Schlichting (Inst. for Chem. Tech., Univ. Karlsruhe, Karlsruhe, Germany).
High Temp.-High Pressures (GB), vol.14, no.6, p.717-24 (1982). [received: June 1983] (International Conference on Chemistry of Materials at High Temperatures, Harwell, Oxon., England, 7-10 Sept. 1981).
The oxidation behaviour of the silicon ceramics ($MoSi_2$, SiC, Si_3N_4, SiAlON) as well as elemental silicon is controlled by the permeation of molecular oxygen through the SiO_2 surface layer. The correlation of the transport mechanism with the oxidation velocity is discussed in detail. Furthermore, it can be shown that the oxygen transport is dependent on the structure of the glassy or partly crystallized SiO_2 surface layer as well as its chemical composition. It is possible to decrease this oxygen transport by crystallization phenomena caused by additions of aluminium or titanium in the ceramics or to increase it by modifying the SiO_2 glass with Na_2O, MgO, or Y_2O_3. In addition to this the oxygen velocity is increased by atmospheric moisture which increases the oxygen transport in the SiO_2 surface layer. (42 refs.)

102061 Two-dimensional numerical analysis of impurity atom diffusion in semiconductors. A.Buonomo (Electrical Dept., Univ. of Calabria, Cosenza, Italy), C.di Bello.
IEEE Trans. Electron Devices (USA), vol.ED-30, no.7, p.857-60 (July 1983).
Linear two-dimensional diffusion of impurity atom through finite-dimension masks has been numerically examined. Numerical simulation results demonstrate the limits of the two-dimensional analytical diffusion model which was first employed in the well-known paper by Kennedy and O'Brien (1965). (10 refs.)

102062 Double-flow mechanism of In and Ag migration in $Cd_xHg_{1-x}Te$. A.V.Gorshkov, F.A.Zaitov, F.K.Isaev, G.M.Shalyapina.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.6, p.97-9 (1982). In Russian.
By the method of noted atoms the diffusion of indium and argentum in monocrystalline samples $Cd_{0.2}Hg_{0.8}Te$ has been investigated. It was established that in this case the diffusional process has low and fast components. The dependencies of coefficients of low and fast diffusion for indium and argentum on temperature are defined in the interval of 300-450°C. It was shown, that the fast component appearing was not related with the migration of diffusion along the accelerated path. (5 refs.)

102063 Diffusion of boron into polycrystalline silicon from a single crystal source. W.A.Rausch, R.F.Lever, R.H.Kastl (IBM General Technol. Div., Hopewell Junction, NY, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4405-7 (Aug. 1983).
Boron was outdiffused at 900°C from single crystal silicon into undoped chemical vapor deposited polycrystalline silicon. Boron concentration profiles measured by secondary ion mass spectrometry showed preferential segregation into the polysilicon with a segregation coefficient of 0.7. Pileup of boron at grain boundaries due to migration of boron ions in the interface field during the diffusion process can account for some of the observed segregation. (20 refs.)

102064 Concentration dependence of diffusion in liquid crystals. A new experimental approach. H.Hakemi (Dept. of Chem., Univ. of Sci. & Technol., Tehran, Iran).
J. Chem. Phys. (USA), vol.79, no.3, p.1434-8 (1 Aug. 1983).
The impurity diffusion of a chiral species into an aligned nematic film displays a unique textural behavior. A dynamical analysis of this type of texture provides a new approach to study the concentration dependence of the diffusion coefficients in liquid crystals. By a simple variable rearrangement in the solution to the Fick's Law, the authors evaluated the diffusion coefficients from the linear portion of the typical x_k^2/t-ln t plot at various measurable concentrations (pitches). The results showed an inverse law between the diffusion coefficient and the concentration of the diffusion profile. Extrapolation to zero concentration would give a good approximation to the self-diffusion coefficient of the nematic solvent. (11 refs.)

102065 Multizone modeling of impurity redistribution in ion-implanted materials. R.Kwor, C.Paz de Araujo (Dept. of Electrical Engng., Univ. of Notre Dame, Notre Dame, IN, USA).
J. Electrochem. Soc. (USA), vol.130, no.7, p.1580-6 (July 1983).
Implanted impurity redistribution has been observed during annealing of many ion-implanted materials. Experimental evidence suggests some position dependence in the redistribution process. The tail region of ion-implanted impurity profiles usually exhibits faster diffusion than the near-surface region. A multizone model for the redistribution of implanted impurities is presented. The implanted substrate is considered as a stratified medium with zones where a local diffusion equation is obeyed, and an effective diffusion coefficient is defined within each zone. The basic formulation of the model and its mathematical background are discussed. The multizone equations are solved using the Crank-Nicolson method. A computer program is used to generate a plot of the post-annealing redistributed impurity profile. The model is applied to the case of sulfur-implanted GaAs for dose range of 4×10^{13} to 4×10^{15} cm^{-2}, with energies of 120 and 300 keV. Good agreement is obtained between the computer generated profile and the SIMS experimental profile. (16 refs.)

102066 Evidence of divacancies in the diffusion of In in GaSb. D.Shaw (Dept. of Phys., Univ. of Hull, Hull, England).
J. Phys. C (GB), vol.16, no.23, p.L839-42 (20 Aug. 1983).
The experimental results of Mathiot and Edelin (1980) for the diffusivity of In in GaSb are interpreted in terms of two parallel diffusion mechanisms involving the divacancies (V_{Ga}-V_{Sb}) and (V_{Ga}-V_{Ga}). This interpretation provides a better fit to the experimental data than the V_{Ga} diffusion mechanism proposed by D. Mathiot and G. Edelin (1980). (9 refs.)

102067 Diffusion of nitric acid in rigid polyvinyl chloride. H.Kawaguchi (Faculty of Engng., Fukui Univ., Fukui, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.356, p.482-5 (May 1983). In Japanese.
It has been known that the creep strength of polyvinyl chloride (PVC) in conc. nitric acid is remarkably lower than that in air. This behavior has been explained from the viewpoint of the plasticizing effect of nitric acid in PVC. However, the diffusion process of nitric acid in PVC has not yet been made clear. The diffusion of conc. nitric acid in rigid polyvinyl chloride was studied experimentally by using the film-adhesion method which is similar to the film-roll method. The tests were carried out under unloaded and loaded conditions at temperatures 25 to 55°C. Under the unloaded condition, the diffusion process is Fickian and the surface concentration of nitric acid in PVC does not change with immersion time. The diffusion coefficients of nitric acid are in the range of 10^{-12}-10^{-11} cm^2/sec. In the case of tensile stress levels less than 75 kg/cm^2, the diffusion process is almost the same as that in the case of the unloaded condition at 40°C. At a stress level of 95 kg/cm^2, the diffusion process is non-Fickian where the surface concentration increases with immersion time. (7 refs.)

102068 Effect of cold working on the hydrogen trapping phenomena in pure iron. W.Y.Choo (Korea Advanced Inst. of Sci. & Technol., Seoul, Korea), Jai Young Lee.
Metall. Trans. A (USA), vol.14A, no.7, p.1299-305 (July 1983).
Hydrogen trapping in iron with various types and amounts of trapping sites was investigated through permeation experiments. The apparent hydrogen diffusivity decreases as the degree of cold working increases. This decrease is attributed to an increase in dislocation density and microvoid concentration. Analysis of the permeation data suggests that hydrogen binding energies of dislocation and microvoid are 25.6 kJ/mole and 29.1 kJ/mole, respectively. The data further show that the apparent hydrogen diffusivity increases as applied hydrogen pressure increases. Energy level diagrams around various trapping sites are proposed. (30 refs.)

102069 Deuterium transport and trapping in aluminum alloys. A.K.Zurek (Materials Phys., Rockwell Internat. Sci. Center, Thousand Oaks, CA, USA), R.Walser, H.L.Marcus.
Metall. Trans. A (USA), vol.14A, no.7, p.1307-12 (July 1983).
A simple model of diffusion and evolution of the density of deuterium in metals is presented. A model of the deuterium evolution in the presence of uniform and nonuniform distributions of traps, as well as perfectly reflecting and partially permeable boundary conditions, is discussed. The computer simulated deuterium distributions after some diffusion time are qualitatively compared with experimentally obtained results. Experimental results describe the deuterium distribution after fatigue crack growth of 2219 and 7075 aluminum alloys in a D_2O water vapor environment and after deuterium ion implantation. (24 refs.)

102070 Modeling of transport of small molecules in polymer blends: application of effective medium theory. J.Sax, J.M.Ottino (Dept. of Chem. Engng., Univ. of Massachusetts, Amherst, MA, USA).
Polym. Eng. & Sci. (USA), vol.23, no.3, p.165-75 (Feb. 1983). [received: July 1983]
The authors are concerned with the prediction of effective diffusion coefficients of small permeants in binary polymer blends of varying degrees of miscibility and microstructural order. Several models have been critically evaluated with the help of previously published experimental data and in terms of consistency of morphological information provided by small permeants serving as morphological probes. Completely random, two-phase media have been modeled in terms of effective medium theory with the coordination number (z) describing the average morphology. A comprehensive analysis of experimental data has shown a correlation between z and various physical situations. Near the percolation threshold, z attains a maximum value while, above it, z tends to decrease with increasing content of the conductive component. Accurate predictions of effective diffusivity can be made for volume fractions between 0.3 and 0.8 by letting $z=6$. Evidence for phase inversion was studied in terms of models with ordered microstructure and transport data. (25 refs.)

102071 Direct observation of boron diffusion using secondary ion mass spectrometry for SiC-coated molybdenum with a boron underlayer. M.Kitajima, M.Fukutomi, M.Okada (Tsukuba Lab., Nat. Res. Inst. for Metals, Ibaraki, Japan).
Thin Solid Films (Switzerland), vol.105, no.4, p.325-30 (29 July 1983).
SiC-coated molybdenum with a boron underlayer (about 1 μm thick) was microanalysed by secondary ion mass spectrometry (SIMS). The coated specimens were cycled 2100 times between 800 and 1000°C and then 560 times between 600 and 1200°C in air under thermocyclic conditions. It was found from the SIMS analyses that the SiC film was boron enriched and also that boron diffused into the molybdenum substrate. The boron underlayer appeared to cause an improvement in the mechanical properties of the SiC film and the molybdenum substrate, and consequently SiC-coated molybdenum with a boron underlayer exhibits high temperature stability in air. (11 refs.)

102072 Diffusion and permeation of vapors in composite polymer thin films. S.A.Jenekhe, J.W.Lin (Corporate Phys. Sci. Center, Honeywell Corporate Technol. Center, Bloomington, MN, USA).
Thin Solid Films (Switzerland), vol.105, no.4, p.331-42 (29 July 1983).
The moisture barrier properties of polyimide (PI) thin films used for passivation in microelectronic devices are poorer than those of many other polymers. The enhancement of the barrier properties of PI films obtainable by coating them with polymers of lower permeability to form multilayer composite membranes was investigated. The authors report a study of the diffusion and permeation of water vapor in four composite PI/polymer thin films: PI/polyethylene, PI/polyethylene-acrylic acid, PI/poly(chloro-*p*-xylylene). The temperature-dependent permeability coefficient of single-layer and composite thin films was measured and found to follow the Arrhenius relation with low activation energies (lower than 6 kcal mol^{-1}). Enhancement in the barrier properties by a factor of 4-6 at 30°C is attained when 2-3 μm PI films are coated with 2 μm films of the four polymers investigated. (18 refs.)

102073 Impurity diffusion in silicon annealed by semi-continuous laser. J.-E.Bouree, C.Leray, M.Rodot (CNRS, Meudon, France).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.221-7
The diffusion of an impurity into a solid which is irradiated by laser pulses of some milliseconds duration has been analysed in terms of effective diffusion time and temperature. In the case of Fe in Si, the diffusion coefficient is found to be similar to that measured by Collins and Carlson (1957), and independent of boron doping. In the case of Al in Si, a value of 2×10^{-10} cm^2/s at 1400°C has been found both for single crystals and for fine-grained polycrystals. (16 refs.)

Calculations of the binding of hydrogen to fixed interstitial impurities in nickel .... See Entry 101692

Profile estimation of an implanted-diffused arsenic layer in silicon .... See Entry 101738

Impurity distribution profiles and surface disorder after laser induced diffusion .... See Entry 101742

The measurement of the trap binding energy by the thermal analysis technique .... See Entry 101745

Theory of helium transport and clustering in materials under irradiation .... See Entry 101756

The influence of the addition of MgO on the surface mass transport of alumina .... See Entry 102158

Low temperature hopping diffusion in doped semi-conductors .... See Entry 102391

Influence of carbon and hydrogen segregation on the electrical properties of grain boundaries in polycrystalline silicon sheets .... See Entry 102423

Muons and muonium in solids .... See Entry 102794

Positrons and solid state physics .... See Entry 102989

On the accelerated ageing of CFRP .... See Entry 103179

Water absorption of glass/epoxy laminates under bending stresses .... See Entry 103213

The effects of water absorption on a polyester/chopped strand mat laminate .... See Entry 103267

Annealing and diffusion processes in thin film CdS/Cu$_2$S solar cells .... See Entry 103705

66.30L Diffusion, migration, and displacement of other defects

102074 Atomic transport in dilute alloys containing interstitial defects. A.R.Allnatt (Dept. of Chem., Univ. of Western Ontario, London, Ontario, Canada), A.Barbu, A.D.Franklin, A.B.Lidiard.
Acta Metall. (USA), vol.31, no.9, p.1307-13 (Sept. 1983).
Presents the results of a reworking of a previous kinetic analysis of the fluxes of solute atoms and of interstitial defects arising from concentration gradients in a dilute alloy of FCC structure (A. Barbu, Acta Metall, vol.28, p.499, 1980). Revised expressions are presented for the various phenomenological coefficients introduced in that previous paper. Although these algebraic forms in terms of the various defect jump frequencies show differences from those given earlier, their numerical values under typical illustration conditions are little altered. At the same time, the corresponding expressions for the more fundamental phenomenological coefficients defined by the nonequilibrium thermodynamics are presented; they satisfy the Onsager reciprocal relationship. A consequential linear relationship among three of Barbu's phenomenological coefficients is also presented. (18 refs.)

M-center growth in alkali halides: computer simulation .... See Entry 101701

Grain boundary motion in vanadium .... See Entry 101714

Annealing of defects in plastically deformed ^{4}He crystals .... See Entry 102113

Discontinuous γ' coarsening in a Ni-Al-Mo base superalloy . See Entry 103161

Temperature- and strain-rate dependence of the flow stress of ultrapure niobium single crystals in cyclic deformation .... See Entry 103207

66.30N Chemical interdiffusion

102075 Interaction of Pb-Er alloys with silicon. G.Ottaviani, K.N.Tu, R.D.Thompson (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA), J.W.Mayer, S.S.Lau.
J. Appl. Phys. (USA), vol.54, no.8, p.4614-22 (Aug. 1983).
In situ resistivity measurements together with MeV $^4He^+$ backscattering, X-ray diffraction, barrier height measurements, and Auger electron spectroscopy combined with Ar sputtering have been used to investigate the interaction of silicon with alloys of rare-earth and near-noble metals with annealing at temperatures up to 650°C. Alloys of Pd-Er with three different compositions have been prepared by dual electron-gun coevaporation on both *n*- and *p*-type silicon with alloys of rare-earth and near-noble metals with annealing at temperatures up to 650°C. Alloys of Pd-Er with three different compositions have been prepared by dual electron-gun coevaporation on both *n*- and *p*-type silicon and Pd/Er bilayers have been deposited on SiO$_2$. The results show that as-deposited these alloys are amorphous and the initial stages of the reaction with silicon upon annealing is controlled by the metal-metal interaction as well as the metal-silicon interaction. The Er-rich alloy (Pd$_{15}$Er$_{85}$) segregates Er to the silicon interface and forms Pd$_2$Er$_5$. For the Pd-rich alloy (Pd$_{65}$Er$_{35}$) the excess Pd is segregated at the silicon surface forming Pd$_2$Si. The near 50-50 alloy forms PdEr and a slightly higher temperature is necessary to promote the reaction with silicon to form the silicide of the excess component. (20 refs.)

102076 Reduction of contact resistivity by As redistribution during Pd$_2$Si formation. I.Ohdomari, M.Hori, T.Maeda, A.Ogura, H.Kawarada, T.Hamamoto, K.Sano (School of Sci. & Engng., Waseda Univ., Tokyo, Japan), K.N.Tu, M.Wittmer, I.Kimura, K.Yoneda.
J. Appl. Phys. (USA), vol.54, no.8, p.4679-82 (Aug. 1983).
The authors have investigated the redistribution of uniformly doped As atoms ($N_D=4.0\times10^{19}$ cm^{-3}) in Si during Pd$_2$Si formation with neutron activation analysis and the influence of the redistribution on contact resistivity. Some of the uniformly doped As atoms are pushed ahead into Si near the silicide-silicon interface during Pd$_2$Si formation at 250°C. The amount of the redistributed As atoms increases with the thickness of Si consumed and reaches a peak concentration of 2.0×10^{20} cm^{-3}. Contact resistivity is reduced from the initial values of 3.8×10^{-5}-4.1×10^{-4} Ω cm^2 before silicide formation, to a final value of 1.8×10^{-6} Ω cm^2 after complete reaction. The electrically active As atoms is estimated to be 50% of the total redistributed. (12 refs.)

102077 Formation of an amorphous alloy by solid-state reaction of the pure polycrystalline metals. R.B.Schwarz, W.L.Johnson (W.M. Keck Lab., California Inst. of Technol., Pasadena, CA, USA).
Phys. Rev. Lett. (USA), vol.51, no.5, p.415-18 (1 Aug. 1983).
Single-phase Au$_{1-x}$La$_x$ alloys, with $0.3\lesssim x\lesssim0.5$, have been formed through solid-state interdiffusion of pure polycrystalline Au and La thin films (100-600 Å) at temperatures of 50-80°C. The reaction is driven by the large negative heat of mixing in the amorphous alloy and occurs at low temperature by the anomalously fast diffusion of Au in La. The composition regime giving a single-phase amorphous product is explained with use of a free-energy diagram. (12 refs.)

102078 The diffusion of salt solutions into nylon-6. R.P.Burford, E.Harrauer (School of Chem. Engng. & Industrial Chem., Univ. of New South Wales, Kensington, NSW, Australia).
Polymer (GB), vol.24, no.8, p.1001-7 (Aug. 1983).
The transport kinetics and concentration profiles of zinc chloride and lithium bromide into nylon-6 have been investigated. Polymers were soaked in solutions of a known concentration for varying lengths of time, and cross-sectional analysis of each sample was then carried out using the energy dispersive X-ray (EDA) technique, supplemented by microprobe (wavelength dispersion, WDA) and atomic absorption data. Broad agreement was obtained between EDA and WDA techniques when depth of penetration and concentration profiles were measured on the same samples, and estimates of salt concentrations in nylon were similar for both the WDA and atomic absorption methods. When the concentration of aqueous zinc chloride solution was increased, a transition from anomalous to Case II behaviour was observed. Lithium bromide transport was poorly defined by comparison, in keeping with a different mechanism of association to the polymer. (23 refs.)

102079 Solid state interaction between thin chromium films and silicon—a comparison between amorphous and single-crystal silicon. A.P.Botha, S.Kritzinger (Dept. of Phys., Univ. of Stellenbosch, Stellenbosch, S Africa), R.Pretorius.
Thin Solid Films (Switzerland), vol.105, no.3, p.237-49 (22 July 1983).
The interaction of a vacuum-deposited thin chromium film with both Si⟨100⟩ and amorphous silicon (a-Si) during heating was studied by means of electron microscopy, electron diffraction and Rutherford backscattering. Measurements on free polycrystalline chromium films alone revealed that the chromium grain size increases with the thickness of the chromium film, but that very little grain growth occurs when the temperature is increased. A phase change in the chromium crystal structure from simple cubic to BCC was detected around 550°C. During Cr-Si interaction, in cases where an unlimited supply of silicon is provided, CrSi$_2$ forms on both single-crystal silicon and a-Si at temperatures around 450°C, i.e. well below 550°C. However, when the silicon supply is limited, a metal-rich phase (Cr-Si$_3$) develops from the CrSi$_2$ and the excess chromium at 550°C. (22 refs.)

Epitaxial NiSi$_2$ formation by pulsed laser irradiation of thin Ni layers deposited on Si substrates .... See Entry 102188

Degradation mechanism of Mo/GaAs$_{0.6}$P$_{0.4}$ Schottky barriers .... See Entry 102492

Flux pinning in interdiffusing thin films .... See Entry 102596

Temperature-dependent ion mixing and diffusion during sputtering of thin films of CrSi$_2$ on silicon .... See Entry 103016

The solid-state reaction of copper and tin: an assessment of the value of an iron barrier layer .... See Entry 103400

The fatigue properties of mild steel with surface diffusion coatings of nickel-iron and nickel-cobalt-iron alloys .... See Entry 103401

Degradation of the performance of Cu$_2$S/CdS solar cells due to a two-way solid state diffusion process .... See Entry 103701

66.30Q Electromigration

102080 Electromigration in CeO$_{2-x}$. F.Millot, N.A.Younes, P.Gerdanian (Lab. des Composes Non-stoechiometriques, Univ. de Paris-Sud, Orsay, France).
High Temp.-High Pressures (GB), vol.14, no.6, p.725-8 (1982). [received: June 1983] (International Conference on Chemistry of Materials at High Temperatures, Harwell, Oxon., England, 7-10 Sept. 1981).
Discusses the values of the effective charge number Z^* obtained from experiments of electromigration in CeO$_{2-x}$. It is first shown that the electron wind force cannot contribute significantly to the redistribution of oxygen in CeO$_{2-x}$. The almost constant value of 2 obtained for Z^* in these experiments is interpreted in terms of a preferential diffusion of doubly ionized vacancies which are not necessarily the majority defect in CeO$_{2-x}$. (26 refs.)

66.70 NONELECTRONIC THERMAL CONDUCTION AND HEAT-PULSE PROPAGATION IN NONMETALLIC SOLIDS

(for thermal conduction in solid metals, see 72.15C and 72.15E; for statistical mechanics of lattice vibrations, see 63.70)

102081 Nonlinear nonclassical boundary problem for thermal conductivity of crystalline media. Yu.M.Kolyano, I.O.Goi.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.5, p.6-9 (1983). In Ukrainian.
A procedure is suggested for determining the nonstationary generalized temperature fields in crystalline bodies and thin plates whose thermal characteristics depend on temperature. The bodies considered are heated by radiation and internal heat sources. (7 refs.)

102082 Surface resistance dominated thermal transport in thin specimens. G.Dharmadurai (Reactor Phys. Section, Reactor Res. Centre, Tamil Nadu, India).
J. Appl. Phys. (USA), vol.54, no.8, p.4664-5 (Aug. 1983).
The effective thermal conductivity of a rarefied gas bounded by two solid surfaces is shown to be dominated by the two surface thermal resistances. Using an analogous picture, it is demonstrated that the thermal transport in a thin solid specimen under ballistic phonon propagation is as well dictated by the thermal boundary resistances of the relevant interfaces, resulting in an effective thermal conductivity proportional to the thickness of the specimen. The implications of the results are discussed. (11 refs.)

102083 Thermophysical properties of quartz glass. O.A.Sergeev, A.G.Shashkov, A.S.Umanskii (All-Union Sci.-Res. Inst. of Metrological Surface, Moscow, USSR).
J. Eng. Phys. (USA), vol.43, no.6, p.1375-83 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.6, p.960-70 (Dec. 1982).
Available experimental data on the thermal conductivity, specific heat, and thermal diffusivity of quartz glass over the temperature range 60-1100K are generalized. Empirical equations describing the temperature dependence of these thermophysical parameters are presented. (40 refs.)

102084 Low-temperature lattice thermal conductivity of heavily deformed metallic alloys. F.L.Madarasz (Universal Energy Systems, Dayton, OH, USA), F.Szmulowicz.
Phys. Rev. B (USA), vol.28, no.4, p.1763-71 (15 Aug. 1983).
Lattice thermal conductivity in Cu-Al alloys is calculated for the first time within a two-dimensional formalism involving the scattering of phonons by strain fields of finite spatial extent around randomly oriented dislocations of edge and screw character. For the finite strain fields, scattering widths indicate that long-wavelength phonons scatter very weakly. In addition to phonon scattering by the strain field around the dislocation, phonon-electron scattering is included to obtain the overall phonon relaxation rate. Comparison is made between the calculated results and measurements on the commercial alloy Evanohm. Evanohm has a very high residual resistivity and thus possesses a low electronic thermal conductivity. Therefore, the phonon contribution to the thermal conductivity may be unambiguously identified for this alloy unlike the situation encountered for most other alloys at very low temperatures. The calculated lattice thermal conductivity is found to depart from the usual T^2 dependence in general agreement with the measurements on Evanohm. (29 refs.)

102085 Calculation of the thermal conductivity of glasses. Yu.V.Vavilov, V.E.Komarov, N.A.Tabunova.
Sov. J. Glass Phys. & Chem. (USA), vol.8, no.4, p.326-30 (July-Aug. 1982). Translation of: *Fiz. & Khim. Stekla (USSR)*, vol.8, no.4, p.472-7 (July-Aug. 1982). [received: May 1983]
By contrast with the usual methods of calculation of the thermal conductivity of glasses in relation to their chemical composition, the proposed method is based on contemporary theories of heat transport in solids and on taking into account the additional thermal resistivity which arises when phonons are scattered on the modifier atoms. This method can be recommended for calculating with an average error of 5% the thermal conductivity of newly synthesized glasses of any composition and also for analyzing the effect of individual components of the glass on its thermal conductivity. (17 refs.)

Thermal conductivity in the diatomic Toda lattice ....See Entry 99060

Cryostat for combined investigation of kinetic and photoelectrical properties of semiconductors within the range from 2 to 650K .... See Entry 99111

Calculation of the temperature regimes for the fine anneal of quartz discs ....See Entry 101026

Kinetics of systems with crystal structure .... See Entry 101837

Heat capacity and thermal conductivity of semiconducting $PtSb_2$ in the range 4.2-300K ....See Entry 102000

Solar energy—its contribution to the future energy supply of the Federal Republic of Germany .... See Entry 103648

Temperature conductivity of calcite, hornblende and crystalline shale at a pressure of up to 8 GPa ....See Entry 104342

67.00 QUANTUM FLUIDS AND SOLIDS; LIQUID AND SOLID HELIUM

(see also 05.30 Quantum statistical mechanics)

67.20 QUANTUM EFFECTS ON THE STRUCTURE AND DYNAMICS OF NONDEGENERATE FLUIDS

102086 Quantisation of flows of an ideal fluid. V.K.Tkachenko (Inst. of Solid-State Phys., Acad. of Sci., USSR).
Theor. & Math. Phys. (USA), vol.53, no.2, p.1150-1 (Nov. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.2, p.318-20 (Nov. 1982).
The possibility of solenoidal flow of an ideal quantum fluid without singularities is demonstrated. This is done by means of the formalism of diffeomorphism groups. (7 refs.)

67.40 BOSON DEGENERACY AND SUPERFLUIDITY OF HELIUM-4

102087 Friction on quantized vortices in helium II. A review. C.F.Barenghi, R.J.Donnelly (Dept. of Phys., Univ. of Oregon, Eugene, OR, USA), W.F.Vinen.
J. Low Temp. Phys. (USA), vol.52, no.3-4, p.189-247 (Aug. 1983).
The authors present an analysis of recent data on friction and drag on quantized vortices in helium II. From these data, they deduce values of the phenomenological and microscopic coefficients of friction on vortex lines and rings over a wide range of temperatures at the saturated vapor pressure. The authors demonstrate that the microscopic parameters are unusually sensitive to the input data. They include brief discussion of the vortex core parameter, and present the results of precision fits of a number of thermodynamic and transport properties of He II which are used in mutual friction calculations. (54 refs.)

102088 Superfluid helium-4 film flow at 11 mK to 1.6K. M.W.Toft, J.G.M.Armitage (Dept. of Phys., Univ. of St. Andrews, St. Andrews, Scotland).
J. Low Temp. Phys. (USA), vol.52, no.3-4, p.343-59 (Aug. 1983).
Experiments on helium-4 film flow over a stainless steel beaker rim have been carried out in the temperature region 11 mK to 1.63K. A study of oscillation damping and low-velocity steady state flow provides the first evidence of dissipation at 'subcritical' transfer rates below 1K and suggests that a dissipation mechanism other than irreversible heat exchange between the bulk liquid reservoirs or the thermal nucleation of vortices and their subsequent transport across the stream is in operation. Flow experiments involving step-function changes in the chemical potential difference between the ends of the film confirmed the existence of a range of metastable 'critical' transfer rates at all temperatures but failed to demonstrate a preferred rate structure. The variation of the mean critical rate with temperature corroborated the results of other workers above 63 mK and extended these measurements to lower temperatures. (40 refs.)

102089 Estimating the intensity of heat transfer to supercritical helium when the specific variation of the thermophysical properties is taken into account. V.G.Pron'ko, G.P.Malyshev (Moscow Sci. & Industrial Assoc. of Helium Technol., Moscow, USSR).
J. Eng. Phys. (USA), vol.43, no.6, p.1350-3 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.6, p.932-5 (Dec. 1982).
The authors carry out an analysis of the rules for averaging the thermophysical properties of helium, and on the basis of this analysis they propose a generalizing function for calculating the intensity of heat transfer. (14 refs.)

102090 Low-frequency oscillations of vortices in rotating He II. E.B.Sonin (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.2, p.100-3 (20 Jan. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.2, p.82-4 (20 Jan. 1983).
The low-frequency branch of the spectrum of oscillations of a stack of disks in rotating He II with large angular velocities corresponds to excitation of an inertial wave, a well known phenomenon in hydrodynamics of rotating classical fluids, in the volume between the disks. This agrees with the results of experiments by Andereck, Chalupa, and Glaberson (1980). (7 refs.)

102091 Inelastic neutron scattering of helium II below 1K. N.M.Blagoveshchenskii, I.V.Bogoyavlenskii, L.V.Karnatsevich, Zh.A.Kozlov, Yu.Ya.Milenko, V.A.Parfenov, A.V.Puchkov.
JETP Lett. (USA), vol.37, no.3, p.184-7 (5 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.3, p.152-4 (5 Feb. 1983).
The temperature dependence of the density of the Bose condensate and of the average kinetic energy per atom in liquid helium has been found through an analysis of neutron inelastic-scattering spectra. The results are discussed. (9 refs.)

102092 The non-equilibrium condensation of spin$^1/_2$ lattice bosons. P.Fazekas, P.Entel (Inst. fur Theoretische Phys., Univ. zu Koln, Koln, Germany).
Phys. Lett. A (Netherlands), vol.97A, no.1-2, p.55-8 (8 Aug. 1983).
A lattice gas model is introduced to study the condensation of bosons possessing two internal states ('spin'). The population of the internal states is out of equilibrium, as suggested for spin-polarized hydrogen. The authors discuss how the presence of two kinds of bosons affects the two condensation temperatures. (8 refs.)

102093 Energy spectrum and hydrodynamics of superfluid He II in a strong electric field. P.N.Brusov, E.D.Gutliansky, V.N.Popov (Res. Phys. Inst., Rostov-on-Don State M.A. Suslov Univ., USSR).
Phys. Lett. A (Netherlands), vol.97A, no.1-2, p.59-60 (8 Aug. 1983).
A strong electric field changes the energy spectrum of elementary excitations in superfluid helium and makes it anisotropic. It is shown that the electric field influences the superfluid hydrodynamics as well, diminishing the superfluid current orthogonal to the field. (5 refs.)

102094 Viscous damping of second sound near the lambda point of liquid ^{4}He. R.A.Ferrell (Dept. of Phys. & Astron., Univ. of Maryland, College Park, MD, USA), J.K.Bhattacharjee.
Phys. Rev. Lett. (USA), vol.51, no.6, p.487-9 (8 Aug. 1983).
The theoretical second-sound damping in ^{4}He II is too small in the background region by 40%. Viscous damping in the normal fluid is identified as the origin of the missing attenuation. Because of simple two-fluid kinematics, this damping grows below the λ point as the superfluid density. The strength of the damping is determined by the coefficient of bulk viscosity, which is already known from the measured background first-sound damping above the λ point. (12 refs.)

102095 Rotons and the density matrix of liquid ^{4}He. S.Battaini, L.Reatto (Istituto di Fisica, Univ. degli Studi di Parma, Parma, Italy).
Phys. Rev. B (USA), vol.28, no.3, p.1263-7 (1 Aug. 1983).
A density matrix for liquid ^{4}He is constructed starting from the elementary-excitation picture. Rotons are described by the Feynman-Cohen wave function. This generalizes Penrose's form for the density matrix that is based on the Feynman form for the wave function. Backflow introduces explicit temperature-dependent three- and four-body correlations in the density matrix in the coordinate representation. The authors have computed the effect of the backflow terms, with the omission of the four-body one, on the structure factor $S(k,T)$ on the basis of the random-phase approximation and of the convolution approximation for the triplet structure factor. They find improved agreement with experiment on the temperature dependence of $S(k,T)$. (16 refs.)

A cryostat for investigating inelastic scattering of neutrons on liquid He^4 between 4.2 and 0.5K ....See Entry 99108

Hydrogen and deuterium atoms, stabilized by condensation of an atomic beam in superfluid helium .... See Entry 100581

On the crystalline, liquid, glassy, gaseous, and superfluid states of simple substances ....See Entry 101925

67.50 FERMI FLUIDS; LIQUID HELIUM-3

102096 Anisotropic superfluidity of liquid ^{3}He (fundamental theoretical notions). M.Odehnal (Fyzikalmi Ustav CSAV, Praha, Czechoslovakia).
Cesk. Cas. Fyz. Sekce A (Czechoslovakia), vol.33, no.3, p.209-36 (1983). In Czech.
The article reviews fundamental physical notions of the superfluid phases of liquid ^{3}He. The author discusses the order parameters of various phases, forces orienting the vectors characterizing different phases of ^{3}He, topological singularities and textures, anomalous transverse and longitudinal nuclear magnetic resonances, collective modes and static properties of new phases A, A_1 and B of superfluid ^{3}He. (36 refs.)

102097 The effective mass and the specific heat of normal liquid ^{3}He. V.K.Mishra, G.E.Brown (Dept. of Phys., State Univ. of New York, Stony Brook, NY, USA), C.J.Pethick.
J. Low Temp. Phys. (USA), vol.52, no.5-6, p.379-96 (Sept. 1983).
The behavior of the specific heat of liquid ^{3}He as a function of temperature implies a rapid variation of effective mass with energy. Recently a model has been developed for understanding this. The authors extend this model to explain the low-temperature ($T \leq 100$ mK) specific heat measurements of normal liquid ^{3}He by Greywall (1983). They find that the model gives a reasonably accurate description of the data in this temperature range. (17 refs.)

102098 Thermal expansion, velocity of sound, and compressibility in liquid ^{3}He under pressure. P.R.Roach, Y.Eckstein, M.W.Meisel, L.Aniola-Jedrzejek (Solid State Sci. Div., Argonne Nat. Lab., Argonne, IL, USA).
J. Low Temp. Phys. (USA), vol.52, no.5-6, p.433-47 (Sept. 1983).
The authors have measured the pressure at constant volume $P_v(T)$, of liquid ^{3}He as a function of temperature from 10 to 600 mK and at starting pressures from 1.6 to 28.1 bar. Simultaneously, they determined the hydrodynamic sound velocity c_1, at the same pressures and temperatures. From this data they have derived very accurate values of the isobaric expansion coefficient α_p and the adiabatic compressibility κ. (17 refs.)

102099 Textures and spin waves in rotating superfluid ^{3}He-B. K.W.Jacobsen, H.Smith (Phys. Lab. I, H.C. Orsted Inst., Univ. of Copenhagen, Copenhagen, Denmark).
J. Low Temp. Phys. (USA), vol.52, no.5-6, p.527-37 (Sept. 1983).
The spin wave modes in rotating superfluid ^{3}He-B have been calculated for a texture of cylindrical symmetry. The textural configuration is determined by minimizing the appropriate free energy and solving the resulting Euler-Lagrange equations for the **n** vector. The texture determines the effective potential entering the spin wave equation. The potential deviates significantly from a harmonic oscillator under realistic experimental conditions, giving rise to shifts of the oscillator frequencies. The agreement with the recent experimental observations of Ikkala et al. (1982) is excellent at all temperatures studied. (11 refs.)

102100 Vortices and NMR in rotating ^{3}He-B. S.Theodorakis, A.L.Fetter (Dept. of Phys., Stanford Univ., Stanford, CA, USA).
J. Low Temp. Phys. (USA), vol.52, no.5-6, p.559-91 (Sept. 1983).
The core structure of singly quantized vortices in ^{3}He-B is studied in the Ginzburg-Landau regime. For zero magnetic field, variational estimates indicate a core anisotropy; the gap is suppressed along the component of **n** in the plane perpendicular to the vortex axis within a core of radius $\sim 6\xi$. For large fields ($\sim$300 Oe) parallel to the vortex axis, a similar transverse anisotropy occurs, but its azimuthal direction is degenerate to leading order. The effective coupling constant λ in a rotating system arises from the kinetic energy of the flow, with anisotropy contributions smaller by two orders of magnitude. Predictions about the transverse NMR are compared with the observed resonances; detection of the corresponding longitudinal modes could help confirm the theoretical description. (16 refs.)

102101 Orbital angular momentum in *B* phase of ^{3}He and its effect on the texture in a rotating vessel. G.E.Volovik, V.P.Mineev (L.D. Landau Inst. of Theoretical Phys., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.2, p.127-30 (20 Jan. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.2, p.103-6 (20 Jan. 1983).
The *B* phase of ^{3}He in a magnetic field **H** has, in addition to the spin angular momentum $\mathbf{S} \sim \mathbf{H}$, an orbital angular momentum $L_i \sim R_{ik}S_k$, where R_{ik} is the rotational matrix entering into the order parameter of ^{3}He-$B \Delta(T) R_{ik} e^{i\phi}$. A change in the energy of the fluid $\Omega \mathbf{L} \sim \Omega_i R_{ik} H_k$ caused by the rotation of the vessel with angular velocity Ω has an orientating effect on the order parameter, comparable in magnitude to the orienting effect on vortices. It is proposed that the magnitude of **L** be measured from the shift of the NMR spectrum in rotating ^{3}He-*B*. (9 refs.)

102102 Comments on surface-induced magnetism of liquid ^{3}He in restricted geometries. H.Jichu, Y.Kuroda (Dept. of Phys., Nagoya Univ., Nagoya, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1358-68 (May 1983).
Mechanisms for the surface-induced magnetizations in liquid ^{3}He confined in restricted geometries are studied. Pressure dependence of the effective Curie constants in the observed Curie-Weiss-law-like susceptibilities is well understood within a simple model including paramagnon effects in liquid ^{3}He. The observed magnetization can be regarded as a giant magnetic moment due to the paramagnon effects in liquid ^{3}He induced by localized spins in the solid ^{3}He layer adsorbed on surfaces of substrates of the sample cell. (18 refs.)

102103 Chaotic behavior of magnetization in superfluid ^{3}He driven by external periodic field. Y.Yamaguchi (Dept. of Phys., Sci. Univ. of Tokyo, Tokyo, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1377-95 (May 1983).
The nonlinear response of magnetization in superfluid ^{3}He, driven by an external alternating field, is analyzed. Various modes of response, including periodic, quasiperiodic and chaotic modes, are found. In particular, chaotic modes are found in a wide range of the space of the frequency and amplitude of external field. The period doubling bifurcation cascade is found both in A and B phases as a representative route to chaos, and its detailed characteristics are shown to be well interpreted in terms of the theory due to Feigenbaum; the constants δ, α and μ are estimated. The periodic windows are produced by the tangent bifurcation, and the intermittent chaos is obtained as a precursor effect of this tangent bifurcation. A sudden change of the chaotic attractor is found, and interpreted in terms of the concept of 'crisis', recently proposed by Grebogi et al. (1982). Finally the experimental implication of the authors results is discussed. (42 refs.)

102104 Observation of the mechanical response of the condensate in He-*B* in the regime of negligible normal fluid density. A.M.Guenault, V.Keith, C.J.Kennedy, G.R.Pickett (Dept. of Phys., Univ. of Lancaster, Lancaster, England).
Phys. Rev. Lett. (USA), vol.51, no.7, p.589-92 (15 Aug. 1983).
Experiments are described in which superfluid ^{3}He-*B* is cooled to sufficiently low temperatures that the normal-fluid fraction becomes so small ($\rho_n/\rho < 10^{-6}$) that the quasiparticle properties become undetectable. The liquid ^{3}He is then effectively a thermal vacuum. In this regime nonlinear effects are observed in the behaviour of a vibrating wire, effects which are not observed in an actual vacuum and which are evidently associated with the mechanical response of the *B*-phase superfluid texture. (6 refs.)

102105 Is the nonlinear zero sound in superfluid ^{3}He a soliton?. H.Ebisawa (Tokyo Univ., Tokyo, Japan).
Solid State Phys. (Japan), vol.18, no.2, p.95-100 (Feb. 1983). In Japanese.
The soliton phenomenon as observed in superfluid ^{3}He both via magnetic and NMR means and zero acoustic wave is reviewed. Zero acoustic wave and acoustic wave resonance absorption are explained. (14 refs.) *M.O.*

Flow of superfluid ^{3}He through micrometer-size channels ......See Entry 101900

Bose spectrum of superfluid systems of the He^3-He^4 type .....See Entry 102108

67.60 MIXED SYSTEMS; LIQUID HELIUM 3-4 MIXTURES

102106 Lagrange thermodynamic potential and intrinsic variables for ^{3}He-^{4}He dilute solutions. H.W.Jackson (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
Phys. Rev. B (USA), vol.28, no.3, p.1286-93 (1 Aug. 1983).
A thermodynamic potential that provides a Lagrangian for derivation of equations of motion by a variational procedure is constructed for a two-fluid model of dilute solutions of ^{3}He in liquid ^{4}He. For uniform velocity fields this Lagrangian is defined as a (negative) Legendre transform of total internal energy, and its primary independent variables together with their thermodynamic conjugates are identified. Similarities between relations in classical physics and in quantum statistical mechanics provide a guide for developing an alternate expression for this function that reveals its character as the difference between apparent kinetic energy and intrinsic internal energy. This expression reduces to Zilsel's formula (1950) for the Lagrangian for pure liquid ^{4}He when the ^{3}He concentration in the mixtures tends to zero. Study of properties of the intrinsic internal energy leads to the introduction of intrinsic chemical potentials along with other intrinsic variables for the mixtures. Explicit formulas for these variables are developed for a noninteracting elementary excitation model of the fluid. With the aid of those formulas and others also derived from quantum statistical mechanics, another equivalent expression for the Lagrangian is generated. When the ^{3}He concentration in the mixtures tends to zero, this expression reduces to the Lagrangian in Lhuillier, Francois, and Karatchentzeff's extension (1975) of Khalatnikov's phenomenological two-fluid theory of pure liquid ^{4}He (1965). The underlying unity of the seemingly different theories of Zilsel and of Khalatnikov established in earlier work for pure liquid ^{4}He is thereby extended here to dilute mixtures of ^{3}He in ^{4}He. (26 refs.)

102107 Critical dynamics near the λ transition in ^{3}He-^{4}He mixtures. V.Dohm (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany), R.Folk.
Phys. Rev. B (USA), vol.28, no.3, p.1332-69 (1 Aug. 1983).
The critical dynamics of the λ transition in ^{3}He- ^{4}He mixtures are studied by means of renormalized field theory applied to the model of Siggia and Nelson. A diagonal representation for the equations of motion is introduced, which greatly simplifies the computations in two-loop order. A universal connection is found with the asymptotic critical dynamics of pure ^{4}He in all orders of perturbation theory. The observable critical dynamics of helium mixtures are dominated by nonuniversal crossover effects which can be properly described only within a nonlinear renormalization-group approach. The theory is applied to explain the observable critical and precritical temperature dependence of the mass diffusion D, of the thermal conductivity κ, of the thermal diffusion ratio k_T, and of the dynamic structure factor for $T \geq T_\lambda(X)$. Recent experimental data for the transport coefficients at the molar ^{3}He concentration $X=0.05$ by Gestrich and Meyer are used to identify the nonuniversal parameters of the theory in the range $X \ll 1$. Consistency with the dynamics of pure ^{4}He ($X=0$) is verified. Predictions without adjustable parameters are made for the dynamic structure factor and the transport coefficients in very dilute mixtures. The Siggia-Kawasaki problem concerning the leading X dependence of $\kappa(T_\lambda)$ in the $X \to 0$ limit is resolved. It is demonstrated that Siggia's prediction $\kappa(T_\lambda) \sim X^{-1}$ is correct but not observable. Theoretical extrapolations to $X > 0.05$ without adjustable parameters are presented and compared with measured transport coefficients at $X=0.11$ and 0.15. The overall agreement is satisfactory. Deviations of order 15% exist with the thermal conductivity κ at $X=0.15$. This may be attributed to dynamic effects arising from the singular specific heat and mass susceptibility, which are not included in the present analysis. (105 refs.)

102108 Bose spectrum of superfluid systems of the He^3-He^4 type. P.N.Brusov (Sci.-Res. Inst. of Phys., State Univ., Rostov-on-Don, USSR), V.N.Popov.
Theor. & Math. Phys. (USA), vol.53, no.3, p.1235-43 (Dec. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.3, p.444-55 (Dec. 1982).
The collective modes of Bose excitations of model Fermi-Bose systems are investigated. Three-dimensional models of the He^{3}A-He^4 and He^{3}B-He^4 systems are investigated, and also models of He^3-He^4 films in which the He^3 component can be in superfluid phases *a* and b. For all models, a hydrodynamic (effective) action functional is constructed which makes it possible to find the Bose spectrum of the considered systems. The interaction of the Fermi and Bose subsystems leads to interaction of the acoustic modes of both subsystems and hardly influences the other modes of the Bose spectrum. A biquadratic equation is obtained for the velocities of the acoustic modes; this equation does not change on the transition from the A to the B phase in the three-dimensional models or from the *a* to the b phase in the models of He^3-He^4 films. (12 refs.)

67.80 SOLID HELIUM AND RELATED QUANTUM CRYSTALS

102109 On the law of the change of the quantum crystal heat capacity C, near the melting point. B.G.Udovidchenko.
Fiz. Nizk. Temp. (USSR), vol.9, no.7, p.749-52 (July 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
Presented is an approach to the analysis of the quantum crystal lattice dynamics near the melting line which proved efficient in describing the nature of temperature dependence of their heat capacity C_v in the said temperature range. Comparison with the available C_v data of ^{3}He, ^{4}He and p-H_2 for a density range varying roughly by a factor of 1.5 corroborates the validity of the quantum crystal C_v change law for a temperature range increasing with the crystal density and reaching 0.42 T_{melt} for p-H_2, $P_{melt} \approx 2400$ bar. (18 refs.)

102110 Investigation of electrons localized above solid hydrogen by means of the cyclotron resonance method. V.S.Edel'man, M.I.Faley (S.I. Vavilov Inst. of Phys. Problems, Acad. of Sci., Moscow, USSR).
J. Low Temp. Phys. (USA), vol.52, no.3-4, p.301-14 (Aug. 1983).
The magnetoresistance and cyclotron resonance of a two-dimensional sheet of electrons localized above liquid and solid hydrogen surfaces are investigated at the frequency of 20 GHz. It is found that the effective electron mass relevant to the motion along the surface is close to the free electron mass. The electron mean free path is determined by collisions with defects of the solid hydrogen surface. For $5 \lesssim T \lesssim 12$K the electron mobility was $\sim 8 \times 10^4/T$ cm^2/V sec, with 20% accuracy, for all the specimens investigated. For $T \lesssim 5$K the mobility follows the law $\mu \propto 1/\sqrt{w_e}$, where W_e is the mean electron energy. The numerical values of the electron mobilities for different specimens differ by factors up to five, and for $T \lesssim 1$K they fall within the range 2×10^4 to 10^5 cm^2/V sec. The experimental results indicate that the solid hydrogen surface has a terrace structures with flat sections about 10^{-5} cm in size.

During the investigation of electrons localized above a saturated helium film wetting the solid hydrogen, the authors observed a shift of the resonance to weaker magnetic fields, which amounts to ~100% at a pressing field of ~10^3 V/cm. It is shown that this shift can be explained by the terrace structure of the substrate. (10 refs.)

102111 A four-sublattice model for solid ^{3}He. J.M.Goodkind (Dept. of Phys., Univ. of California, San Diego, La Jolla, CA, USA).
J. Low Temp. Phys. (USA), vol.52, no.3-4, p.335-41 (Aug. 1983).
Nuclear magnetic resonance measurements on the antiferromagnetic ordered phase of solid ^{3}He have indicated that the magnetic structure consists of ferromagnetically ordered parallel planes of atoms. The magnetization vectors lie in the planes and are aligned in a sequence with two or more in a row pointing in the same direction followed by the same number pointing in the opposite direction. In the simplest case, with only two in a row pointing in the same direction, the system can be described in terms of sublattices if four are used. In this work the appropriate four-sublattice model is solved for the uniform free normal modes and for the excitation of the modes by density oscillations. (9 refs.)

102112 Pressure-induced rotation-libration transition in molecular solid hydrogen. A comparison between interaction potentials. I.Aviram, S.Goshen (Nuclear Res. Center Negev, Beer Sheva, Israel), R.Thieberger.
J. Low Temp. Phys. (USA), vol.52, no.5-6, p.397-407 (Sept. 1983).
The pressure-induced rotation-libration transition in solid molecular para-H_2 and ortho-D_2 is calculated using anisotropic nearest neighbor interaction potentials of the form $V_{ij}=\Sigma_m C_m(r_{ij})Y_{2m}(\Omega_i)Y_{2-m}(\Omega_j)$. The contribution of various m terms is investigated. It is found that, for a trial wave function of Jastrow type, the expectation of the $m=1$ term vanishes, while the ratio between the expectations of the $m=0$ and $m=2$ terms is a rational numerical constant. The trial wave function incorporates two variational parameters and the variational integrals are evaluated by a Monte Carlo procedure. The potentials of Ree and Bender (1979), and of Van Kranendonk (1965) and Nakamura (1955) were compared to each other. The Ree and Bender potential seems to be better suited for describing high-density properties, although the transition pressure turned out to be well above the experimental value. (14 refs.)

102113 Annealing of defects in plastically deformed ^{4}He crystals. A.A.Levchenko, L.P.Mezhov-Deglin (Inst. of Solid State Phys., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.4, p.205-7 (20 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.4, p.173-4 (20 Feb. 1983).
The activation energy for diffusion of dislocations in deformed ^{4}He crystals, grown under a pressure of 31 atm, coincides with the activation energy of vacancies in specimens with the same density, as well as with the characteristic activation energy of ^{3}He impurity atoms and charges in the region of thermally activated motion. (3 refs.)

102114 Pinning of dislocations in HCP and BCC ^{3}He by stress waves and by ^{4}He impurities. J.R.Beamish, J.P.Franck (Dept. of Phys., Univ. of Alberta, Edmonton, Alberta, Canada).
Phys. Rev. B (USA), vol.28, no.3, p.1419-32 (1 Aug. 1983).
Large-amplitude ($\gtrsim 200$ N/m^2) ultrasonic pulses at a frequency of 3 MHz were observed to pin dislocations in pure HCP and BCC ^{3}He below 300 mK. Unpinning occurs as a thermally activated process above about one-half of the melting temperature. Activation energies obtained from the unpinning process are in good agreement with activation energies for thermally activated mobile vacancies. Doping with ^{4}He impurities at levels above about 1500 ppm also leads to dislocation pinning. In these impure crystals stress-induced breakaway was observed. In crystals with strongly pinned dislocations the sound attenuation was found to follow the zero-sound behavior at low temperatures. (26 refs.)

102115 Observation of thermal remanence in a quadrupolar solid. D.G.Haase, M.A.Klenin (Phys. Dept., North Carolina State Univ., Raleigh, NC, USA).
Phys. Rev. B (USA), vol.28, no.3, p.1453-6 (1 Aug. 1983).
The authors have measured the specific heat of solid hydrogen as a function of temperature and orthohydrogen concentration in the region of the FCC-HCP phase boundary, and have found a dependence of this quantity on thermal history. Samples isothermally converted from the FCC to the HCP phase showed a slow continuous change to molecular disorder, which is somewhat analogous to remanence in spin-glass field-cooling experiments. New Monte Carlo simulations indicate remanence can be caused by the HCP geometry and quadrupolar-site dilution, independently of the FCC-HCP structural change. (19 refs.)

Atomic and molecular hydrogen and deuterium: quantum gases and solids ....See Entry 102116

67.90 OTHER TOPICS IN QUANTUM FLUIDS AND SOLIDS (E.G. NEUTRON-STAR MATTER)

102116 Atomic and molecular hydrogen and deuterium: quantum gases and solids. I.F.Silvera (Lyman Lab. of Phys., Harvard Univ., Cambridge, MA, USA).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.3-13 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
After the first succesful stabilization of atomic gases of spin-polarized hydrogen ($H\downarrow$) and deuterium ($D\downarrow$), a series of experiments were carried out to study their properties. Most challenging has been the attempt to observe Bose Einstein condensation in $H\downarrow$. The access to the required high density has been limited by recombination. Experiments demonstrated that this takes place on the ^{4}He or ^{3}He-^{4}He surfaces of the cell. Techniques were developed to measure surface adsorption energies and recombination mechanisms. $H\downarrow$ on the helium surface was recognized as an almost ideal 20-dim gas that can also be a superfluid. Recent advances have enabled the polarization of the nuclear as well as the electron spin, suppressing the most important recombination mechanism. This has been directly demonstrated by ESR measurements. Significantly higher densities and thus phenomena of the degenerate quantum gases are promised. Molecular hydrogen and deuterium form lattices of quantum mechanical free rotors at $T\simeq 14$K and low pressure. Increasing density of the solid distorts this picture. Pressures as high as 600 kbar have been achieved at $T=1.1$K. In solid ortho-deuterium a broken rotational symmetry phase transition has been observed at 278 kbar while H_2 maintains its low pressure state to the highest densities yet achieved. At still higher pressures a transition to a metallic phase is expected. Equation of state measurements predict this to be in the 2-6 megabar region. (26 refs.)

102117 Compression of spin-polarized hydrogen to high density. R.Sprik, J.T.M.Walraven (Natuurkundig Lab., Univ. van Amsterdam, Amsterdam, Netherlands), I.F.Silvera.
Phys. Rev. Lett. (USA), vol.51, no.6, p.479-82 (8 Aug. 1983).
A new technique enabled the authors to compress doubly polarized hydrogen by up to five orders of magnitude and study the sample in very small volumes at constant density up to $2\times 10^{18}/\mathrm{cm}^3$. The first determination of the bulk three-body dipolar recombination rate was made, ${K_V}^{3b}=4(1)\times 10^{-39}$ cm^6 s^{-1}. The authors also identified a new process, bulk electronic dipolar $b\rightarrow c$-state relaxation with rate constant ${G_V}^{bc}\exp(2\mu_B B/k_B T)=8(4)\times 10^{-16}$ cm^3 s^{-1}. Samples were very delicate and too rapid a compression could result in an explosion. (9 refs.)

102118 Observation of three-body recombination in spin-polarized hydrogen. H.F.Hess, D.A.Bell, G.P.Kochanski, R.W.Cline, D.Kleppner, T.J.Greytak (Dept. of Phys., MIT, Cambridge, MA, USA).
Phys. Rev. Lett. (USA), vol.51, no.6, p.483-6 (8 Aug. 1983).
Three-body recombination in spin-polarized hydrogen has been observed. Doubly polarized hydrogen was compressed by a piston into a thin cell and the temperature and pressure were independently monitored. Measurements were carried out in the temperature range 0.3 to 0.45K in a magnetic field of 8.0 T at densities up to 1.5×10^{18} cm^{-3}. The results are in good agreement with the theory of Kagan, Vartanyants and Shlyapnikov (1982). (10 refs.)

The non-equilibrium condensation of spin$^1/_2$ lattice bosons ...See Entry 102092

68.00 SURFACES AND INTERFACES; THIN FILMS AND WHISKERS

(for impact phenomena, see 79.; for physics of crystal growth, see 61.50C; for corrosion, oxidation, and surface treatments, see 81.60)

68.10 FLUID SURFACES AND INTERFACES WITH FLUIDS

(inc. surface tension, capillarity, wetting and related phenomena)

102119 Equilibrium and spreading of liquids on solid surfaces. A.Marmur (Dept. of Chem. Engng., Technion-Israel Inst. of Technol., Haifa, Israel).
Adv. Colloid & Interface Sci. (Netherlands), vol.19, no.1-2, p.75-102 (July 1983).
Contact angle equilibrium and dynamic spreading of liquids on solid surfaces are reviewed and discussed. The thermodynamic status of the Young equation is critically reviewed. It is redeveloped rigorously and shown to apply locally, even for rough and heterogeneous though rigid and insoluble solid surfaces, when written in terms of the local interfacial tensions. The line tension approach and the molecular approach to relate the local interfacial tensions to their values far away from the three-phase contact line are critically discussed, and the difficulties with some recent corrections of the Young equation are explained. The problem of the shape of the fluid-fluid interface near the contact line is analysed, and it is shown that a discontinuous transition has to occur between the solid surface and the fluid-fluid interface. Experimental data and theoretical models for dynamic spreading are discussed and compared. (77 refs.)

102120 Measurement of low interfacial tensions under high hydrostatic pressures. B.Thiebot, J.Briant (Inst. Francais du Petrole, Rueil-Malmaison, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.16, p.1221-4 (2 May 1983). In French.
The ability of the sessile drop and of the pendant drop methods for measuring low interfacial tensions are shown. These methods present also the advantage of being easily suitable to measurements under high pressures at elevated temperatures. Experimental results show the influence of high hydrostatic pressures on low interfacial tensions. (5 refs.)

102121 The wetting liquid-vapor interface of a binary liquid mixture. D.Beaglehole (Phys. Dept., Victoria Univ. of Wellington, Wellington, New Zealand).
J. Chem. Phys. (USA), vol.79, no.3, p.1469-73 (1 Aug. 1983).
The paper includes gravitational effects in the Cahn squared-gradient model for the wetting liquid-vapor interface, and determines the temperature dependence of the wetting layer thickness for both regular solution and nonclassical free energy functionals. (13 refs.)

102122 The meniscus on a needle—a lesson in matching. L.L.Lo (Dept. of Mech. Engng., Stanford Univ., Stanford, CA, USA).
J. Fluid Mech. (GB), vol.132, p.65-78 (July 1983).
The author reconsiders the second approximation for the height of the meniscus on a slender vertical cylinder, which has been calculated by James using the method of matched asymptotic expansions. Fraenkel has warned that the asymptotic matching principle may fail in certain cases, and the author confirms that failure here. This meniscus problem is used to discuss the kind of failures that may occur if Fraenkel's restricted form of the matching principle is not used. A less restricted matching principle is also suggested. With this matching principle, the author shows that the last known term of order $Re^3 \ln Re$ in the drag on a sphere in low-Reynolds-number flow is correct, even though it was found in a way that violates Fraenkel's warning. (11 refs.)

102123 Determination of surface tension coefficient of liquid metals and alloys using the phenomenon of capillary wave formation. K.Rozniakowski (Inst. of Phys., Tech. Univ. of Lodz, Lodz, Poland).
Mater. Res. Bull. (USA), vol.18, no.7, p.875-9 (July 1983).
A possibility of determining the surface tension coefficient of 6H13 liquid steel and of technically pure ion (Armco-Fe) has been presented. In the investigation the phenomenon of ring structure formation (capillary waves) on the surface of a molten metal affected by light pulses of a glass neodymium laser ($\lambda=1.06$ μm, $\tau_i\approx 1$ ms, $E_i\approx 6$J) has been considered. The values obtained for the surface tension coefficent are in good agreement with those determined by other methods (for liquid metals in the temperature range 2000K-5000K). (10 refs.)

102124 Direct observation of layer-to-layer wetting of graphite by ethylene. M.Sutton, S.G.J.Mochrie, R.J.Birgeneau (Dept. of Phys., MIT, Cambridge, MA, USA).
Phys. Rev. Lett. (USA), vol.51, no.5, p.407-10 (1 Aug. 1983).
It has been demonstrated directly by use of X-ray diffraction that at temperatures below the triple point of bulk ethylene (103.8K) adsorption of ethylene onto the basal planes of graphite only occurs up to a finite number of molecular layers. Further addition of molecules results in the formation of

bulk crystallites. Reversible transitions between the total number of layers adsorbed and the coexisting bulk are observed. (8 refs.)

Beware of surface tension! .... See Entry 98690

Instabilities of dynamic thermocapillary liquid layers. I. Convective instabilities .... See Entry 101231

Instabilities of dynamic thermocapillary liquid layers. II. Surface-wave instabilities .... See Entry 101264

Surface order in nematics .... See Entry 101545

Line effects in disk-shaped heterogeneous nucleation .... See Entry 101897

Surface spinodals and extended wetting in fluids and polymer solutions .... See Entry 101980

The calculation of molecular interaction in phosphoryl chloride .... See Entry 102001

Aspects of dispersion and flow in thermoplastic-elastomer blends .... See Entry 102034

Effects of mass flux, flow quality, thermal and surface properties of materials on rewet of dispersed flow film boiling .... See Entry 102127

Adsorption of cycloalkane and cyclopentanealkyl acids at the air/water interface .... See Entry 102152

Neutron diffraction from ethylene adsorbed on graphite .... See Entry 102165

Melting and wetting behavior in oxygen films .... See Entry 102167

Dimensional effect during wetting of amorphous carbon substrates with small islands of bismuth and lead films (particle sizes 5×10^{-7} to 3×10^{-5} cm) .... See Entry 102205

Surface tensions and micellization of ω-cyclohexylalkanoic acids and their sodium salts .... See Entry 103596

The surface geometrical structure effect in X-ray fluorescence analysis of metallic samples .... See Entry 103627

68.15 LIQUID THIN FILMS

102125 Thin films and froth flotation. J.Ralston (Dept. of Appl. Chem., Swinburne Inst. of Technol., Hawthorn, Victoria, Australia).
Adv. Colloid & Interface Sci. (Netherlands), vol.19, no.1-2, p.1-26 (July 1983).
The properties of thin, aqueous films on solid surfaces and their central role in the froth flotation process are discussed. The stability of these films can generally be described in terms of electrostatic and van der Waals forces. Significant experimental and theoretical advances are required in many areas (e.g. short range forces, film drainage) before a clear picture of the collision of, adhesion between and detachment of bubbles and particles will emerge. (114 refs.)

102126 Studies of two-dimensional lattices using ferrofluid. A.T.Skjeltorp (Inst. for Energy Technol., Kjeller, Norway).
J. Magn. & Magn. Mater. (Netherlands), vol.37, no.3, p.253-6 (July 1983).
By exerting a magnetic field H normal to a ferrofluid layer, a triangular lattice of droplets is formed when H exceeds a characteristic critical field. The lattice may be 'heated' by reducing H and the effects of dislocations and disclinations may be studied. This offers a new experimental system for direct visual observations of phenomena related to two-dimensional melting. (13 refs.)

102127 Effects of mass flux, flow quality, thermal and surface properties of materials on rewet of dispersed flow film boiling. O.C.Iloeje (Dept. of Mech. Engng., Univ. of Nigeria, Nsukka, Nigeria), D.N.Plummer, W.M.Rohsenow, P.Griffith.
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.304-8 (May 1982).
The effects of mass flux, flow quality, material thermal properties, surface roughness, and surface oxidation on the rewet-wall superheat for dispersed vertical flow were experimentally investigated. The mass fluxes tested were 40.7, 81.4, 169.5 and 271.3 kg/s-m^2. Flow qualities varied from 10-90 percent. The test materials were copper, aluminum, and inconel-600. Overall dimensions of the test pieces were 10.16 mm i.d., 25.4 mm OD, and 25.4 mm long. A smooth inside surface was prepared for each material, with roughness amplitudes of approximately 0.5 μm. Two inconel test pieces had roughnesses of 15-20 μm and 66 μm, respectively. Another inconel piece was oxidized to a thin oxide layer of approximately 1.3 μm. The test fluid was liquid nitrogen. The results incidated that the rewet wall superheat increased with mass flux. The rewet wall superheat decreased with increasing flow quality, with the rate of decrease being more rapid at higher mass fluxes and higher qualities. Increases in wall roughnesses, and the presence of surface oxidation, increased the rewet superheat. The effect of an oxide layer increased with increasing mass flux and decreasing quality, and was thought to result from the decrease in contact angle between the liquid and the oxidized surface. Differences in wall thermal properties were not very significant up to a mass velocity of 81.4 kg/s-m^2. Above this mass flux, the copper data did not clearly show the increasing T_{min} with increasing mass flux, while the inconel data did. A comparison of T_{min} for several materials with different thermal properties therefore was not made above mass flux of 81.4 kg/s-m^2. (9 refs.)

68.20 SOLID SURFACE STRUCTURE

102128 Surface variations in chemical composition of titanium disulphide single crystals. A.A.Balchin (School of Phys., Brighton Polytech., Brighton, England).
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.457-62 (Aug. 1983).
In order to determine the stoichiometry of crystals grown by iodine vapour transport, a study has been made of single crystals of TiS_2 by Auger and ESCA spectroscopy. Chemical analyses of trace impurities and of variations of chemical composition with depth below the surface of the crystal were obtained. (5 refs.)

102129 Surface reconstruction and adsorbate geometry by surface core level spectroscopy. J.Lecante, C.Guillot (Service de Phys. des Atomes et des Surfaces, CENS, Gif-sur-Yvette, France).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.427-33 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Previous studies on surface core level shifts have shown the interest of the core level spectroscopy as a very sensitive probe of surface layers. A brief review of the experimentally measured core level shifts is given and also a survey of a theoretical model using the tight binding approximation. Several applications of this new technique are presented concerning clean surface reconstruction and chemisorption studies. (5 refs.)

102130 Surface compositional studies of heat reduced lead silicate glass. J.M.Simeonova (Central Lab. for Space Res., Bulgarian Acad. of Sci., Sofia, Bulgaria), J.S.Kourtev, Y.B.Dimitriev.
J. Non-Cryst. Solids (Netherlands), vol.57, no.1, p.177-87 (Aug. 1983).
SIMS and AES compositional analysis of the surface layer for a lead silicate glass reduced at three different temperatures was carried out and the depth distribution for some components to a depth of 120 nm was obtained. It was found that by increasing the reduction temperature the layer located just below the surface becomes rich in silicon oxides, a potassium accumulation takes place on the surface and the depth distribution of the other chemical components exhibits a maximum, the location of which depends on the reduction temperature. (23 refs.)

102131 Cation valencies and surface segregation in copper ferrites under X-ray photoelectron spectroscopy conditions. V.A.M.Brabers (Dept. of Phys., Eindhoven Univ. of Technol., Eindhoven, Netherlands).
Mater. Res. Bull. (USA), vol.18, no.7, p.861-8 (July 1983).
Cu2p XPS spectra of copper ferrites and copper magnesium manganite are reported. It turns out that the surface layer of the ferrites are enriched with copper and that for the so-called cuprous ferrite $Cu_{0.5}$-$Fe_{2.5}O_4$, a decomposition in the surface layer occurs into α-Fe_2O_3 and $CuFeO_3$. Evidence is found that in the ferrites only monovalent copper in A sites is present at room temperature and bivalent copper in A and B sites. The tetrahedral Cu^+ ions show a remarkable negative shift of the core levels in comparison with metallic copper (1.4-1.7 eV). (16 refs.)

102132 Thermal self-decoration of GeS crystals. J.Vetter, H.Bethge (Inst. of Solid State Phys. & Electron Microscopy, Acad. of Sci., Halle, Germany).
Phys. Status Solidi a (Germany), vol.78, no.1, p.103-9 (16 July 1983).
On annealing GeS single-crystals in a vacuum a self-decoration of surface steps is found to appear which is observable in a scanning electron microscope. The effect occurs on vacuum-cleaved as well on air-cleaved samples. On the basis of X-ray microanalysis, Auger electron spectroscopy, and electron diffraction the observed decoration is shown to be due to Ge precipitates resulting from a preferred evaporation of the S component. (12 refs.)

102133 Structure of graphitic carbon on Ni(111): a surface extended-energy-loss fine-structure study. R.Rosei, M.de Crescenzi (Dipartimento di Fisica, Univ. della Calabria, Cosenza, Italy), F.Sette, C.Quaresima, A.Savoia, P.Perfetti.
Phys. Rev. B (USA), vol.28, no.2, p.1161-4 (15 July 1983).
The structural parameters of the graphitic carbon overlayer on a Ni(111) substrate has been determined by using surface extended-energy-loss fine-structure spectroscopy. The authors find that graphitic carbon is very similar to a graphite single-crystal plane, but slightly expanded (~2%), with C-C_1 and C-C_2 distances of 1.45 ± 0.03 and 2.50 ± 0.03 Å, respectively. The graphite overlayer floats at 2.80 ± 0.08 Å above the Ni(111) face. The C-Ni interaction is strong enough to force the overlayer in registry with the substrate. However, they find that the Ni-Ni distance remains identical, showing that the substrate is not affected by the growth of the graphitic overlayer. (27 refs.)

102134 New results on the quenched '1×1' structure of Si{111} surfaces. W.S.Yang, F.Jona (Dept. of Materials Sci. & Engng., State Univ. of New York, Stony Brook, NY, USA).
Phys. Rev. B (USA), vol.28, no.2, p.1178-80 (15 July 1983).
The '1×1' structure known to form from the 7×7 structure at high temperatures on Si{111} surfaces was studied at room temperature after quenching from 1200°C. Comparisons of low-energy electron diffraction spectra both at normal and off-normal incidence from this quenched phase with corresponding spectra from the Te-stabilized 1×1 surface show that these phases are not the same. The quenched phase exhibits weak but sharp $^1/_2$-order beams that reveal the presence of large 2×1 domains. There is some indication that the 2×1 distortion may be similar to that of the cleaved 2×1 structure, thus implying that the 2×1 phase of Si{111} is not metastable, as heretofore believed, but indeed very stable. (14 refs.)

102135 Channeling and optical study of thin Si crystals distorted by pressure. R.B.Alexander, P.J.Drallos, S.C.Johnson, K.R.Padmanabhan (Dept. of Phys. & Astron., Wayne State Univ., Detroit, MI, USA), J.C.Buchholz.
Phys. Rev. B (USA), vol.28, no.3, p.1207-13 (1 Aug. 1983).
The ion backscattering-channeling technique and reflection of laser light have been used to study the distortion of thin Si single crystals produced by a pressure differential across the crystal. For channeling in a Si-air cell, the channeled fraction at a fixed pressure decreases with increasing ion energy, beam diameter, and crystal area, and increases with crystal thickness. The threshold pressure for the abrupt decrease in the channeled fraction behaves in the same way. From an interference pattern observed in the reflected laser beam, the shape of the distorted Si surface can be deduced. The maximum deformation, which is a sublinear function of pressure, decreases with increasing crystal thickness. Calculations have been made on the channeled fraction from the results of the optical measurements, with the use of a geometric model in which the channeling minimum yield is determined by the distribution of angles of ion incidence over the bowed crystal surface. Comparison of calculated and measured values of the channeled fraction suggests that both rigidity and membrane stresses determine the crystal shape. (11 refs.)

102136 A comment on the W(001) surface stability and reconstruction. S.Pick, M.Tomasek (J. Heyrovsky Inst. of Phys. Chem. & Electrochem., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Surf. Sci. (Netherlands), vol.130, no.1, p.L307-10 (July 1983).
Arguments are presented in favour of an additional softening which those changes of surface force constants that lead to a pronounced 'soft' surface phonon mode (e.g. M_5) can invoke in the global surface phonon spectrum. This result is illustrated for the W, Mo and Cr (001) surface. Analysis of phonons at an isolated layer is used together with a 'perturbation theorem'. (18 refs.)

102137 Ordered steps on Bi(~0001) vicinal surfaces by laser pulse anneal. W.P.Ellis, K.A.Thompson, N.S.Nogar (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
Surf. Sci. (Netherlands), vol.130, no.1, p.L317-23 (July 1983).
LEED patterns characteristic of an ordered array of equally spaced steps of minimum height resulted from pulsing disordered Bi(~0001) vicinal surfaces. Ten XeCl excimer laser pulses at $\lambda=308$ nm, of 10 ns duration and 4 mJ/cm^2 each and at 0.5 s intervals optimized ordering on the Bi$(10\bar{1}16)$ surface, but additional exposure degraded the surface crystallinity as did a twentyfold increase in power density. (15 refs.)

102138 He diffraction from clean Pt(111) and (1×1) H/Pt(111) surface. J.Lee, J.P.Cowin, L.Wharton (James Franck Inst., Univ. of Chicago, Chicago, IL, USA).
Surf. Sci. (Netherlands), vol.130, no.1, p.1-28 (July 1983).
He diffraction from clean and hydrogen-covered Pt(111) has been observed and used to investigate their surface structure. Hydrogen adsorbs in a well-

ordered (1×1) overlayer structure on Pt(111) at 160K. The binding site of C_{3v} symmetry is deduced from in-plane as well as out-of-plane diffraction intensity distributions. Furthermore, the (1×1) overlayer contains a single adsorption state which occupies only one type of three-fold hollow sites. At ≤150K a new low-temperature state is found to populate to result in a disordered overlayer. The hard corrugated wall analysis of the diffraction intensities is made to obtain the surface topography. The clean Pt(111) surface can be described by a corrugation amplitude of 0.01 Å, remarkably flat. The (1×1) H/Pt(111) surface requires an additional corrugation of amplitude 0.13 Å on each second three-fold minimum of the basic corrugation, which is increased to 0.05 Å by hydrogen adsorption. Based on the surface corrugation of the (1×1) H overlayer, which of the two possible three-fold hollow sites (HCP or FCC site) is preferred by the hydrogen atom is discussed. (28 refs.)

102139 Surface reconstruction of Cu(111) upon oxygen adsorption. H.Niehus (Inst. fur Grenzflachenforschung und Vakuumphys., KFA Julich, Julich, Germany).
Surf. Sci. (Netherlands), vol.130, no.1, p.41-9 (July 1983).
Low-energy He^+ ion scattering (IS) in combination with AES, LEED and work function measurements has been applied for the determination of surface reconstruction of Cu(111) upon oxygen adsorption. IS data clearly indicate that oxygen is not significant incorporated into the bulk at room temperature adsorption; however the surface shows reconstruction by displacement of Cu atoms by 0.3 Å. The disappearance of structure of both Cu_{IS} and O_{IS} in the 'ϕ_{in} pattern' demonstrates the development of a disordered layer of reconstruction centres. At saturation coverage, a rough and dis-ordered oxygen-copper surface layer is present. (24 refs.)

102140 X-ray spectral study of the surface of flat glass. N.N.Semenov, Yu.N.Romashchenko, I.A.Brytov, L.B.Vasil'eva, K.B.Kostin, S.Ya.Shulov, L.A.Samsonova (All-Union Sci.-Res. Inst. of Specialized & Tech. Glass, Saratov, USSR).
Sov. J. Glass Phys. & Chem. (USA), vol.8, no.4, p.277-80 (July-Aug. 1982). Translation of: *Fiz. & Khim. Stekla (USSR)*, vol.8, no.4, p.412-15 (July-Aug. 1982). [received: May 1983]
By comparison with the upper surface, the covalent component of the Si-O bonds in the surface layer (~150 Å) on the lower surface of heat-polished glass increases as a result of the decrease in the positive charge on the Si atoms. This is caused by the incorporation of the tin atoms from the melt into the silicon-oxygen framework and by the formation of groups which are structurally similar to tin silicates. Electrochemical treatment of the glasses leads to a less significant change in the parameters of the $SiL_{2,3}$ sqy than in the case where the surface of the glass is in contact with the tin melt, i.e. the maximum distribution of the impurity atoms of Cu and Pb lies at a depth greater than the 150-200 Å accessible to this method of research while the ionicity of the Si-O bonds in the electrochemically treated glasses increases by comparison with the heat-polished glass (upper surface). This is associated with the migration of sodium ions into the depth of the glass. An increase in the temperature of the electrochemical treatment shifts the maximum of the distribution of impurity Cu and Pb into the depth of the glass but the ionicity of the Si-O bonds in this case is very little changed; it is at the greatest with a medium treatment temperature when the maximum migration of sodium ions from the surface of the glass is achieved. (5 refs.)

102141 Surface structural damage produced in InP(100) by RF plasma or sputter deposition. W.C.Dautremont-Smith, L.C.Feldman (Bell Labs., Murray Hill, NJ, USA).
Thin Solid Films (Switzerland), vol.105, no.2, p.187-96 (15 July 1983).
Rutherford backscattering detected at grazing angle under channeling conditions was employed to observe and quantify surface structural damage to InP(100) produced by dielectric deposition methods involving direct 13.56 MHz RF plasma exposure. Sputter deposition at any plasma power produced surface damage, to a maximum depth of about 30 Å at power densities within the range 0.25-2.2 W cm^{-2}. In contrast, damage due to plasma deposition was not observable at any plasma power density up to 0.32 W cm^{-2} for InP substrates at either 250 or 31°C. This power level produced the high SiO_2 deposition rate of 1500 Å min^{-1}. Thus plasma deposition is particularly applicable to InP, whereas diode sputter deposition should be voided for any application in which structral damage may be detrimental. (22 refs.)

102142 $Pt_{50}Ni_{50}$ and $Pt_{78}Ni_{22}$(111) single crystal alloys: superficial composition determination by ion scattering and Auger spectroscopy. L.De Temmerman, C.Creemers, H.Van Hove, A.Neyens (Fysico-Chem. Lab., Katholieke Univ. Leuven, Leuven, Belgium), P.Delichere, J.Massardier, B.Tardy, M.Abon, J.C.Bertolini.
Vide les Couches Minces (France), vol.38, no.217, p.275-8 (May-July 1983). In French.
The surface composition of $Pt_{50}Ni_{50}$(111) and $Pt_{78}Ni_{22}$(111) single crystal alloys has been determined from ion scattering and Auger spectroscopy experiments. The clean surface is largely enriched with platinum leading to a quasicomplete Pt layer in the surface. The Pt enrichment spreads at further depths of this monolayer, particularly in the $Pt_{78}Ni_{22}$(111) single crystal. (3 refs.)

102143 Phase relationships for adsorbed layers on surfaces. T.-M.Lu (Dept. of Phys., Rensselaer Polytech. Inst., Troy, NY, USA), M.G.Lagally.
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.313-26
Ordering phenomena of adsorbed atoms that are commensurate with the substrate structure can be described by a two-dimensional lattice gas. The major features of temperature-coverage phase diagrams for commensurate overlayers are reviewed and illustrated with several experimental examples. For overlayers with net attractive interactions, a two-phase region consisting of ordered overlayer and nearly empty substrate surface forms at low coverage. Substrate extended defects such as steps can create diffusion barriers, thus forming thermodynamic subsystems by eliminating communication between adsorbed atoms on either side of the steps. Steps can also prevent the growth of a reconstructed layer. Experimental examples are presented. (44 refs.)

Scanning tunneling microscopy .... See Entry 99237

Regimes of laser-induced periodic surface structure on germanium: radiation remnants and surface plasmons .... See Entry 101761

Laser induced periodic surface structure .... See Entry 101783

Picosecond laser-induced surface transformations in solids ... See Entry 101784

Aligned, coexisting liquid and solid regions in pulsed and CW laser annealing of Si .... See Entry 101785

Surface studies of laser annealed semiconductors .... See Entry 101790

Laser-induced surface defects .... See Entry 101791

Evidence for a commensurate-incommensurate phase transition with an intermediate fluid phase: N_2 adsorbed on Ni(110) .... See Entry 101955

Monotonic and alternating surface segregation profiles in binary alloys .... See Entry 101986

Study of the structure of a *c*(2×2) overlayer of carbon monoxide on Co (001) by LEED intensity measurements .... See Entry 102151

Study of Ag/Si(111) submonolayer interface. II. Atomic geometry of Si(111) ($\sqrt{3}\times\sqrt{3}$)R30°-Ag surface .... See Entry 102174

Optical microanalysis of small semiconductor structures .... See Entry 102894

Studies on whitening phenomena induced by some non-solvents on highly oriented glassy polymers .... See Entry 103357

68.25 MECHANICAL AND ACOUSTICAL PROPERTIES OF SOLID SURFACES AND INTERFACES

(for tribology, see 62.20P and 81.40P)

102144 Experimental study of the Scholte wave propagation on a plane surface partially immersed in a liquid. M.de Billy, G.Quentin (Groupe de Phys. des Solides, Ecole Normale Superieure, Univ. Paris VII, Paris, France).
J. Appl. Phys. (USA), vol.54, no.8, p.4314-22 (Aug. 1983).
This study shows that as a pseudo-Rayleigh wave propagates on the surface of a semi-infinite elastic plane solid, partially immersed in a liquid, a new repartition of the energy appears at the liquid-solid interface. Two interface waves are generated: a generalized Rayleigh wave (or leaky Rayleigh wave) and a Scholte wave (or pseudo-Stoneley). The authors show that for values of the angle of immersion θ_i less than $\theta_{i,m}=\theta_R/2+\pi/4$ (where θ_R is the Rayleigh angle), the amplitude of the Scholte wave depends strongly on the wetting and on θ_i. In this angular region the leaky Rayleigh wave does not disturb the Scholte wave propagation. For $\theta_i>\theta_{i,m}$ the experimental records present an oscillating behavior that the authors have attributed to the superposition of the pseudo-Stoneley wave and the generalized Rayleigh wave specularly reflected by the air-liquid interface. (17 refs.)

102145 Surface acoustic waves in a highly anisotropic film on an isotropic substrate. I.M.Gel'fgat, E.S.Syrkin (Physicotech. Inst. of Low Temperatures, USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.10-12 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.19-22 (Jan.-Feb. 1983).
Surface acoustic waves polarized in the shear and vertical directions are investigated in a layer of a highly anisotropic crystal on an isotropic substrate. The dispersion of the phase and group velocities of these waves is investigated. It is shown that the wave velocity is small for certain orientations of the crystal layer and sufficiently high frequencies. (11 refs.)

102146 Scattering of surface acoustic waves by three-dimensional boundary discontinuities. V.G.Polevoi.
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.52-5 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.91-5 (Jan.-Feb. 1983).
The scattering of surface acoustic waves by three-dimensional boundary discontinuities is analyzed in the Born approximation. Expressions are derived for the amplitude of the scattered surface wave and the differential scattering cross section of the discontinuity. (7 refs.)

Surface acoustic wave measurements using an impulsive converging beam .... See Entry 100993

On the disturbance produced by an impulsive shearing stress on the surface of a semi-infinite poro-elastic medium .... See Entry 101113

Comparative study of surface acoustic wave and photocurrent spectroscopies in GaP .... See Entry 102466

Transverse acousto-EMF as a function of acoustically stimulated adsorption on the surface of a semiconductor .... See Entry 102467

Interaction of a moving domain wall in a orthoferrite with Lamb waves .... See Entry 102695

68.30 DYNAMICS OF SOLID SURFACES AND INTERFACE VIBRATIONS

102147 Anomalous surface phonon dispersion relations for Ag(111) measured by inelastic scattering of He atoms. R.B.Doak (Bell Telephone Labs., Murray Hill, NJ, USA), U.Harten, J.P.Toennies.
Phys. Rev. Lett. (USA), vol.51, no.7, p.578-81 (15 Aug. 1983).
High-resolution time-of-flight measurements of 17-meV He atoms scattered from an Ag(111) surface along the ⟨112⟩ and ⟨110⟩ azimuths are reported. Most of the spectra reveal two sharp peaks and from their locations dispersion curves have been determined out to the zone boundary. The agreement of the lower-frequency mode with the theoretical Rayleigh dispersion curve is excellent. The other mode is significantly lower (35%) than the calculated longitudinally polarized surface mode. (25 refs.)

102148 Vibrational damping of adsorbed molecules: Effects of a realistic metal surface. P.Apell (Phys. Dept., Univ. of Pennsylvania, Philadelphia, PA, USA).
Solid State Commun. (USA), vol.47, no.8, p.615-18 (Aug. 1983).
The damping of a vibrationally excited CO molecule adsorbed on copper can be fully accounted for within an image-dipole interaction provided the effects of nonlocality and particularly a smooth electron density profile of the metal are taken into account. (18 refs.)

102149 Effects of non-locality and surface diffuseness on the electromagnetic response of a vacuum metal interface. P.Apell (Phys. Dept., Univ. of Pennsylvania, Philadelphia, PA, USA).
Solid State Commun. (USA), vol.47, no.8, p.619-22 (Aug. 1983).
A characteristic feature of the response of a metal to an external probe, such as photons or electrons is an induced surface charge. Allowing for a non-local response and a smooth electron density profile in the surface region the classical singular surface charge will relax spatially and the center of gravity of the induced charge will be an important physical quantity characterizing the response. The author proposes a simple analytical interpolation formula for this, having the correct static limit as well as giving a relatively good description of the dynamical response. (13 refs.)

Sagittal elastic waves in infinite and semi-infinite superlattices .... See Entry 101880

Localized surface modes and resonances for vicinal surfaces: the (117) face of FCC crystals .... See Entry 101886

A comment on the W(001) surface stability and reconstruction .... See Entry 102136

The adsorption of cyclic hydrocarbons on Ru(001). I. Cyclopropane .... See Entry 102175

The adsorption of cyclic hydrocarbons on Ru(001). II. Cyclohexane .... See Entry 102176

Infrared-active combination band in a surface formate species .... See Entry 102880

68.40 SURFACE ENERGY OF SOLIDS; THERMODYNAMIC PROPERTIES

Universal features of bonding in metals .... See Entry 101621

Single-ion and pair-interaction potentials near simple metal surfaces .... See Entry 102292

Multilayer lattice relaxation at metal surfaces: a total-energy minimization .... See Entry 102293

Structured films of magnetizable surface-active substances .... See Entry 102714

68.45 SOLID-FLUID INTERFACE PROCESSES

(see also 82.65 Sorption and accommodation coefficients)

102150 Current state in adsorption from multicomponent solutions of nonelectrolytes on solids. M.Borowko, M.Jaroniec (Dept. of Theoretical Chem., M. Curie-Sklodowska Univ., Lublin, Poland).
Adv. Colloid & Interface Sci. (Netherlands), vol.19, no.1-2, p.137-77 (July 1983).
Surveys the research carried out on the adsorption from multicomponent liquid mixtures of nonelectrolytes on solids with emphasis on the work performed by the authors. The consistent theoretical treatment of adsorption from concentrated and dilute multicomponent solutions and its application to the liquid adsorption chromatography with the mixed mobile phase are presented. This treatment involves nonideality of the bulk and surface phases, energetic heterogeneity of the adsorbent surface and it may be extended to multilayer adsorption from solutions. (144 refs.)

102151 Study of the structure of a $c(2\times2)$ overlayer of carbon monoxide on Co (001) by LEED intensity measurements. M.Maglietta (Facolta di Ingegneria, Univ. di Firenze, Firenze, Italy).
Appl. Phys. A (Germany), vol.A31, no.3, p.165-70 (July 1983).
Cross-comparison of experimental LEED intensity spectra from Co $(001)c(2\times2)$-CO with both experimental and theoretical data from Ni $(001)c(2\times2)$-CO for the same beams at normal incidence indicates that CO is chemisorbed at the same sites and in the same position in the two cases. As a secondary goal, the effect of the LEED primary beam was also investigated and found to induce different structural modifications, with respect to those observed in the case of nickel. (14 refs.)

102152 Adsorption of cycloalkane and cyclopentanealkyl acids at the air/water interface. J.J.Spitzer, L.D.Heerze (Dept. of Chem., Univ. of Lethbridge, Lethbridge, Alberta, Canada).
Can. J. Chem. (Canada), vol.61, no.6, p.1067-70 (June 1983).
Surface tensions of aqueous solutions of cyclopropane, cyclobutane, cyclopentane, and cycloheptane carboxylic acids, and of cyclopentaneacetic and cyclopentanepropionic acids were measured at 25°C by the drop volume method. The Traube constants for calculation of standard free energies of absorption were estimated from second and third degree polynomial least-squares analyses, from nonlinear least-squares analysis using the Szyszkowsky equation, and graphically. The standard free energies of adsorption at the air/solution interface of cycloalkane and cycloalkanealkyl carboxylic acids are less negative than those of the corresponding straight chain acids, but not by a constant amount; the standard free energy of the CH_2 group in a cycloalkane ring is -2.5 kJ mol^{-1} as compared to a value of -3.3 kJ mol^{-1} for straight chain acids. (12 refs.)

102153 The adsorption of hydrocarbons on silicalite and ZSM5. U.Lohse, B.Fahlke (Akad. der Wissenschaften, Berlin, Germany).
Chem. Tech. (Germany), vol.35, no.7, p.350-3 (July 1983). In German.
The adsorption of in-hexane, benzene and p-xylene on silicalite and ZSM5 has been investigated by isotherm measurements. The adsorption isotherms exhibit a plateau located at half of the saturation capacity which is more pronounced at increased temperature. For the adsorption system benzene—silicalite a hysteresis loop in the isotherms and an unusual dependence of the heat of adsorption on the number of adsorbed molecules are observed. The results are discussed with respect to the geometrical factors within the narrow channel system of silicalite and ZSM5. (21 refs.)

102154 Deactivation of singlet oxygen $O_2^*(^1\Delta_g)$ on gold surfaces. M.E.Ryskin, B.R.Shub (Inst. of Chem. Phys., Acad. of Sci., Moscow, USSR), J.Pavlicek, Z.Knor.
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.140-3 (29 July 1983).
The deactivation of singlet oxygen $O_2^*(^1\Delta_g)$ on a gold surface and its change due to temperature variation and water vapour addition have been investigated in a flow system. (17 refs.)

102155 Properties of thermally modified controlled porous glasses (CPG). II. Study of CPG surface properties by means of adsorption heat measurements. A.L.Dawidowicz, I.Choma, A.Patrykiejew, K.Pilorz (Dept. of Chem. Phys., Maria Curie Sklodovska Univ., Lublin, Poland).
Mater. Chem. & Phys. (Switzerland), vol.8, no.6, p.531-40 (June 1983).
For pt.I see ibid., vol.8, no.4, p.323-36 (1983). The properties of thermally modified CPG have been studied by means of gas chromatography. The isosteric heat adsorption for hexane, benzene, chloroform and diethylether adsorbed on CPG surfaces of different boron concentration were determined. It was found that the heating of CPG causes (a) dehydroxylation of the surface (b) a gradual increase of the boron concentration in the surface region, and (c) formation of borate crystals on the glass surface. (11 refs.)

102156 Multicritical behavior of polymers near an adsorbing wall. E.Eisenriegler (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.697-702 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Due to possible technological and biological applications, the statistical mechanics of polymer adsorption has been of longstanding interest. Recently, the problem has been reconsidered both numerically and analytically. This was stimulated mainly by recent advances in the field theory of semi-infinite spin systems. The author presents some of these recent results both for a single long chain with excluded-volume interaction and for semidilute solutions in good solvent near an adsorbing wall (or surface). As for other critical phenomena the behavior near the adsorption temperature is independent of most details ('universality') and one may discuss simple models. (11 refs.)

102157 Molecular dynamics simulations of phase transitions in physisorbed nobel gases. S.W.Koch, F.F.Abraham (IBM Res. Lab., San Jose, CA, USA).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.755-64 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The freezing transition of xenon on graphite and the commensurate-incommensurate transition of krypton on graphite are studied by molecular-dynamics computer simulations. The results are shown to be in good agreement with recent X-ray scattering experiments of these systems. The simulations lead to valuable physical insights into the detailed nature of the investigated phase transitions. (14 refs.)

102158 The influence of the addition of MgO on the surface mass transport of alumina. C.Monty, J.Le Duigou (CNRS Lab. de Phys. des Materiaux, Meudon, France).
High Temp.-High Pressures (GB), vol.14, no.6, p.709-16 (1982). [received: June 1983] (International Conference on Chemistry of Materials at High Temperatures, Harwell, Oxon., England, 7-10 Sept. 1981).
The influence of MgO additions on the sintering of Al_2O_3 is a well known but not well understood phenomenon. It has been suggested that the enhancement of surface diffusivity permits sintering to full density. A series of experiments was performed to measure the surface mass transport by following the decay of periodic gratings on basal planes of pure alumina and MgO-doped alumina (21 ppm). Annealing was performed under air, at 1650°C and 1700°C. It was found that the rate of surface mass transport is decreased by the addition of MgO. The kinetics of matter transport of pure alumina under air and under argon are faster than under vacuum. This shows a contribution of vapour phase transport in dense atmospheres. (21 refs.)

102159 The electronic structure of aromatic molecules adsorbed on Pd (111). F.P.Netzer, J.U.Mack (Inst. fur Phys. Chem., Univ. Innsbruck, Innsbruck, Austria).
J. Chem. Phys. (USA), vol.79, no.2, p.1017-25 (15 July 1983).
Angle resolved ultraviolet photoelectron spectroscopy (ARUPS) and electron energy loss spectroscopy (ELS) have been used to study the electronic energy level structure of aromatic molecules such as benzene, *m*-xylene, pyridine, and 2,6-dimethylpyridine adsorbed on Pd (111) at room temperature. Angle resolved He I and He II spectra were investigated to assign adsorbate derived bands in terms of molecular orbitals of the gas-phase molecules, whereby He II radiation proved particularly useful for this assignment because deeper lying σ orbitals can be observed. Angle resolved photoemission behaviour of benzene is satisfactorily described by an adsorbate complex of C_{6v} symmetry, i.e. consisting of benzene molecules with their ring plane parallel to the surface. It appears that the geometrical structure of the surface does not greatly influence the symmetry properties of the surface molecule. Reduction of the free-molecule symmetry C_{2v} to C_s in the adsorbed state is necessary for *m*-xylene, pyridine, and dimethylpyridine to account for the relaxation of symmetry based restrictions in normal emission. This can be interpreted for *m*-xylene and dimethylpyridine in terms of adsorption parallel to the surface, but for pyridine an adsorbate phase of molecules in an inclined geometry, with their molecular plane tilted with respect to the surface, is proposed. The initial state information of UPS is used to discuss the electronic excitation spectra of aromatic molecules on Pd (111). The intramolecular $\pi\rightarrow\pi^*$ excitations of the free molecules are not clearly observed in ELS of the adsorbed molecules, but strong charge transfer bands are seen in the loss energy region 2.5-5 eV. Possible reasons for the absence of distinct intramolecular features in adsorbate ELS are discussed. These include pronounced modifications of the π orbital structure for strong adsorbate-surface interaction, reduction of transition probabilities due to the dielectric response of the substrate, and interference of the molecular transition with surface plasmon excitation. (34 refs.)

102160 The influence of steps on the desorption kinetics of NO from Pt(111). J.A.Serri, J.C.Tully, M.J.Cardillo (Bell Labs., Murray Hill, NJ, USA).
J. Chem. Phys. (USA), vol.79, no.3, p.1530-40 (1 Aug. 1983).
A kinetic model is presented which describes thermal desorption of molecules from surfaces and incorporates trapping at steps. The model is applied to desorption of NO from Pt(111). The results of three molecular beam experiments, which differ substantially from each other, are accounted for quantitatively by the model using one set of rate parameters. It is demonstrated that steps, even when present in small concentrations on accurately cut crystals, can play a dominant role in thermal desorption. The magnitude of the effect depends on the difference between the binding energies on the terrace and at steps, which for NO on Pt(111) is large (25 ± 2 kcal/mol and 34 ± 2 kcal/mol, respectively). Furthermore, it is shown that the rate parameters governing terrace desorption, escape from steps, and surface diffusion can all be extracted from modulated molecular beam studies carried out for a suitable range of conditions. (13 refs.)

102161 Inert-gas energy-accommodation coefficients on tungsten. S.F.Borisov, Yu.G.Semenov, P.E.Suetin (Gor'kii Urals Univ., Sverdlovsk, USSR).
J. Eng. Phys. (USA), vol.43, no.6, p.1394-8 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.6, p.983-8 (Dec. 1982).
Measurements have been made of the energy-accommodation coefficiencts for inert gases on the thermally cleaned and partially controllable surface of tungsten at about 300K under conditions of oil-free pumping. (12 refs.)

102162 Adsorption layers of surface-active substances and their influence on polyurethane network formation. T.E.Lipatova, Sh.G.Vengerovskaya, A.E.Feinerman, L.S.Sheinina (Inst. of Organic Chem., Acad. of Sci., Kiev, Ukrainian SSR).
J. Polym. Sci. Polym. Chem. Ed. (USA), vol.21, no.7, p.2085-94 (July 1983).
The study of polyurethane systems in the presence of surface-active substances (SASs) proves that surfactants cause structural and kinetic changes in the reaction system. Surfactant decreases the viscosity of these systems in the early stages of reaction, shifting the beginning of structural gel formation to the higher degrees of NCO-group conversion. The reaction rate is a complex function of surfactant concentration. The binary polyether-surfactant system was studied by IR spectroscopy and surface tension measurement. The data prove that intermolecular and intramolecular H bonds in the system are redistributed at all surfactant concentrations but 0.03 and 0.15%. According to the authors calculations for surfactant adsorption layers at the polyether-air interface, ΔS values do not depend on temperature at surfactant concentration 0.03%; whereas at 0.15% ΔS and ΔH values are maximum. The results obtained by different methods are well correlated and suggest that kinetic effects are due to redistribution of H bonds under the influence of conformational changes in surfactant structure. (19 refs.)

102163 Theory of the long range polarization of an adatom near a solid surface. L.Galatry, D.Girard (Lab. de Phys. Moleculaire, Univ. de Besancon, Besancon, France).
Mol. Phys. (GB), vol.49, no.5, p.1085-101 (10 Aug. 1983).
The electric polarization of an adatom near a solid surface is studied in the absence of electron overlap. This polarization is formulated in the frame of the non-linear (electro-optical) effect. It exhibits a dependence with respect to the dielectric constant of the solid and to a quadratic hyperpolarizability of the atom. The result is then shown to be consistent with other formulations of the same effect, presently available in the literature. (24 refs.)

102164 Heat of adsorption of water on E glass fibre surfaces. M.Akinc, D.M.Martin (Materials Sci. & Engng., Iowa State Univ., Ames, IA, USA).
Phys. & Chem. Glasses (GB), vol.25, no.5, p.117-21 (Oct. 1983).
E glass fibres were prepared by drawing into atmospheres containing water vapour and tetrafluoromethane (CF_4). After suitable conditioning, the heat of adsorption of the water vapour in the monolayer and multilayer regimes was determined using adsorption isotherms. Adsorption of water vapour on fibre drawn in humid atmospheres was exothermic, as expected, while strongly endothermic adsorption was observed on fibres drawn in atmospheres containing CF_4. Fluorinated fibres became hydrophobic on exposure to benzene vapour, due to the irreversible nature of the adsorption of benzene. (12 refs.)

102165 Neutron diffraction from ethylene adsorbed on graphite. S.K.Satija, L.Passell, J.Eckert, W.Ellenson (Brookhaven Nat. Lab., Upton, NY, USA), H.Patterson.
Phys. Rev. Lett. (USA), vol.51, no.5, p.411-14 (1 Aug. 1983).
A neutron-diffraction study of deuterated-ethylene overlayers on graphite basal planes reveals the existence of three distinct adsorbed solid phases as well as the coexistence of adsorbed and bulk phases at higher coverages. Evidence of a surface wetting transition involving transfer of molecules from the bulk to adsorbed phase is also obtained. (8 refs.)

102166 Comment on 'Observation of resonant photoemission in an adsorbed molecule'. J.A.D.Matthew (Dept. of Phys., Univ. of York, York, England), D.E.Ramaker, E.Bertel, M.A.Chesters.
Phys. Rev. Lett. (USA), vol.51, no.6, p.521 (8 Aug. 1983).
Loubriel et al. (see ibid., vol.49, p.571, 1982) have recently reported resonantly enhanced photoemission data for CO chemisorbed on Pt(111). The authors compare this data with existing electron-excited Auger data on the same system, and present modifications to their interpretation as suggested by this comparison. (5 refs.)

102167 Melting and wetting behavior in oxygen films. D.D.Awschalom, G.N.Lewis, S.Gregory (Lab. of Atomic & Solid State Phys., Cornell Univ., Ithaca, NY, USA).
Phys. Rev. Lett. (USA), vol.51, no.7, p.586-8 (15 Aug. 1983).
At high coverages and low temperatures oxygen on exfoliated graphite takes the form of a bilayer film plus bulk solid clusters. A transition at 47K is interpreted as prewetting in which a thick film is formed. Evidence for this transition is seen in heat-capacity and magnetic-susceptibility measurements. (7 refs.)

102168 Static dipole moment of an atom or a centrosymmetric molecule near a perfect metallic surface. P.Grossel (Lab. d'Optique, Univ. de Reims, Reims, France), J.M.Vigoureux, D.Van Labeke.
Phys. Rev. A (USA), vol.28, no.2, p.524-31 (Aug. 1983).
The expression for the dipole moment of an atom or a centrosymmetric molecule in the vicinity of a perfect metallic surface is given at any distance. The near-zone (London) and the far-zone (Casimir) limits of these results are also considered. (28 refs.)

102169 Coupling of phonons to a helium atom adsorbed on graphite. R.D.Williams, M.W.Cole, S.E.Koonin (California Inst. of Technol., Pasadena, CA, USA).
Phys. Rev. B (USA), vol.28, no.2, p.1076-80 (15 July 1983).
The authors compute the self-energy for a ^4He atom adsorbed on graphite to second order in the phonon coupling. The phonon contributions amount to several degrees Kelvin. The imaginary part corresponds to a lifetime of some 10^{-11} s. (23 refs.)

102170 Ion desorption from surfaces following photon excitation of core electrons in the bulk. R.Jaeger, J.Stohr (Corporate Res. Sci. Labs., Exxon Res. & Engng. Co., Linden, NJ, USA), T.Kendelewicz.
Phys. Rev. B (USA), vol.28, no.2, p.1145-7 (15 July 1983).
Comparison of photon-excited total electron yield and H^+-ion yield spectra above the N *K* edge and Ni *L* edge for single and multiple NH_3 layers on Ni (110) reveal the dominance of an indirect ion-desorption mechanism. This mechanism consists of photon excitation in the bulk with long-range transfer of the excitation to the surface by secondary electrons. The results imply important limitations in the existing picture of the electron- and photon-stimulated-desorption techniques as site-specific, local surface probes. (10 refs.)

102171 Chemisorption on CO of Co(0001). II. Multielectron excitations. H.-J.Freund (Lehrstuhl fur Theoretische Chem., Univ. zu Koln, Koln, Germany), F.Greuter, D.Heskett, E.W.Plummer.
Phys. Rev. B (USA), vol.28, no.4, p.1727-33 (15 Aug. 1983).
For pt.I see ibid., vol.27, p.7117 (1983). The outer valence levels of CO chemisorbed on Co(0001) have been studied and discussed in a previous paper. In this paper the authors compare the photoionization of all core and valence levels for an adsorbate system [CO-Co(0001)] to those of a corresponding metal-molecule cluster $[Co_4(CO)_{12}]$. The observed multielectron excitations accompanying these molecular ionizations are discussed in detail. The observation of a resonance in the valence-band satellite of bulk cobalt is also described. (30 refs.)

102172 Theoretical studies of chemisorbed oxygen on Ag(110). R.L.Martin, P.J.Hay (Theoretical Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
Surf. Sci. (Netherlands), vol.130, no.1, p.L283-8 (July 1983).
The interaction of an oxygen atom with a 26-atom cluster model of the (110) face of Ag has been investigated with ab initio self-consistent-field and configuration-interaction theory. The SCF results for the bridge site (C_{2v}) predict r=0.3 Å and ω_e=327 cm^{-1}, in good agreement with the available experimental evidence. The calculated binding energy (D_e=9 kcal/mole) is roughly an order of magnitude too small. The inclusion of electron correlation increases r_e and ω_e only slightly, but should have a dramatic effect on D_e. The ground state corresponds to a 'surface oxide' state. The theoretical projected density-of-states curves exhibit 'bonding' and 'anti-bonding' O(2p) peaks, separated by ~6 eV, in good agreement with recent angle-resolved photoemission data. (17 refs.)

102173 Thermal desorption of N_2 from (N_2+O_2) coadsorbed on polycrystalline rhenium surfaces. T.Kioka, H.Miki, K.Kawasaki (Dept. of Phys., Sci. Univ. of Tokyo, Chiba, Tokyo, Japan).
Surf. Sci. (Netherlands), vol.130, no.1, p.L294-8 (July 1983).
The coadsorption of $^{15}N_2$ and O_2 on polycrystalline rhenium filament has been studied by thermal desorption mass spectroscopy. The sample was exposed to a mixture of $^{15}N_2$ and O_2 with various concentrations of $^{15}N_2$ at room temperature. It is suggested that NO on Re at low coverage is dissociative and the bonding strength of nitrogen on Re is weakened by the coadsorption with oxygen atoms. (12 refs.)

102174 Study of Ag/Si(111) submonolayer interface. II. Atomic geometry of Si(111) ($\sqrt{3}\times\sqrt{3}$)R30°-Ag surface. S.Kono, H.Sakurai, K.Higashiyama, T.Sagawa (Dept. of Phys., Tohoku Univ., Sendai, Japan).
Surf. Sci. (Netherlands), vol.130, no.1, p.L299-306 (July 1983).
For pt.I see ibid., vol.127, no.1, p.35-47 (1983). Final state diffraction of Ag 3d X-ray photoelectrons from the Si(111) ($\sqrt{3}\times\sqrt{3}$)R30°-Ag surface has been measured. From a kinematical analysis of the diffraction patterns, it is found that a buried honeycomb framework of Ag atoms is formed on the surface with lateral displacement of the first Si layer. (17 refs.)

102175 The adsorption of cyclic hydrocarbons on Ru(001). I. Cyclopropane. T.E.Felter, F.M.Hoffmann, P.A.Thiel, W.H.Weinberg (Dept. of Chem., California Inst. of Technol., Pasadena, CA, USA).
Surf. Sci. (Netherlands), vol.130, no.1, p.163-72 (July 1983).
The adsorption of cyclopropane on Ru(001) at 90K has been investigated by high-resolution electron energy loss spectroscopy, He I photoelectron spectroscopy, low-energy electron diffraction and thermal desorption mass spectrometry. The results indicate that the molecule adsorbs nondissociatively without long-range order and that no opening of the carbon ring occurs. The adsorption bond is weak, and multilayers form at 90K only in the presence of a relatively high c-C_3H_6 equilibrium pressure. The vibrational spectrum is characterized by strong, dipole-active ring deformation modes and an additional mode at 570 cm^{-1}, which is due to a frustrated translation of the admolecule perpendicular to the surface with some ring deformation character. The photoelectron spectrum is characterized by a Jahn-Teller splitting of the 3e′ molecular orbital, which is observed also in the gas phase. With the exception of a uniform relaxation shift no other shifts could be observed in comparison with the gas phase. The results are discussed in relation to possible bonding mechanisms. (26 refs.)

102176 The adsorption of cyclic hydrocarbons on Ru(001). II. Cyclohexane. F.M.Hoffmann, T.E.Felter, P.A.Thiel, W.H.Weinberg (Div. of Chem., California Inst. of Technol., Pasadena, CA, USA).
Surf. Sci. (Netherlands), vol.130, no.1, p.173-90 (July 1983).
For pt.I see ibid., vol.130, p.163 (1983). The adsorption of cyclohexane on Ru(001) at 90K has been investigated by thermal desorption mass spectrometry, EELS, UV photoemission and LEED. Thermal desorption indicates the adsorption of the undissociated molecule first in a chemisorbed monolayer (T_d=200K) with subsequent formation of multilayers (T_d=165K) at higher exposures. The vibrational spectrum obtained by EELS is characterized by a frequency shift of the C-H stretching mode from 2920 cm^{-1} (mutilayer) to 2560 cm^{-1} for the chemisorbed monolayer. Off-specular EELS data indicate two different electron scattering mechanisms for the C-H stretching mode. Whereas for the C-H stretching mode of the multilayer, large angle electron impact scattering is observed, the C-H soft-mode of the monolayer is largely due to small angle dipolar scattering. The He I photoelectron spectra of cyclohexane multilayers are characteristic of the undissociated molecule. A new assignment of C(2s) and the lowest C(2p) level, based on a comparison with benzene, shows that the chemisorbed monolayer is characterized by the absence of emission or broadening of the $2a_{1u}$ level. This is attributed to C_{3v} symmetry of the chemisorbed layer and to a possible interaction of the $2a_{1u}$ orbital with the metal surface. (44 refs.)

102177 Investigation of surface self-diffusion of Ni atoms on the Ni(100) plane by means of work function measurements and Monte Carlo calculations. P.Schrammen, J.Holzl (Fachbereich Phys., Univ. des Landes Hessen, Kassel, Germany).
Surf. Sci. (Netherlands), vol.130, no.1, p.203-28 (July 1983).
A novel method is presented to study migration of adsorbed metal atoms on a clean (*hkl*) surface of a metal substrate. The system used was Ni on Ni(100). The authors make use of the assumption that each single step of random walk motion of an individual adatom on the metal substrate refers to an activation energy ΔE_{if} (indices i and f giving the number of occupied nearest neighour sites in the initial and final position respectively). Furthermore, they assume that the dipole moment p_ν of an adatom is determined by the number ν of occupied nearest neighour sites. Via their dipole moments the adsorbed atoms induce a change of work function $\Delta\Phi$ of the substrate metal, $\Delta\Phi$ being related to the average dipole moment per unit area by the Helmholtz equation. To measure $\Delta\Phi$ they use a pendulum device. At fixed low coverage θ the variation of $\Delta\Phi$ with temperature T has been calculated numerically within the framework of a Monte Carlo simulation (MCS) model, using various activation energies ΔE_{if} and dipole moments p_ν as input parameters. By fitting these data to the experimental curves the authors derive the following dipole moments and activation energies: $p_0=0.45\pm0.05$ D, $p_1=0.36\pm0.05$ D, $p_2=0.27\pm0.05$ D, $p_3=0.18\pm0.05$ D, $\Delta E_{00}=0.60\pm0.02$ eV, $\Delta E_{10}=0.70\pm0.025$ eV, $\Delta E_{21}=0.80\pm0.05$ eV, $\Delta E_{20}=0.90\pm0.05$ eV. They compare these results with those of other workers. (17 refs.)

102178 Adsorption of coumarin on faces of a bismuth single crystal. N.A.Paltusova, A.R.Alumaa, U.V.Palm.
Sov. Electrochem. (USA), vol.18, no.11, p.1380-4 (Nov. 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.11, p.1546-50 (Nov. 1982).
The results of capacitance measurements have led to the conclusion that coumarin molecules are adsorbed on mercury and on bismuth in two different orientations: in a vertical orientation at high negative charges and in an inclined orientation near the p.z.c. At the same time, the plots of the differential capacitance on a fixed bismuth electrode differ qualitatively from the C, E curves on mercury, i.e. on bismuth there is no intermediate capacitance maximum between the two absorption regions. Therefore, the study of the laws governing the adsorption of coumarin on the individual faces of a bismuth single crystal is of considerable interest. (7 refs.)

102179 Adsorption of cyanide ions on silver. Effect of electrode potential and surface coverage by adsorbed ions on the adsorption-desorption equilibrium rate. N.A.Rogozhnikov, R.Yu.Bek.
Sov. Electrochem. (USA), vol.18, no.11, p.1394-7 (Nov. 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.11, p.1561-3 (Nov. 1982).
A study of the relationship between the adsorption-desorption equilibrium rate (ν_0) and the surface density of an adsorbed substance (A) as well as the electrode potential (E) can be used to determine how these factors affect the forward and reverse processes. The following expression for resistance (R_{11}) includes the term ν_0: $R_{11}=RT/(\partial q/\partial A)E^2\nu_0$ where R is the universal gas constant, T is the absolute temperature, and q is the electrode charge. The R_{11} values were determined from the relation of frequency to capacitance

using a substitution procedure similar to that for single-step adsorption whose laws also govern the effect under study. (7 refs.)

102180 Phase transitions in adsorbed layers. IV. Thermodynamics of monolayer adsorption. A.Patrykiejew (Dept. of Chem. Phys., Marie Curie-Sklodowska Univ., Lublin, Poland).
Thin Solid Films (Switzerland), vol.105, no.3, p.259-83 (22 July 1983).
For pt.III see ibid., vol.88, p.359 (1982). The effects of dimensional incompatibility and of potential barriers for surface diffusion on the phase transitions in a monolayer are discussed in terms of the partially mobile adsorption layer model presented in the previous publication. It is pointed out that the formation of a two-dimensional solid phase with the adsorbent can be either discontinuous (first order) or continuous depending on the properties of the adsorption system. In particular, the first-order transition from the liquid to the solid phase can occur only when the system exhibits small dimensional incompatibility. The changes in various thermodynamic functions for the monolayer (e.g. the isosteric heat of adsorption, the differential entropy and the heat capacity) due to phase transitions are discussed. (25 refs.)

102181 Studies of photon induced gas desorption using synchrotron radiation. O.Grobner, A.G.Mathewson, H.Stori, P.Strubin (CERN, Geneva, Switzerland), R.Souchet.
Vacuum (GB), vol.33, no.7, p.397-406 (July 1983).
In view of finalizing the design of the vacuum system of the Large Electron and Positron Storage Ring (LEP), the authors have studied synchrotron radiation induced neutral gas desorption. A 3 m section of an aluminium vacuum chamber has been exposed to the photon beam emerging from the electron storage ring DCI in Orsay, under conditions closely simulating the environment in a particular accelerator. In order of importance the gases desorbed were H_2, CO_2,CO and CH_4 with H_2O practically absent. Under the experimental conditions of an unbaked chamber and 11 mrad glancing incidence of the photons, the initial molecular desorption yields for these gases were typically 0.5, 8×10^{-2}, 2×10^{-2} and 8×10^{-3} molecules per photon respectively. These values could be reduced by about 1 to 2 orders of magnitude during continued photon exposure and in most cases without evidence that this 'beam cleaning action' would be limited. After exposure to air and pumpdown of the previously cleaned chamber, a significant memory effect was observed. The dependence of the photon desorption on the angle of incidence has been studied down to a glancing angle of 11 mrad showing a definite deviation from the previously assumed $1/\sin\phi$ scaling. The implications of the results in terms of the expected beam-gas lifetimes in LEP are discussed. (7 refs.)

102182 Analysis of laser-enhanced adsorption/desorption processes on semiconductor surfaces via electronic surface state excitation. W.C.Murphy, A.C.Beri, T.F.George (Dept. of Chem., Univ. of Rochester, Rochester, NY, USA), J.-T.Lin.
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.273-82
Electronic surface states in semiconductors often lie between the valence and conduction bands and give rise to charge densities confined to the surface region. Laser radiation of frequency less than the energy gap can excite electrons from delocalized valence band states to these localized surface states leading to large changes in the charge distribution at the surface. Selective enhancement of adsorption/desorption processes involving ionic or polar adspecies can result from such a charge redistribution. Using a one-dimensional model for silicon, the cross-section for the laser-induced electronic transition to surface states is shown to be large. The interaction energy of an adspecies with the surface changes significantly with direct excitation of surface states in a semiconductor. For a one-dimensional metal, however, direct transitions between bulk and surface states are not allowed, but phonon-mediated transitions coupled with laser radiation lead to substantial charge transfer as for semiconductors. (10 refs.)

Electronic spectra of n-aminoazo dyes adsorbed on surfaces of alumosilicate catalysts and their quantum chemical interpretation .... See Entry 100411

Evidence for a commensurate-incommensurate phase transition with an intermediate fluid phase: N_2 adsorbed on Ni(110) .... See Entry 101955

Direct observation of layer-to-layer wetting of graphite by ethylene .... See Entry 102124

Surface reconstruction and adsorbate geometry by surface core level spectroscopy .... See Entry 102129

Structure of graphitic carbon on Ni(111): a surface extended-energy-loss fine-structure study .... See Entry 102133

He diffraction from clean Pt(111) and (1×1) H/Pt(111) surface .... See Entry 102138

Surface reconstruction of Cu(111) upon oxygen adsorption ....See Entry 102139

Vibrational damping of adsorbed molecules: Effects of a realistic metal surface .... See Entry 102148

Electron energy loss and Auger study of epitaxially grown Cu on Ni(100) .... See Entry 102206

Effects of gas flow speed and chlorine concentration on tellurium uptake in gas-phase epitaxy of gallium arsenide .... See Entry 102210

Solid-gas interaction influence on the conductivity of molybdenum sulphides in the vicinity of an order-disorder transition .... See Entry 102390

The relation between contact potential and planar conduction as a-Si:H films undergo gas adsorption or temperature changes .... See Entry 102400

Transverse acousto-EMF as a function of acoustically stimulated adsorption on the surface of a semiconductor .... See Entry 102467

Core- and valence-band energy-level shifts in small two-dimensional islands of gold deposited on Pt(100): the effect of step-edge, surface, and bulk atoms .... See Entry 102483

Influence of chain length on conformations of poly(ethylene glycol) chains grafted on silica [ESR observations] .... See Entry 102751

Electroreflectance study of π-adsorption .... See Entry 102853

The dependence of SERS on the vibrational mode, exciting radiation and applied potential .... See Entry 102859

Infrared-active combination band in a surface formate species .... See Entry 102880

Role of electromagnetic resonances in the surface-enhanced Raman effect .... See Entry 102881

Fluorescence of rare earth ions adsorbed on porous Vycor glass .... See Entry 102920

An anomalous emission from $Ru(bpy)_3^{2+}$ adsorbed onto porous Vycor glass .... See Entry 102921

Trapping and energy accommodation of atoms on metal surfaces .... See Entry 103020

Influence of an electric field on the evaporation of Fe-Si, Fe-Mn and Fe-Al melts in helium. Experimental investigation .... See Entry 103036

Laser chemical etching of conducting and semiconducting materials .... See Entry 103366

Intermediate product identification for ammonia decomposition at Ni(110) .... See Entry 103518

The standard enthalpy of formation of $LaNi_5$. The enthalpies of hydriding of $LaNi_{5-x}Al_x$ .... See Entry 103578

Statistical rates for reactions of heterogeneous surfaces: the influence of non-ideal collisions .... See Entry 103580

Resonance Raman spectra of benzene adsorbed on Cu^{2+}-montmorillonite. Formation of poly(*p*-phenylene) cations in the interlayer of the clay mineral .... See Entry 103581

Surface enhanced Raman spectra of benzotriazole adsorbed on a copper electrode .... See Entry 103583

Ab initio study of the symmetric reaction path of H_2 with a surface *V* center in magnesium oxide .... See Entry 103587

The role of adsorbed sulfur in the H_2-D_2 equilibrium reaction on Pt single crystals .... See Entry 103588

The role of surface phenomena in the interactions of reactive metals with gases .... See Entry 103590

68.48 SOLID-SOLID INTERFACES

(inc. bicrystals; for grain boundaries, see 61.70N)

102183 Metal-semiconductor interface formation. D.Bolmont (Lab. de Phys. des Solides, Univ. Pierre et Marie Curie, Paris, France).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.483-92 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The more and more detailed study of an increasing number of metal-semiconductor (MS) interfaces tends to demonstrate the prevailing part played by the different local bonds associated with the compositional change at the interface. In the case of the abrupt interfaces both geometrical properties and electronic equilibrium are settled at a coverage below one monolayer. A few cases are discussed which show the variety of physical phenomena involved in the barrier height fixation in contradiction with all attempts to a unified model. (11 refs.)

102184 Electron microscope studies of a Ge-GaAs superlattice grown by molecular beam epitaxy. T.S.Kuan, C.-A.Chang (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4408-13 (Aug. 1983).
A Ge-GaAs superlattice with individual layer thicknesses of 10 nm (Ge layers) and 8 nm (GaAs layers) grown on a (100) oriented GaAs substrate at 400°C by molecular beam epitaxy was examined by transmission electron microscopy. Cross-sectional lattice images of the superlattice revealed no lattice irregularities in both GaAs and Ge layers and perfect lattice match at the Ge-GaAs interfaces. However, bright field and dark field images of the same superlattice indicated the presence of planar defects in the GaAs layers but not in the Ge layers. These planar defects, whose nature does not involve perturbations of the crystal lattice other than elastic strain fields, are most likely antiphase boundaries, which are generated during the growth of the GaAs layers by the coalescence of GaAs domains independently grown on the Ge surface. The generation of antiphase boundaries in GaAs layers might be responsible for the segregated Ge and GaAs columnar structure previously observed in Ge-GaAs superlattices with individual layer thicknesses of only a few monolayers. (12 refs.)

102185 Grain boundary strength of molybdenum bicrystals with a $\langle 110\rangle$ twist boundary. H.Kurishita (Dept. of Materials Sci. & Technol., Kyushu Univ., Fukuoka, Japan), S.Kuba, H.Kubo, H.Yoshinaga.
J. Jpn. Inst. Met. (Japan), vol.47, no.7, p.539-45 (July 1983). In Japanese.
Grain boundary fracture in molybdenum was investigated by the four-point bending test at 77K as a function of misorientation angle by using bicrystals with a $\langle 110\rangle$ twist boundary. It was found that fracture always occurs at the grain boundary. The fracture strength and strain to fracture markedly depend on the misorientation angle, i.e. the bicrystals of misorientation up to 20° and those of around 70° (Σ^3) have much higher fracture strength than the others, and some appreciable plastic strain is only observed for these strong bicrystals. Misorientation width of the peak in strength agrees with the predicted value from the Brandon's equation. There are no peaks in strength around Σ^9 and Σ^{11} coincidence boundaries. (21 refs.)

102186 Grain boundary fracture in molybdenum bicrystals with a $\langle 110\rangle$ symmetric tilt boundary. H.Kurishita (Dept. of Materials Sci. & Technol., Kyushu Univ., Fukuoka, Japan), A.Oishi, H.Kubo, H.Yoshinaga.
J. Jpn. Inst. Met. (Japan), vol.47, no.7, p.546-54 (July 1983). In Japanese.
In order to investigate the grain boundary fracture in molybdenum with a $\langle 110\rangle$ symmetric tilt boundary, the four-point bending test was conducted at 77K by using bicrystals with various misorientations from 0° to 90°. The stress-strain curve to fracture was measured as a function of misorientation angle ϕ. Two classes of specimens were used to clarify the impurity effect on the grain boundary fracture: one was as-grown specimens which contained carbide precipitates at grain boundaries and the other was purified specimens in which no precipitates were observed. A marked misorientation dependence of both fracture stress and plastic strain to fracture, was observed for the purified specimens; the stress and strain were both much higher for $\phi=0°$-10° (Σ^1), around 70° (Σ^3, (112) twin boundary) and around 87° (Σ^{17b}, (223) twin boundary) than for the other boundaries. The dependence observed for the as-grown specimens was qualitatively similar to but quantitatively much less than that for the purified specimens. The misorientation dependence of the grain boundary energy and the effect of carbon impurity on the grain boundary cohesion were discussed. (21 refs.)

102187 Evidence for grain boundary phase transition in a 2D bicrystal. F.Carrion, G.Kalonji, S.Yip (Dept. of Nuclear Engng., MIT, Cambridge, MA, USA).
Scr. Metall. (USA), vol.17, no.7, p.915-18 (July 1983).
Molecular dynamics simulation results are presented on a two-dimensional bicrystal which reveal a structural transition at a temperature approximately between 0.7 T_m to 0.8 T_m. The evidence lies mainly in a discontinuous behavior in the temperature variations of thermodynamic properties of a two-dimensional $\Sigma=7$ (38.21°) bicrystal in which the atoms interact through a Lennard-Jones 6-12 potential. Additional results in the form of instantaneous atomic configurations at various stages of the simulation support this interpretation. (16 refs.)

Reduction of contact resistivity by As redistribution during Pd_2Si formation ....See Entry 102076

Al-GaAs(001) Schottky barrier formation ....See Entry 102491

Auger electron spectroscopy interface study of evaporated and ion-plated silver films on steel substrates ....See Entry 103076

The solid-state reaction of copper and tin: an assessment of the value of an iron barrier layer ....See Entry 103400

68.55 THIN FILM GROWTH, STRUCTURE, AND EPITAXY

(for techniques of crystal growth and film deposition, see 81.10 and 81.15)

102188 Epitaxial $NiSi_2$ formation by pulsed laser irradiation of thin Ni layers deposited on Si substrates. M.G.Grimaldi, P.Baeri, E.Rimini (Istituto Dipartimentale di Fisica, Cătania, Italy), G.Celotti.
Appl. Phys. Lett. (USA), vol.43, no.3, p.244-6 (1 Aug. 1983).
Pulsed laser irradiation was used to induce silicide formation in Ni thin layer deposited onto Si substrates of ⟨100⟩ and ⟨111⟩ orientation, respectively. Suitable energy densities of the 30-ns Nd glass laser pulse produced epitaxial $NiSi_2$ silicide for a 15-nm-thick Ni layer. Irradiation of thicker metal films formed instead several silicides of nonuniform composition. (11 refs.)

102189 Growth of metastable $Cu_{1-x}Cr_x$ solid solutions by ion mixing during bias-sputter deposition. S.M.Shin, M.A.Ray, J.M.Rigsbee, J.E.Greene (Dept. of Metall., Univ. of Illinois, Urbana, IL, USA).
Appl. Phys. Lett. (USA), vol.43, no.3, p.249-51 (1 Aug. 1983).
The Cu-Cr system exhibits a miscibility gap in the liquid and has essentially no solid solubility. However, using low energy, <160 eV, Ar^+ ion bombardment of the growing film to promote ballistic collisional mixing, metastable single phase face-centered-cubic Cu-rich and body-centered-cubic Cr-rich solid solutions have been grown on amorphous glass substrates at 75°C. The films were typically 1 μm thick with average grain sizes of 90 and 110 nm, respectively, and a (111) preferred orientation. Annealing studies combined with X-ray and electron diffraction analyses showed that the films have good thermal stability against phase separation at temperatures up to 400°C. The metastable to equilibrium phase transformation occurred with the precipitation of an essentially pure second phase, rather than through a continuous series of metastable states, due to structural constraints. (8 refs.)

102190 Epitaxial growth of $Hg_{0.7}Cd_{0.3}Te$ by laser-assisted deposition. J.T.Cheung (Rockwell Internat. Sci. Center, Thousand Oaks, CA, USA).
Appl. Phys. Lett. (USA), vol.43, no.3, p.255-7 (1 Aug. 1983).
Epitaxial *n*-type $Hg_{0.7}Cd_{0.3}Te$ layers on (111)A CdTe substrates have been grown at 130°C by laser-assisted deposition. Mobility and carrier concentration values at 77K range from 4000 to 7000 cm^2/Vs and 0.7 to 3×10^{16} cm^{-3}, respectively. Films can be converted to *p* type after annealing at 410°C. Implanted n^+/p photodiodes have been demonstrated. (6 refs.)

102191 Epitaxial film transfer technique for producing single crystal Si film on an insulating substrate. M.Kimura, K.Egami, M.Kanamori (Fundamental Res. Labs., NEC Corp., Kawasaki, Japan), T.Hamaguchi.
Appl. Phys. Lett. (USA), vol.43, no.3, p.263-5 (1 Aug. 1983).
Epitaxial film transfer, a new technique for producing a single crystal Si film with both large size and high quality on an insulating substrate, is demonstrated. The technique in which an epitaxial Si film is transferred to a secondary substrate by using three fundamental processes of epitaxial growth, bonding of two wafers, and substrate elimination, can produce a 2-in. single crystal Si film as thin as 1.5 μm on an insulating substrate. Thickness variation can be controlled to ±0.06 μm across a 2-in. wafer. An epitaxial Si film is transferred without significant degradation in quality although a fine film waving exists. (6 refs.)

102192 Temperature and concentration dependence of epitaxial growth rate in Sb and Ga implanted Si. S.U.Campisano, Chu Te Chang (Istituto Dipartimentale di Fisica, Catania Univ., Catania, Italy).
Appl. Phys. A (Germany), vol.A31, no.3, p.157-60 (July 1983).
The epitaxial growth rate of SI (100) implanted with several doses of Sb or Ga has been measured at 480 and 500°C by channeling-effect technique. The growth rate at each temperature is constant up to a given concentration, and then it increases almost abruptly as the dopant concentration increases. This critical concentration is 8×10^{19} and 1.8×10^{20} at./cm^3 for Sb at 480 and 500°C, respectively, whilst for Ga it is $\sim1.5\times10^{20}$ at./cm^3 for both temperatures. These results cannot be simply explained within the known models of epitaxial rate enhancement due to dopant addition, thus pointing out the need for more extensive measurements and more realistic descriptions. (12 refs.)

102193 Structure and properties of evaporated amorphous films consisting of transition metal-metalloid alloys. N.I.Recheshter, E.Ya.Badinter, A.A.Yakunin, V.F.Bashev, I.S.Miroshnichenko (Ukraine & Russia Reunion Tercentenary State Univ., Dnepropetrovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1213-15 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of eutectic and hypereutectic Fe-B, Fe-Ni-P, and Ni-Fe-B alloys of the compositions (at.%): $Fe_{82.5}B_{17.5}$; $Fe_{68.5}Ni_8P_{23.5}$; $Ni_{69}Fe_{13.5}B_{17.5}$. Thin amorphous films were deposited by the ion-plasma evaporation method. The structure was determined by electron diffraction. The temperature dependences of the electrical resistivity and surface resistance were found. The temperature-time stability of the films in respect of their resistance was also studied. The observed changes were attributed to surface oxidation of the films. (3 refs.) *A.T.*

102194 Electron diffraction studies of metastable phase decay in amorphous bismuth with high hydrogen content. Yu.F.Komnik, B.I.Belevtsev, L.A.Yatsuk.
Fiz. Nizk. Temp. (USSR), vol.9, no.7, p.745-8 (July 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The coordination structure of amorphous bismuth films was studied by electron diffraction technique. The films were evaporated in hydrogen atmosphere onto a substrate cooled by liquid helium down to 3.5K. The main problem was to study variations in the coordination structure of the films with the decay of the metastable phase *a*-Bi (H) at ~5K. The electron diffraction data were processed on an electronic computer to construct the radial distribution function of atomic density. It has been found that as the phase α-Bi (H) decays, an average number of atoms in the first coordination sphere decreases appreciably. The results may be taken as the basis for treatment of severe variations in resistivity and temperature of superconducting transition during the *a*-Bi (H) phase decay. (7 refs.)

102195 Characterization of tantalum-silicon films on GaAs at elevated temperatures. W.F.Tseng (Naval Res. Lab., Washington, DC, USA), B.Zhang, D.Schott, S.S.Lau, A.Christou, B.R.Wilkins.
IEEE Electron Device Lett. (USA), vol.EDL-4, no.7, p.207-9 (July 1983).
RF sputter-deposited tantalum-silicon films on GaAs have been investigated using four-point probe, glancing-angle X-ray diffraction, Auger electron spectroscopy, and MeV $^4He^+$ backscattering spectrometry as a function of annealing up to 850°C. Experimental results show that: 1) there is no observable Ta or Si migration from the $TaSi_2$ overlayer into the GaAs substrate; 2) the structure of the As-sputtered film is amorphous and crystallization into a polycrystalline $TaSi_2$ laser occurs at ~500°C accompanied by a reduction in electrical resistivity. After annealing at 650°C, As and/or Ga appear to have migrated into the $TaSi_2$ layer. The amount of this migration remains unchanged up to an annealing temperature of 850°C. On the other hand, migration of Ta and/or Si into the GaAs substrate is not detected up to 850°C. This absence of the Ta and/or Si migration contributes to the stability of the Schottky-diode characteristics against annealing reported previously. (7 refs.)

102196 Structural characterization of low-defect-density silicon on sapphire. K.W.Carey, F.A.Ponce, J.Amano, J.Aranovich (Hewlett-Packard Labs., Palo Alto, CA, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4414-20 (Aug. 1983).
The structure of (100) silicon on (1102) sapphire is discussed for films grown by a special, defect-limiting process. A three-epitaxial-step technique, which utilizes both vapor phase epitaxy and solid phase epitaxy, is employed in the fabrication of low-defect-density films. The effects of different Si^+ implantation energies and initial Si film thicknesses on the final structure of the film are investigated in order to optimize the electrical characteristics. The improvement in crystalline quality during the solid phase epitaxy step is due to overgrowth of the [221]-oriented microtwins by the (001) Si matrix. Both Rutherford backscattering spectroscopy and cross-sectional transmission electron microscopy are used in the analysis of the structure of these films. (18 refs.)

102197 Reactively RF magnetron sputtered AlN films as gate dielectric. A.Fathimulla, A.A.Lakhani (Bendix Advanced Technol. Center, Columbia, MD, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4586-9 (Aug. 1983).
AlN films were deposited on silicon (100,111), fused quartz and GaAs (100) by sputtering in an $Ar:N_2$ gas mixture. The authors report on the physical and chemical analysis of the films with the aid of scanning electron microscopy, X-ray diffraction, and Auger electron spectroscopy. The films were found to be transparent with a *c*-axis orientation. Their bulk resistivity was 10^{15} Ω-cm. Quasistatic *C-V* analysis of Al/AlN/Si gave a flat-band voltage of 0.85 V, density of fixed charge 6×10^{10} cm^{-2} and a density of fast interface charge of 1.5×10^{11} cm^{-2} eV^{-1} at midgap. These films were formed at 250°C and offer an attractive fabrication alternative for gate dielectric. (17 refs.)

102198 TEM observations of laser-induced Pt and Au deposition on InP. D.Brasen, R.F.Karlicek, V.M.Donnelly (Bell Labs., Murray Hill, NJ, USA).
J. Electrochem. Soc. (USA), vol.130, no.7, p.1473-5 (July 1983).
Laser-induced deposits of Au or Pt on (001) InP surfaces have been examined by transmission electron microscopy. It is found that Pt deposition results in the formation of $Pt(P,In)_2$; whereas, in the case of Au, Au and Au_4In are observed. A description of the general morphology, together with a discussion as to why the compound and alloy might form is presented. (10 refs.)

102199 Atomic structure, size, and shape of small nickel particles in thin films. [Electron diffraction and FMR observations]. F.Vergand, D.Fargues (Lab. de Chimie Phys., Univ. Pierre et Marie Curie, Paris, France), O.Olivier, L.Bonneviot, M.Che.
J. Phys. Chem. (USA), vol.87, no.13, p.2373-6 (23 June 1983).
Structural properties of small nickel particles, embedded in aluminum or MgF_2 films, are studied both by transmission high-energy electron diffraction and by ferromagnetic resonance. These methods lead to knowledge of the lattice parameter, found equal to the bulk one, of the size, in the range of 2-4 nm, and of the shape of the particles, plates parallel to the film. A magnetostriction effect is evidenced for the samples embedded in aluminum. (13 refs.)

102200 Closed system LPE growth of $Cd_xHg_{1-x}Te$. K.E.Mironov, V.K.Ogorodnikov, V.D.Rozumnyi, V.I.Ivanov-Omskii (A.F. Ioffe Physico-Tech. Inst., Acad. of Sci., Leningrad, USSR).
Phys. Status Solidi a (Germany), vol.78, no.1, p.125-31 (16 July 1983).
Epitaxial layers of $Cd_xHg_{1-x}Te$ are grown on CdTe substrate from Hg- and Te-rich solutions, as well as from stoichiometric melts. The interaction of the gas phase with the substrate and the layer during LPE growth of $Cd_xHg_{1-x}Te$ $(0.2\leq x\leq0.3)$ in a closed system is studied. It is shown that mirror-smooth layers can be obtained under conditions precluding condensation of vapour on the epi-layer surface. The compositional profiles over the surface and in the direction of growth studied under different conditions are discussed. The mechanisms of constant and graded composition layer growth are considered. The advantages and shortcomings of the various methods of closed-system $Cd_xHg_{1-x}Te$ liquid-phase epitaxial growth are analyzed. (12 refs.)

102201 $(Ba,Sr)TiO_3$ heteroepitaxial films. V.M.Mukhortov, Yu.I.Golovko, V.A.Aleshin, E.V.Sviridov, Vl.M.Mukhortov, V.P.Dudkevich, E.G.Fesenko (Inst. of Phys., State Univ., Rostov on Don, USSR).
Phys. Status Solidi a (Germany), vol.78, no.1, p.253-7 (16 July 1983).
Heteroepitaxial $(Ba,Sr)TiO_3$ films are obtained on MgO crystals cut by RF sputtering. An altering of the film growth mechanism by means of a thee dimensional nucleation in the mechanism of monolayer growth in dependence of the deposition conditions is proved to be possible. A change of the film structure at the ferroelectric phase transition temperature is observed. The peculiarities of film domain configurations are described. (11 refs.)

102202 Observation of voids in thin silver films by TEM. S.K.Sharma, J.Spitz (Lab. d'Etudes des Materiaux Mince, CENG, Grenoble, France).
Prakt. Metallogr. (Germany), vol.20, no.5, p.245-53 (May 1983). In English, German.
The defocus contrast technique offers a powerful tool to observe small voids in materials and for their studies. A high density of voids observed in silver films on RT aging and high temperature annealing is caused as a result of accumulation of vacancies. Void formation and growth can be suitably explained on the basis of annihilation of excess vacancies (by vacancy migration) at sinks such as pre-existing voids or other vacancies in the as-deposited films. Vacancies can be created as well as annihilated at the sinks. (13 refs.)

102203 X-ray photoemission study of $Fe-Al_2O_3$ granular thin films. E.Paparazzo, J.L.Dormann, D.Fiorani (CNR, Roma, Italy).
Phys. Rev. B (USA), vol.28, no.2, p.1154-7 (15 July 1983).
Granular $Fe-Al_2O_3$ thin films, composed of small iron particles dispersed in an amorphous alumina matrix, have been analyzed as a function of the composition and of the depth by X-ray photoemission spectroscopy. The surface

of all the samples is composed of a fully oxidized Fe^{3+} form within an alumina-rich partly hydrated region, and the surface quantitative composition is highly dependent on the bulk composition. After Ar^+ etching, metallic iron and iron aluminates become apparent. The concentration of the first species increases with increasing depth and the iron content in the bulk of the granular films. (18 refs.)

102204 Small-angle neutron scattering study of anisotropic growth morphology and irreversible photodensification in *a*-$GeSe_3$ films. T.Rayment, S.R.Elliott (Dept. of Phys. Chem., Univ. of Cambridge, Cambridge, England).
Phys. Rev. B (USA), vol.28, no.2, p.1174-7 (15 July 1983).
The anisotropic growth morphology of obliquely evaporated amorphous $GeSe_3$ thin films has been studied by small-angle neutron scattering. Films deposited at 80° to the normal contain ellipsoidal voids 240 Å in length and 120 Å in diameter inclined at 70° to the normal, and which account for 47% of the volume. Absorption of band-gap light reduces the level and anisotropy of the scattering. The ellipsoidal voids collapse to form smaller spherical voids distributed isotropically. (7 refs.)

102205 Dimensional effect during wetting of amorphous carbon substrates with small islands of bismuth and lead films (particle sizes 5×10^{-7} to 3×10^{-5} cm). S.P.Chizhik, N.T.Gladkikh, L.K.Grigor'yeva, V.I.Larin, S.V.Dukarev, I.V.Kudrik, V.D.Frolov.
Russ. Metall. (GB), no.4, p.64-70 (1981). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.4, p.73-80 (1981). [received: June 1983]
Electron microscope examinations have shown that, for particle sizes below $2\text{-}3\times10^{-6}$ cm, a size effect is observed; the wetting angle decreases with decreasing particle size. Analysis of the dependence of the wetting angle on the particle size demonstrates a decrease in the surface energy of small metallic particles with decreasing particle size. The dependence of the surface energy on particle size was determined in the case of wetting lead and bismuth particles.. (22 refs.)

102206 Electron energy loss and Auger study of epitaxially grown Cu on Ni(100). P.A.Montano, P.P.Vaishnava, E.Boling (Dept. of Phys., West Virginia Univ., Morgantown, WV, USA).
Surf. Sci. (Netherlands), vol.130, no.1, p.191-202 (July 1983).
Auger and electron energy loss spectra have been measured on films of Cu epitaxially grown on Ni(100). The films were prepared under UHV conditions using a quartz crystal for monitoring the deposition rate. LEED measurements were taken to determine the orientation of the films. The presence of a monolayer of Cu on Ni(100) is enough to suppress the 3p-3d transition on the surface of the sample. The electron energy loss spectra were studied as a function of the primary electron energy (50 to 300 eV). The experimental results were qualitatively analyzed using recent theoretical calculations of Cooper and co-workers. The effect of a small Cu coverage on Ni(100) on the chemisorption of CO and O_2 was also studied. A strong suppression of CO chemisorption at room temperature was observed. In the case of O_2, large exposures are necessary in order to observe a significant amount of oxygen on the surface. The absence of any appreciable chemisorption on the surface of the metal is attributed to the lack of empty d-surface states. (15 refs.)

102207 Structure of thermally vaporized-on films of tungsten oxide WO_3. L.A.Aleshina, A.D.Fofanov, O.N.Shivrin (O.V. Kuusinen State Univ., Petrozavodsk, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.945-6 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.596-8 (Nov. 1982).
Studies oxide films deposited on glass substrates by thermal evaporation of WO_3 powder in vacuum. The measurements of the X-rays scattered by the samples were carried out with a DRON-3 diffractometer. The use of Cu and Mo Kα radiation limited the region of measurements to values of $s=4\pi \sin\theta/\lambda=7.85$ and 17 $Å^{-1}$, respectively. The results were analyzed by the method of constructing pair functions D(r). (9 refs.)

102208 Kinetics of the formation of concentrational transitions between epitaxial layers of silicon in the process of growth from a molecular beam. M.I.Obsyannikov, R.G.Loginova, S.D.Tsarevskii (N.I. Lobachevskii Gorki Univ., Gorki, USSR).
Sov. Phys. J. (USA), vol.25, no.11, p.983-5 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.9-12 (Nov. 1982).
The doping kinetics of an epitaxial layer of silicon growing from a molecular beam is considered, taking mechanisms of impurity-atom capture by the growing layer into account: diffusional capture and immurement by atoms of the basic material. It is shown that, with increase in the growth rate, the thickness of the concentrational transition between regions with different levels of doping rises in the case of predominance of the first mechanism of impurity incorporation in the growing layer and decreases in the case of predominance of the second mechanism. Quantitative estimates of the thickness of the concentrational transition, taking account of the equilibrium coefficients of the impurity distribution between the surface region and the volume of the epitaxial layer, give satisfactory agreement with the experimental results. (12 refs.)

102209 Effects of growth temperature and substrate orientation on the entry of tellurium into epitaxial gallium arsenide films. L.G.Laverent'eva, M.D.Vilisova, V.A.Moskovkin, S.E.Toropov (V.D. Moskovkin, Physicotech. Inst., Tomsk State Univ., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.11, p.986-90 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.12-17 (Nov. 1982).
Measurements have been made on the electrophysical properties and rate of tellurium uptake in epitaxial films of gallium arsenide grown at various temperature (600-800°C) on GaAs substrates of principal and vicinal orientations. The activation energy for tellurium uptake has been determined and the rate-limiting stages for various faces have been examined. (20 refs.)

102210 Effects of gas flow speed and chlorine concentration on tellurium uptake in gas-phase epitaxy of gallium arsenide. L.G.Lavrent'eva, S.E.Toropov, L.P.Porokhovnichenko (V.D. Kuznetsov Physicotech. Inst., Tomsk State Univ., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.11, p.990-3 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.18-21 (Nov. 1982).
A comparison is made between the growth kinetics of gallium arsenide films and the uptake of tellurium in gas-phase epitaxy in a chlorine system. The rate-limiting stages for both processes are the same and are associated with diffusion through the boundary layer and the rates of surface processes (adsorption and desorption). (11 refs.)

102211 Structure of reactively sputtered nickel nitride films. G.J.W.R.Dorman, M.Sikkens (Dept. of Appl. Phys., Univ. of Groningen, Groningen, Netherlands).
Thin Solid Films (Switzerland), vol.105, no.3, p.251-8 (22 July 1983).
Thin nickel nitride films were prepared by reactive sputtering of nickel in an $Ar\text{-}N_2$ gas mixture. The structure of these films was investigated with X-ray and electron diffraction and was found to depend on the partial N_2 pressure during the sputtering process. All nickel nitrides which have been reported earlier, except Ni_3N_2, were observed in the sputtered films. At high partial N_2 pressures a body-centred tetragonal phase was observed. Up to now, this phase has not been explicitly reported as a nickel nitride. On the basis of the results the authors believe that the phase is another nickel nitride, namely Ni_2N. (21 refs.)

102212 Laser-initiated Ga-deposition on quartz substrates. Y.Rytz-Froidevaux, R.P.Salathe, H.H.Gilgen (Inst. of Appl. Phys., Univ. of Berne, Berne, Switzerland).
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.29-34
The deposition of Ga on quartz substrates by photodissociation of trimethylgallium has been investigated. Light from a frequency doubled Ar-ion laser beam (257.2 nm) was focused onto quartz substrates. The Ar-ion laser was operated under CW or mode-locking conditions. The deposition rate has been investigated as a function of averaged UV power densities in the range of 1.8-1750 W/cm^2 and is shown to depend critically on the laser operating mode. For CW operation, the maximum growth rate within the focal zone is limited to 17 Å/s whereas under mode-locking conditions, no saturation is observed and the growth rate increases linearly with the laser power up to 70 Å/s at 1.75 kW/cm^2. (11 refs.)

102213 IR laser-induced deposition of silicon thin films. T.R.Gattuso, M.Meunier, D.Adler, J.S.Haggerty (MIT, Cambridge, MA, USA).
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.215-22
The deposition of a-Si:H by means of CO_2 laser-induced pyrolysis of silane gas is described. Deposition rates were found to increase with increasing silane flow rate, reactor pressure, laser power and substrate temperature. Spin density decreased and both optical gap, and hydrogen content increased with decreasing substrate temperature. Electrical conductivities are reported. (28 refs.)

102214 Laser-induced solid phase crystallization in amorphous silicon films. G.L.Olson, S.A.Kokorowski, J.A.Roth, L.D.Hess (Hughes Res. Labs., Malibu, CA, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.141-54
The authors review recent work on the kinetics of laser-induced solid phase epitaxial crystallization of silicon as determined from time-resolved reflectivity measurements. Specific topics which are addressed include: the intrinsic kinetics of solid phase epitaxy (SPE) in ion-implanted and UHV-deposited films; SPE rate enhancement by implanted dopant atoms and the effects of electrical compensation on the SPE rate; and the temperature dependence of SPE and competing processes in samples containing impurity atoms at concentrations exceeding the solid solubility limit. The high temperature kinetics results are compared with predictions from transition state theory and are discussed with respect to a proposed depression in the amorphous Si melting temperature. (40 refs.)

102215 Solid-phase-epitaxial growth of ion implanted silicon using CW laser and electron beam annealing. J.Narayan, O.W.Holland (Solid State Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA), G.L.Olson.
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.155-63
The nature of residual damage in As^+, Sb^+, and In^+ implanted silicon after CW laser and e^- beam annealing has been studied using plan-view and cross-section electron microscopy. Lattice location of implanted atoms and their concentrations were determined by Rutherford backscattering and channeling techniques. Maximum substitutional concentrations achieved by furnace annealing in a temperature range of 500-600°C have been previously reported and greatly exceeded the retrograde solubility limits for all dopants studied. Higher temperatures and SPE growth rates characteristic of electron or CW laser annealing did not lead to greater incorporation of dopant within the lattice and often resulted in dopant precipitation. Dopant segregation at the surface was sometimes observed at higher temperatures. (4 refs.)

102216 Defect control during epitaxial regrowth by rapid thermal annealing. H.Baumgart (Bell Labs., Murray Hill, NJ, USA), G.K.Celler, D.J.Lischner, McD.Robinson, T.T.Sheng.
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.349-54
Rapid Thermal Annealing (RTA) with tungsten halogen lamps provides excellent regrowth of silicon layers damaged by ion implantation. In addition to minimizing dopant redistribution, the inherent advantage of this technique is good control of temperature gradients. The latter is instrumental in reducing the density of extended defects in the annealed samples. In contrast, solid phase laser annealing, which involves steep temperature gradients, always leaves interstitial dislocation loops and point defect clusters. The authors present a comparative study of crystal quality following laser processing and incoherent light annealing as well as furnace annealing of As, P and B ion implanted Si wafers. (9 refs.)

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68.60 PHYSICAL PROPERTIES OF THIN FILMS, NONELECTRONIC

102217 Spin coated amorphous chalcogenide films: thermal properties. G.C.Chern, I.Lauks (Dept. of Electrical Engng. & Sci., Univ. of Pennsylvania, Philadelphia, PA, USA), A.R.McGhie.
J. Appl. Phys. (USA), vol.54, no.8, p.4596-601 (Aug. 1983).
The annealing behavior of spin coated thin films prepared from solutions of As_2S_3 dissolved in *n*-propylamine and *n*-butylamine has been investigated using IR, mass spectrometry, thermogravimetric analysis, and scanning calorimetry. As-prepared films containing arsenic sulfide glass domains with surfaces reacted as alkyl ammonium salt undergo loss of amine and hydrogen sulfide during heating. H_2S removal is believed to be accompanied by cross linking of glass domains resulting in a network glass containing only arsenic and sulfur. (10 refs.)

102218 Stress in polycrystalline and amorphous silicon thin films. R.T.Howe, R.S.Muller (Dept. of Electrical Engng. & Computer Sci., Univ. of California, Berkeley, CA, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4674-5 (Aug. 1983).
Stress in polycrystalline and amorphous silicon thin films deposited on oxidized silicon wafers is determined from the lengthening of the undercut edge of a silicon stripe. The technique measures only compressive stresses, has a stress resolution of 10^8 dyn/cm^2, and a spatial resolution on the wafer of 250 μm. Unannealed silicon thin films deposited on oxide are under high compressive stress (10^{10} dyn/cm^2). This stress is reduced below the resolution by annealing at 1100°C for 20 min in N_2, except for the thinnest polycrystalline silicon films studied (230 nm thick). (8 refs.)

102219 Strength characteristics of contact zone of thin metal films with alkali metal halides. S.A.Varchenya, A.A.Simanovskii, G.P.Upit.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.3, p.14-20 (1983). In Russian.
The adhesion tensile strength of vacuum deposited films of s-metals (Cu, Ag, Au, Al, In, Sn, Pb) has been studied at room temperature on alkali halide crystal (LiF, NaCl, KCl) surfaces. It has been shown that the failure occurs adhesively on the interface in the system Me/LiF and in Me/KCl cohesively within the crystal, whereas in Me/NaCl it manifests itself both adhesively on the interface and cohesively within the crystal. The adhesion tensile strength of atomically pure interfaces of Me/LiF and Me/NaCl systems exceeds, but not more than 1.5 times, that of adhesion strength of metals contacting the crystal surfaces prepared in the air. A qualitative correlation between the adhesion tensile strength and the dispersion energy of interaction in the systems investigated has been established. The adhesion of metals on alkali halide crystals is concluded to arise due to nonchemical interaction forces. (16 refs.)

Surface acoustic waves in a highly anisotropic film on an isotropic substrate .... See Entry 102145

Structured films of magnetizable surface-active substances .... See Entry 102714

68.90 OTHER TOPICS IN THE STRUCTURE AND NONELECTRONIC PROPERTIES OF SURFACES AND THIN FILMS

102220 The structure of ultrathin iron films on tungsten single-crystal surfaces. T.M.Gardiner (Phys. Inst., Tech. Univ. Clausthal, Clausthal-Zellerfeld, Germany).
Thin Solid Films (Switzerland), vol.105, no.3, p.213-25 (22 July 1983).
Ultrathin iron films vapour deposited onto the surface of a cylindrical tungsten single crystal are discussed. Results from work function change, Auger electron spectroscopic and low energy electron diffraction techniques are combined for a comparison of the initial stages of film growth on four low index planes. Advantage is taken of the opportunity to evaporate onto and simultaneously to make measurements on all surface orientations of the ⟨110⟩ zone. (11 refs.)

70.00 CONDENSED MATTER: ELECTRONIC STRUCTURE, ELECTRICAL, MAGNETIC, AND OPTICAL PROPERTIES

(see also 81.40R Electrical and magnetic properties related to materials treatment, 81.40T Optical properties related to materials treatment)

Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS .... See Entry 98627

Quantum processes in polar semiconductors and insulators .... See Entry 98679

71.00 ELECTRON STATES

(see also 63. Lattice dynamics, 73. Surfaces, interfaces, and thin films)

Spectroscopy and excitation dynamics of condensed molecular systems .... See Entry 98672

71.10 GENERAL THEORIES AND COMPUTATIONAL TECHNIQUES

102221 Unique labelling of many-electron states in multicentre systems. K.S.Chan, D.J.Newman (Dept. of Phys., Univ. of Hong Kong, Hong Kong).
J. Phys. A (GB), vol.16, no.11, p.2389-403 (1 Aug. 1983).
General methods of generating complete sets of states for $l(\leq 2n)$ electrons in s-states on *n* centres are described. It is shown that a unique labelling of these states can always be obtained using a fictitious S_n symmetry of the *n* centres. Explicit descriptions of eight, seven and four electrons on eight centres are derived and the problem of determining a unique labelling for these states on rigid eight-centre structures with cubic and lower symmetry is solved. (13 refs.)

102222 On the ground state energy of the symmetric Anderson model. K.Ueda (Inst. fur Theoretische Phys., ETH-Honggerberg, Zurich, Switzerland), W.Apel.
J. Phys. C (GB), vol.16, no.23, p.L849-52 (20 Aug. 1983).
In this article the authors examine the analytic structure of the Bethe ansatz solution for the ground state energy of the symmetric Anderson model as a function of the interaction *U*. They find that the energy is analytic for all real *U* and examine also the strong coupling limit $U \rightarrow \infty$. (15 refs.)

102223 Orbital constraints in the application of chemical pseudopotentials. J.Kumar Rudra, W.Beall Fowler (Dept. of Phys., Lehigh Univ., Bethlehem, PA, USA).
Phys. Rev. B (USA), vol.28, no.2, p.1056-60 (15 July 1983).
The authors have developed a modification of Anderson's chemical pseudopotential (CP) which appears to be more useful in tight-binding analyses of energy bands. They have also shown that the Anderson CP implies symmetry constraints on the orbitals which, if ignored, can lead to serious errors, especially in low-symmetry systems. (17 refs.)

102224 Self-consistent Hellmann-Feynman theorem for tight-binding models. J.Oliva (Dept. of Phys., Univ. of California, Berkely, CA, USA).
Phys. Rev. B (USA), vol.28, no.4, p.1798-801 (15 Aug. 1983).
A useful formal expression for the Hartree-Fock ground-state energy for the Anderson model is derived using a self-consistent variation of the Hellmann-Feynman idea. The major feature is that the total energy is given in terms of a single energy integral involving only the local self-energy at the impurity site. This differs from the usual approach in which the energy density is summed over ‘all’ sites. Generalization to a broader class of locally inhomogeneous and locally correlated tight-binding Hamiltonians is straightforward. (10 refs.)

102225 Intermediate order and its effect on the random field in an amorphous homopolar semiconductor. V.D.Iskra (Acad. of Agriculture, Ukrainian SSR).
Sov. Phys. J. (USA), vol.25, no.11, p.1002-5 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.31-4 (Nov. 1982).
The binary correlation function of a random field is calculated with the simplest model concepts, taking into account the presence of intermediate order in a macroscopically homogeneous and isotropic semiconductor. (4 refs.)

102226 Exact solution of Anderson Hamiltonian. A.Okiji (Osaka Univ., Osaka, Japan).
Solid State Phys. (Japan), vol.18, no.2, p.59-69 (Feb. 1983). In Japanese.
The Anderson model which can describe the electronic states of the dilute alloy, of the adsorbed atom at surfaces and of the mixed valence system is found to be exactly soluble. The properties of the exact solution are reviewed. Anderson-Hamiltonian and Bethe-Yang type equations are treated. Symmetrical Anderson Hamiltonian basic states are elucidated. Electronic specific heat at low temperatures is used as an example and the s-d Anderson models are compared. (32 refs.) *M.O.*

71.20 ELECTRONIC DENSITY OF STATES DETERMINATIONS

(inc. energy states of liquid semiconductors; see also 65.40 Lattice and electronic heat capacity)

102227 Anisotropy of optimum fluctuations in crystals with a degenerate spectrum. F.V.Kusmartsev, E.I.Rashba (L.D. Landau Inst. of Theoretical Phys., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.2, p.130-4 (20 Jan. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.2, p.106-9 (20 Jan. 1983).
It is shown that in crystals with degenerate spherical bands optimum fluctuations, which form tails in the density of states in the forbidden band, are nonspherical. They are elongated or flattened. (10 refs.)

102228 Reconstruction of the density of states from its moments. A.Trias, M.Kiwi, M.Weissmann (Dept. de Fisica, Univ. Simon Bolivar, Caracas, Venezuela).
Phys. Rev. B (USA), vol.28, no.4, p.1859-63 (15 Aug. 1983).
The problem of the reconstruction of a non-negative spectral density from its low-order power moments is reexamined. With the assumption that the parameters of the continued-fraction representation of the Green's function obey a certain analytic expression, the authors derive an extrapolation procedure for them. This procedure leads to significantly improved results and is simple to implement. Several relevant examples of its application are provided and show the advantages of the method, which works adequately both for the translationally invariant case (ie. when Van Hove singularities are present) and also in the general disordered situation. The method is particularly useful in trying to estimate the position of the effective band edges (Lifshitz limits), for which it yields quite accurate values. (17 refs.)

Comment on ‘de Haas-van Alphen study of coherent magnetic breakdown in magnesium’ .... See Entry 102239

Electronic structure of amorphous semiconductors .... See Entry 102241

Synchrotron-radiation studies of the transition of hydrogenated amorphous carbon to graphitic carbon .... See Entry 102245

Electronic structure of disordered alloys. II. Self-consistent cluster CPA. Application to III-V ternary alloys .... See Entry 102249

Electronic structures of the $LaBO_3$ (B=Co, Fe, Al) perovskite oxides related to their catalysis .... See Entry 102256

Electrical conductivity, structure and Hall effect measurements of InSe films .... See Entry 102543

Density of states at each carbon layer of K-intercalated HOPG compounds-high resolution ^{13}C NMR experiment .... See Entry 102763

71.25 NONLOCALIZED SINGLE-PARTICLE ELECTRONIC STATES

102229 Three-dimensional energy band in graphite and lithium-intercalated graphite. T.Fauster, F.J.Himpsel (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA), J.E.Fischer, E.W.Plummer.
Phys. Rev. Lett. (USA), vol.51, no.5, p.430-3 (1 Aug. 1983).
Angle-resolved inverse photoemission with tunable photon energies has been used to map out the unoccupied bands of graphite and lithium-intercalated graphite. At the Brillouin zone center the bottom of the lowest band is found at 4.0±0.5 eV above the Fermi level in graphite. This band shows strong dispersion normal to the basal plane in excellent agreement with recent self-consistent band-structure calculations. A similar three-dimensional band is found in lithium-intercalated graphite shifted 3 eV to lower energy. (13 refs.)

102230 Lithium-intercalated graphite: self-consistent electronic structure for stages one, two, and three. N.A.W.Holzwarth (Corp. Res.-Sci. Lab., Exxon Res. & Engng. Co., Linden, NJ, USA), S.G.Louie, S.Rabii.
Phys. Rev. B (USA), vol.28, no.2, p.1013-25 (15 July 1983).
First-principles electron structure calculations were carried out for LiC_6, LiC_{12}, LiC_{18} representing first-, second-, and third-stage model graphite intercalation compounds. By comparing the charge density of these compounds to that of reference grahite compounds, the authors could define a ‘total difference density’ in order to quantify charge transfer and polarization in these materials. The total difference is found to be highly concentrated near the intercalant ions. However, the conduction electrons (those in partially occupied bands) are found to have the distribution of virtually undistorted π wave functions and have a much more delocalized distribution than that of the total difference density. These two types of charge distributions account for many of the unusual electronic properties of graphite intercalation compounds. (33 refs.)

Quick and easy measurement of the band gap in semiconductors .... See Entry 98700

Structural and electronic properties of small metal aggregates .... See Entry 101633

71.25C Techniques of band-structure calculation (general theory, applications of group theory, analytic continuation, etc)

102231 Bloch electrons in rational and irrational magnetic fields. G.M.Obermair (Univ. Regensburg, Regensburg, Germany).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.245-54 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
States of crystal electrons in a homogeneous magnetic field are of considerable practical and theoretical interest: they are the basis of the magneto-oscillatory effects which yield in turn information on Fermi surfaces, provided a theory connecting zero and finite magnetic field Bloch states exists. This is achieved by the semiclassical Peierls-Onsager theory which explains experimental results at least for nondegenerate bands. However, this metheod lacks a rigorous first principle derivation. Recently such a rigorous treatment has been developed; the obtained electronic spectra are in agreement with semiclassical results for simple bands; they show, moreover the splitting of degenerate bands and the detailed structure of magnetic breakdown. Another intriguing aspect of the problem is the coexistence of two pace lengths: lattice constant and Landau orbit diameter, which are almost always incommensurate (‘irrational’ versus ‘rational’ magnetic fields). As a consequence the spectrum exhibits an extremely complicated fine structure, related to the ‘chaotic’ properties of certain maps. (11 refs.)

102232 Electronic structure computations. Their role in the advancement of solid state physics. V.Heine (Cavendish Lab., Univ. of Cambridge, Cambridge, England).
Phys. Bull. (GB), vol.34, no.8, p.327-9 (Aug. 1983).
The author reviews the present state of electronic structure calculations and examines the contribution they can make to the mainstream of solid state physics. (no refs.)

102233 Error in the tetrahedron integration scheme. L.Kleinman (Dept. of Phys., Univ. of Texas, Austin, TX, USA).
Phys. Rev. B (USA), vol.28, no.2, p.1139-41 (15 July 1983).
The author shows that the widely used tetrahedron scheme for integrating functions over the Brillouin zone misweights the contributions from the k points at which the function has actually been evaluated. A simple example demonstrates that his misweighting can cause unacceptably large errors. A slight refinement of the scheme is shown to restore the correct weighting. (12 refs.)

102234 Band-structure effects and resistivity saturation. F.Guinea (Inst. for Theoretical Phys., Univ. of California, Santa Barbara, CA, USA).
Phys. Rev. B (USA), vol.28, no.2, p.1148-50 (15 July 1983).
It is shown that electron-phonon scatttering alters significantly the band structure of systems with narrow bands at high temperatures. This effect can be viewed as an increase in phonon-assisted hopping, which exactly compensates for the decrease in scattering time if the bands are narrow enough. The tendency towards saturation and saturation values are in good agreement with experiments. (15 refs.)

102235 New photoelectron spectroscopic procedure for the precise location of the edges of electron energy bands. B.C.Meyers, T.E.Feuchtwang (Dept. of Phys., Pennsylvania State Univ., University Park, PA, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2212-15 (15 Aug. 1983).
An analysis of band-gap emission is presented for a semi-infinite Kronig-Penney model. The results suggest the singularities predicted for the energy derivative of the angle-resolved energy distribution may provide an accurate method to identify the edges of both initial (occupied) and final (unoccupied) energy bands of the photoemitter. (11 refs.)

102236 Nonrelativistic dispersional equations for crystals of sphalerite and diamond structure. A.A.Lipnik, K.Ya.Shtivel'man (Ternopol'skii Inst., USSR).
Sov. Phys. J. (USA), vol.25, no.11, p.977-80 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.3-6 (Nov. 1982).
The tenth- and eleventh-order dispersion equations obtained for sphalerite and diamond structures in previous works (1982) are reduced to algebraic form and compared. The dispersion equation for the sphalerite structure is factorized at the axes and in the planes of symmetry. At the axes Δ and Λ the factorization is complete; the zones of heavy and light holes are the same as in the diamond structure. At the axes Σ only a zone of heavy holes is isolated, which is again no different from that obtained from the diamond structure. Factorization of the equations for both structures in the whole of the (110) plane is performed. (5 refs.)

102237 Dispersion laws for the valence bands of crystals with the sphalerite structure. A.A.Lipnik, K.Ya.Shtivel'man (Ternopol'skii Pedagogical Inst., USSR).
Sov. Phys. J. (USA), vol.25, no.11, p.980-2 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.6-9 (Nov. 1982).
Approximate solutions are obtained—in analytic form—for the valence bands of crystals with the sphalerite structure at the symmetry axes and in the (110) symmetry planes. The values derived from them for the energy of heavy and light holes at the points X of the Brillouin band and also the maximum values of the spin-orbital splitting of the upper valence bands at the axes Δ and Λ are in good agreement with the available experimental data and the results of numerical calculations. (12 refs.)

Orbital constraints in the application of chemical pseudopotentials .... See Entry 102223

Electronic structure of disordered alloys. II. Self-consistent cluster CPA. Application to III-V ternary alloys .... See Entry 102249

71.25H Measurement of Fermi surface parameters

(inc. dHvA, magnetoacoustic, position annihilation, and cyclotron resonance studies, etc.)

102238 The effect of hydrostatic pressure on the Fermi surfaces of rubidium and cesium. I.M.Templeton (Div. of Phys., Nat. Res. Council of Canada, Ottawa, Canada).
J. Low Temp. Phys. (USA), vol.52, no.3-4, p.361-76 (Aug. 1983).
The anisotropy and absolute values of the pressure coefficients for the Fermi surfaces of rubidium and cesium in the 25-bar pressure range at 1K have been measured. In both cases the area pressure coefficient anisotropy is con-

siderably greater than the dimensional anisotropy about 4.7 times in Rb and 5.6 times in Cs. The mean values of $2.13_3 \pm 0.005 \times 10^{-2}$ kbar^{-1} for Rb and $2.87_4 \pm 0.0140\mathrm{M}10^{-2}$ kbar^{-1} for Cs, are in fair agreement with those derived from ultrasonic measurements of the bulk modulus, but are several percent lower than the corresponding piston-displacement figures. (18 refs.)

102239 Comment on 'de Haas-van Alphen study of coherent magnetic breakdown in magnesium'. L.Lorenzen, H.Smith (Phys. Lab. I, H.C. Orsted Inst., Copenhagen, Denmark).
Phys. Rev. Lett. (USA), vol.51, no.7, p.615 (15 Aug. 1983).
For original paper see ibid., vol.48, p.275 (1982). In a recent Letter Eddy and Stark (ES) reported the observation of a number of features in the de Haas-van Alphen spectra of pure Mg that are not accounted for by the theory of Falicov and Stachowiak (FS) (1966). In their search for an explanation of these differences the authors made a numerical comparison of Pippard's semiclassical network theory (1964) and the FS theory, and concluded that the two are inequivalent. ES calculated some Fourier coefficients (FC) of Pippard's two-dimensional density of states and found a difference period in addition to amplitude variations of the FC as a function of the Bragg-reflection probability $q^2 = 1 - \exp(H_0/H)$, H_0 being the breakdown field, both in disagreement with the FS theory. The present authors have performed similar calculations of the FC and reached the opposite conclusion that for the network in question the two theories are equivalent. (3 refs.)

Theory of doping in chalcogenide glasses .... See Entry 101577

Bonding and structure of $CoSi_2$ and $NiSi_2$ .... See Entry 101664

Anisotropy of the sound absorption quantum oscillations in white tin .... See Entry 101868

Bloch electrons in rational and irrational magnetic fields .... See Entry 102231

Coulomb resonance at the Fermi level of the electron-hole liquid in germanium .... See Entry 102268

Single injection current in insulator with traps lying below the Fermi level .... See Entry 102409

Thermoelectric power of aluminum films .... See Entry 102522

Positrons and solid state physics .... See Entry 102989

71.25J Effective mass and g-factors

102240 Effective mass of electrons in $BaPb_{1-x}Bi_xO_3$. S.Tajima, K.Kitazawa, S.Tanaka (Dept. of Appl. Phys., Univ. of Tokyo, Tokyo, Japan).
Solid State Commun. (USA), vol.47, no.8, p.659-61 (Aug. 1983).
The reflectivity spectra of $BaPb_{1-x}Bi_xO_3$ were measured in near-infrared region in several samples. The effective masses for the metallic samples of compositions from $x=0$ to 0.25 were estimated from the observed plasma edges to be 0.5-0.8 m_e. These values are rather small comparing with those in other typical high T_c superconductors. (12 refs.)

Calculation of optical properties of semiconductors with the use of simple orbitals .... See Entry 102841

71.25M Electron energy states in amorphous and glassy solids

102241 Electronic structure of amorphous semiconductors. J.Robertson (Central Electricity Res. Labs., Leatherhead, England).
Adv. Phys. (GB), vol.32, no.3, p.361-452 (May-June 1983).
The authors review the bonding in a wide range of non-crystalline materials, such as the elemental and compound amorphous semiconductors, liquid semiconductors and, briefly, some oxide glasses and amorphous silicon dioxide. The review concentrates on the experimental determination of electronic structure from photoemission, optical spectra and core spectra and on its theoretical description, particularly using tight-binding methods. The review also describes the bonding at defects in amorphous semiconductors and in particular that of dopants and hydrogen in hydrogenated amorphous silicon (a-Si:H). (565 refs.)

102242 Electrons and phonons in metallic glasses. J.Hafner (Inst. fur Theoretische Phys., Tech. Univ. Wien, Wien, Austria).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.257-68 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Reviews recent advances in the calculation of electronic and vibrational states in metallic glasses. The author starts with a brief discussion of the start of the art of structural modelling and the simplifications of the different modelling algorithms on the electronic and the vibrational properties. The various techniques for calculating the spectra of elementary excitations in the absence of translational symmetry (equation of motion method, recursion technique, multiple scattering cluster calculations, effective medium approximation) are critically reviewed. Exemplary applications of these methods to metallic glasses, involving comparisons with recent experiments on electron and phonon states are presented. (31 refs.)

102243 Capacitance temperature analysis of midgap states in hydrogenated amorphous silicon. D.Jousse, S.Deleonibus (Lab. de Phys. des Composants a Semiconducteurs, CNRS, Grenoble, France).
J. Appl. Phys. (USA), vol.54, no.7, p.4001-7 (July 1983).
Simultaneous low frequency capacitance-temperature and conductance-temperature measurements on Schottky diodes in the range 180-450K enable the authors to deduce the real density of bulk midgap states $N(E)$ of hydrogenated amorphous silicon in the zero frequency limit. The analysis of the results indicates that the interaction kinetics is controlled by the thermal release time of the midgap states. The response times are consistent with an electron capture cross section ranging from 2×10^{-16} to 5×10^{-15} cm^2, very similar to the value reported for crystalline Si-SiO_2 interface states. Furthermore, results show that thermal equilibrium is established directly with conduction band electrons at high temperature or through intermediate states at temperature lower than 300K. The high accuracy of the method is demonstrated by detecting 15% variations of $N(E)$ due to light-induced effects. The physical nature of midgap states is also discussed. (34 refs.)

102244 On electronic structure of interacting solitons with impurities in polyacetylene. B.R.Bulka (Inst. of Molecular Phys., Polish Acad. of Sci., Poznan, Poland).
Phys. Status Solidi b (Germany), vol.118, no.1, p.K57-9 (1 July 1983).
The author shows that the electronic structure of polyacetylene differs strongly when interactions are taken into account. The author studies a one-dimensional tight binding model with hopping integrals confined to nearest neighbours. The author assumes that interactions shift the atomic level at the centre of a soliton. It is legitimate as the Coulomb interaction part of a Hamiltonian in the Hartree-Fock approximation is $H_c = V_c \langle n_i \rangle n_O$, where $\langle n_i \rangle$ is the average number of electrons at the impurity. Thus the shift is $V = V_c \langle n_i \rangle$. For a covalent interaction the shift is $V \approx -t_{oi}{}^2/V_i$, where t_{oi} and V_i are the hopping integral and the atomic potentials difference of the nearest neighbour atom and the impurity. Defect levels are determined from poles of Green functions, which are expressed by continued fractions. (5 refs.)

102245 Synchrotron-radiation studies of the transition of hydrogenated amorphous carbon to graphitic carbon. D.Wesner (Brookhaven Nat. Lab., Upton, NY, USA), S.Krummacher, R.Carr, T.K.Sham, M.Strongin, W.Eberhardt, S.L.Weng, G.Williams, M.Howells, F.Kampas, S.Heald, F.W.Smith.
Phys. Rev. B (USA), vol.28, no.4, p.2152-6 (15 Aug. 1983).
Using the synchrotron-radiation facility at Brookhaven National Laboratory, the authors have studied the electronic structure of thin hydrogenated amorphous carbon films produced by DC glow discharges of hydrocarbons. Valence-band photoemission measurements on these films yielded information on the occupied valence-band density of states, while near-edge absorption at the carbon K edge elucidated features of the unoccupied conduction band. The as-deposited, unannealed films are essentially amorphous, showing no extended X-ray absorption fine-structure (EXAFS) features. Valence-band photoemission results show that these films are insulating, suggesting tetrahedral (diamondlike) coordination. The near-edge-absorption results, however, show some unsaturated carbon-carbon bonds as evidenced by a $1s \rightarrow \pi^*$ feature. Upon annealing, the films become more graphitic as evidenced by both the photoemission and near-edge-absorption measurements showing fine structure in agreement with that observed for crystalline or microcrystalline graphite. They also become conductive. Annealing is accompanied by evolution of hydrogen from the films, and this appears correlated with the development of certain features of the band structure as the film orders. The annealed films also show the beginnings of features in the EXAFS region. (18 refs.)

102246 Photo-induced changes in the bulk density of gap states in hydrogenated amorphous silicon associated with the Staebler-Wronski effect. J.D.Cohen (Dept. of Phys., Univ. of Oregon, Eugene, OR, USA), D.V.Lang, J.P.Harbison, A.M.Sergent.
Sol. Cells (Switzerland), vol.9, no.1-2, p.119-31 (June-July 1983).
The authors observe a reversible photo-induced modification in the bulk density of gap states in hydrogenated amorphous silicon associated with the Staebler-Wronski effect. Detailed analysis of deep level transient spectroscopy, admittance and thermally stimulated capacitance measurements indicates that as a result of prolonged illumination (1) a lowering of the bulk Fermi level occurs in the mobility gap, (2) a large increase occurs in the density of states below midgap and (3) no discernible change occurs in the midgap defect density normally associated with dangling bond defects. In addition the authors find that the annealing behavior of the light-induced effects indicates a broad range of activation energies. A comparison of these findings with measurements made by other groups is discussed briefly. (18 refs.)

Electron-phonon scattering in polyparaphenylene .... See Entry 102273

Optical instabilities and localized electronic states in hydrogenated amorphous silicon .... See Entry 102299

The effect of light soaking on the low temperature photoconductivity of hydrogenated amorphous silicon .... See Entry 102460

The interpretation of photoconductivity measurements in hydrogenated amorphous silicon .... See Entry 102461

Origin of the photo-induced changes in hydrogenated amorphous silicon .... See Entry 102462

71.25P Band structure of crystalline metals

Effective charges of the valence shells on atoms of A15 chemical compounds .... See Entry 101623

An estimation of the thermodynamic data of liquid transition metal based alloys .... See Entry 102009

Comment on 'de Haas-van Alphen study of coherent magnetic breakdown in magnesium' .... See Entry 102239

Anomalies of the electrical resistivity of Ni_3Fe alloys containing Nb, Ta and V .... See Entry 102347

Deviations of Matthiessen's rule in some PdAu alloys .... See Entry 102351

Kinetic and electronic properties of $Ni_3(Fe_{1-x}Ta_x)$ and $Ni_3(Fe_{1-x}V_x)$ alloys .... See Entry 102358

Thermoelectric power of aluminum films .... See Entry 102522

Evidence for the tetravalence of cerium in $CeRu_2$ .... See Entry 102984

Mechanism for the valence-band photoemission in Ni: inclusion of interatomic interactions .... See Entry 103033

71.25R Band structure of crystalline elemental semiconductors

102247 Energy-band distortion in highly doped silicon. D.S.Lee, J.G.Fossum (Dept. of Electrical Engng., Univ. of Florida, Gainesville, FL, USA).
IEEE Trans. Electron Devices (USA), vol.ED-30, no.6, p.626-34 (June 1983).
A plausible model for the doping dependences of the conduction-and valence-band shifts, and of the concomitant narrowings of the optical and electrical energy gaps, caused by high doping concentrations in silicon is developed by refining, extending, and combining previously described theories. A meaningful link is thereby established between the fundamental solid-state physics that underlies the energy-band distortion and the silicon device physics that describes the pragmatic ramifications of it. The important many-body effects, which produce actual rigid shifts in the conduction and valence bands, are identified and characterized, and are shown to exclusively narrow the optical energy gap. The electrical energy-gap narrowing comprises additional effective shifts defined by the band tails due to the randomness of the dopant distribution, which are described. Predictions of the optical and electrical energy-gap narrowings, the difference between which is explained physically for the first time, are shown to agree well with measurements from several independent experiments. (43 refs.)

Density-functional theory of excitation spectra of semiconductors: application to Si .... See Entry 102279

71.25T Band structure of crystalline semiconductor compounds and insulators

102248 Studies on electronic processes in graphite during the last decade in Japan. T.Tsuzuku (Coll. of Sci. & Technol., Nihon Univ., Tokyo, Japan).
Carbon (GB), vol.21, no.4, p.415-27 (1983).
Briefly reviews the studies on the energy band structure and electron transport properties of graphite which have been performed in Japan mostly during the last decade, since around 1970. Topics dealt with are the overall band structure calculated on the basis of the combined OPW-TB approximation, topographical research of the Fermi surface, anomalous transport phenomena resulting from the extremely strong electron-phonon coupling, *c*-axis conduction in connection with the stacking fault structure, new important findings obtained through further detailed investigation of galvano-magnetic effects, and the quantum-limit behaviors under ultrahigh magnetic fields leading to an electronic phase transition. (67 refs.)

102249 Electronic structure of disordered alloys. II. Self-consistent cluster CPA. Application to III-V ternary alloys. A.Mookerjee, V.K.Srivastava, V.Choudhry (Dept. of Phys., Indian Inst. of Technol., Kanpur, India).
J. Phys. C (GB), vol.16, no.23, p.4555-64 (20 Aug. 1983).
In pt.I (see ibid., vol.15, p.1939, 1982), a self-consistent cluster CPA, generalised to take into account the effects of clusters, was developed. Off-diagonal disorder and short-ranged order were also taken into account. In this paper the method has been applied to calculate the density of states of the valence band of ternary random III-V semiconducting alloys. (11 refs.)

102250 Photoacoustic determination of the band gaps of Ca_2MnO_4 and $Ca_3Mn_2O_7$. M.L.Norton, R.Tom, W.S.Glaunsinger (Dept. of Chem., Arizona State Univ., Tempe, AZ, USA).
J. Solid State Chem. (USA), vol.48, no.2, p.242-5 (1 July 1983).
Black powders of the magnetically layered semiconductors Ca_2MnO_4 and $Ca_3Mn_2O_7$ prepared by a carbonate-precursor technique have been investigated by photoacoustic spectroscopy (PAS) over the energy range 1.25-4 eV. The band-gap energies of these two compounds have been evaluated to be 1.6 and 1.4 (± 0.1) eV, respectively. It is concluded that PAS is a most useful method for determining the variation of the band gap with composition in large band-gap polycrystalline semiconductors. (10 refs.)

102251 Electronic structure of some binary uranium and thorium oxides and halides. G.C.Allen, P.M.Tucker, J.W.Tyler (Berkeley Nuclear Labs., CEGB, Berkeley, England).
Philos. Mag. B (GB), vol.48, no.1, p.63-75 (July 1983).
X-ray photoelectron spectra of U and Th 4f core levels and valence bands have been recorded from UF_4, UCl_4, ThF_4 and $ThCl_4$ using a Kratos ES300 X-ray photo-electron spectrometer. The spectra are compared with their counterparts recorded from uranium and thorium dioxide surfaces. The results obtained are discussed as a function of metal ionicity, the covalency of the metal-ligand bond and the participation of 5f electrons in bonding. (27 refs.)

102252 Electronic band structure of stishovite (tetragonal SiO_2). J.Kumar Rudra, W.Beall Fowler (Dept. of Phys., Lehigh Univ., Bethlehem, PA, USA).
Phys. Rev. B (USA), vol.28, no.2, p.1061-7 (15 July 1983).
The authors have calculated the valence-band structure of stishovite, a tetragonal form of SiO_2, using a simple tight-binding method. As in similar fits to computed valence bands in α-quartz and β-cristobalite, only oxygen orbitals are used in the basis set. Values of the tight-binding parameters are based on the earlier calculations. A direct forbidden optical edge is predicted, as found in other tetragonal oxides of group-IV elements. There is no gap between bonding and nonbonding valence bands, in contrast to forms of SiO_2 which exhibit twofold oxygen coordination. Implications regarding the electronic structure of a-SiO_2 are discussed. (28 refs.)

102253 Evidence of nonparabolic-band effect on two-photon spectrum of ZnSe. I.M.Catalano, A.Cingolani (Dipartimento di Fisica, Univ. degli Studi di Bari, Bari, Italy).
Phys. Rev. B (USA), vol.28, no.2, p.1130-1 (15 July 1983).
The magnitude and frequency dependence of the two-photon-absorption (TPA) coefficient in ZnSe have been measured for photon energies significantly greater than the energy-band gap E_g. Valence-band degeneracy and nonparabolicity effects on the TPA mechanism for a typical zinc-blende semiconductor are proven. (7 refs.)

102254 Simplified self-interaction correction applied to the energy bands of neon and sodium chloride. M.R.Norman (Dept. of Phys., Tulane Univ., New Orleans, LA, USA), J.P.Perdew.
Phys. Rev. B (USA), vol.28, no.4, p.2135-9 (15 Aug. 1983).
The local-density approximation (LDA) for the exchange-correlation potential underestimates the fundamental energy gaps of insulators by about 40%. When a simplified self-interaction correction (SSIC) is applied to the band structures of Ne and NaCl, vast improvements over LDA are found in the gaps, with little change in the valence-band widths or conduction-band structures. Because it is applied directly to the Bloch orbital representation, SSIC is very easy to incorporate into LDA computer codes. Results are also reported using the Langreth-Mehl (LM) generalized gradient correction to LDA. The LM potential, which the authors regard as a close approximation to the exact Kohn-Sham potential yields band structures very close to those of LDA. (29 refs.)

102255 Co (III) ions high-spin configuration in nonstoichiometric Co_3O_4 films. I.D.Belova, Yu.E.Roginskaya, R.R.Shifrina, S.G.Gagarin, Yu.V.Plekhanov, Yu.N.Venevtsev (Karpov Inst. of Phys. Chem., Moscow, USSR).
Solid State Commun. (USA), vol.47, no.8, p.577-84 (Aug. 1983).
Optical spectra in UV, visible and near IR wavelength range have been measured and the SCF $X_\alpha SW$ method calculation of Co_3O_4 electronic structure has been carried out. The nature of absorption bands observed has been revealed. As shown, the principal peculiarity of the nonstoichiometric films electronic structure compared with 'bulk' samples is a stabilization of Co(III) ions high-spin configuration in Co_3O_4 spinel octahedral sublattice. (17 refs.)

102256 Electronic structures of the $LaBO_3$ (B=Co, Fe, Al) perovskite oxides related to their catalysis. I.Kojima, H.Adachi, I.Yasumori (Dept. of Chem., Tokyo Inst. of Technol., Tokyo, Japan).
Surf. Sci. (Netherlands), vol.130, no.1, p.50-62 (July 1983).
The discrete-variational (DV) $X\alpha$ molecular orbital method has been applied to investigate the bulk and surface electronic structures of perovskite oxides such as $LaCoO_3$, $LaFeO_3$ and $LaAlO_3$. The calculated XPS spectra for these oxides are in good agreement with the experimental ones and only the $LaCoO_3$ exhibited a rather high electron density of states near the Fermi level (E_F). The catalytic behavior of these oxides is discussed on the basis of their electronic structures; the marked catalysis by $LaCoO_3$ is associated with electron occupation of crystal field d states near E_F and with the buildup of surface charge so as to enhance the electron transfer between a surface cation and an interacting molecule. (19 refs.)

Bonding and structure of $CoSi_2$ and $NiSi_2$ .... See Entry 101664

Electronic model of fianites .... See Entry 102038

Calculation of optical properties of semiconductors with the use of simple orbitals .... See Entry 102841

High resolution laser diagnostics for direct gap semiconductor materials .... See Entry 102955

Optical and electrical properties of RF-sputtered indium-tin oxide films .... See Entry 102976

X-ray spectroscopic investigations of lead chloride, $PbCl_2$ ..... See Entry 103000

Resonant photoemission in transition-metal chlorides .... See Entry 103032

71.30 METAL-INSULATOR TRANSITIONS

102257 Experimental tests of localization in semiconductors [metal-insulator transition]. M.A.Paalanen, G.A.Thomas (Bell Labs., Murray Hill, NJ, USA).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.27-34 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Experimental results indicate that both randomness and electron-electron interactions are important driving mechanisms of the metal-insulator transition in noncrystalline systems. Although previous studies are consistent with Mott's minimum metallic conductivity, measurements at much lower temperatures and higher resolution in density argue for a continuous transition. A review of these experiments compared to the latest theoretical developments indicates that understanding is still incomplete. (16 refs.)

102258 The metal insulator transition in disordered electron systems. A.Gold, W.Gotze (Dept. of Phys., Tech. Univ. Munchen, Garching, Germany).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.47-53 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The selfconsistent current relaxation theory for the motion of fermions in a random potential is generalized by taking into account Coulomb interaction effects. In particular the influence of various local field corrections to the random phase approximation on the metal insulator transition point are examined. The conductivity and the static dielectric constant near the mobility edge are calculated. (23 refs.)

102259 Metal-nonmetal transition in copper-xenon system. A.I.Eatah (School of Maths. & Phys., Univ. of East Anglia, Norwich, England), A.A.Ghani Awad.
J. Chem. Phys. (USA), vol.79, no.3, p.1552-4 (1 Aug. 1983).
As part of a series of investigations of metal-nonmetal transition, containing copper as metal, the authors have carried out measurements of the electrical conductivity of the Cu-Xe system. The results of measurements suggest that the transition is Mott's type. They put forward the indications and counterindications of such transition. (15 refs.)

102260 Optical and thermal evidence for the metal-insulator transition in 1T-TaS_2. S.C.Bayliss, A.Clarke, W.Y.Liang (Cavendish Lab., Univ. of Cambridge, Cambridge, England).
J. Phys. C (GB), vol.16, no.23, p.L831-4 (20 Aug. 1983).
Reports on thermal evidence for the existence of the phase transition from the incommensurate charge density wave state to the undistorted form of 1T-TaS_2. The effect of the transition on the reflectivity spectra is discussed in terms of a metal-insulator transition. (6 refs.)

102261 The metal-insulator transitions in the Peierls chain. P.Y.Le Daeron, S.Aubry (Center for Nonlinear Studies, Los Alamos Nat. Lab., Los Alamos, NM, USA).
J. Phys. C (GB), vol.16, no.24, p.4827-38 (30 Aug. 1983).
The ground state (at 0K) of a discrete molecular-crystal model for the Peierls chain with classical atoms and non-interacting spinless quantum electrons is calculated numerically as a function of the electron-phonon coupling for an 'irrational' electron concentration. A metal-insulator transition arising from the extinction of the Frohlich conductivity for the incommensurate system is observed when the Peierls gap is only 10% of the total unperturbed bandwidth. Beyond the critical coupling, the Frohlich mode disappears and the electrons are exponentially localised but the lattice distortion remains incommensurate (the polaron lattice). In this region, the Peierls-Nabarro barrier does not vanish and is calculated. The existence of metastable Fermi glasses is also proved, but they are shown to have an energy larger than that of the incommensurate ground state. The observed transition is identified as a transition by breaking of analyticity, which is similar to the one found previously in the Frenkel-Kontorova model. This behaviour is explained as being a consequence of the competition between the Fermi and the lattice wavevectors, which are incommensurate with each other. (26 refs.)

102262 Nonmetal-metal transition in NiS and its impurity-substituted materials. S.Anzai (Keio Univ., Yokohama, Japan).
Oyo Buturi (Japan), vol.52, no.3, p.212-19 (March 1983). In Japanese.
Outlines the White-Mott transition model describing a cause for the nonmetal-metal transition (NMT) in NiS. Furthermore, the model is examined using spectroscopic data. Experimental results for the effect of impurity substitution on the NMT in NiS are reviewed from the standpoints of: (1) volume change due to substitution, (2) interaction change due to the difference in electronegativity between Ni or S and impurity elements, (3) e_g electron change due to substitution, and (4) local density due to impurities. (39 refs.) *K.B.*

102263 The metal insulator transition in two-dimensional systems with charged impurities. A.Gold, W.Gotze (Phys.-Dept., Tech. Univ., Munchen, Garching, Germany).
Solid State Commun. (USA), vol.47, no.8, p.627-9 (Aug. 1983).
The motion of interacting electrons in an array of charged impurities in two dimensions is discussed within a generalized selfconsistent current relaxation theory. The ratio of impurity density n_i to electron density n_c, where the metal insulator transition takes place, is shown to depend on n_c and varies between 0.2 and 10. A comparison of the theory with mobility measurements of Na^+ drift experiments in inversion layers is made. (18 refs.)

Iron-ion—implantation effects in MgO crystals .... See Entry 101730

Neutron scattering study on the structural transition of quasi-one-dimensional conductor $K_{0.3}MoO_3$ .... See Entry 101947

Magnetic susceptibility of Wigner's crystal .... See Entry 102278

Pressure-temperature phase diagrams of several $(TMTTF)_2X$ compounds: stabilisation of a highly conducting metallic state under pressure in $(TMTTF)_2Br$ .... See Entry 102362

Effect of defects on phase transitions in tetraselenotetracene chloride, $(TSeT)_2Cl$ .... See Entry 102364

71.35 EXCITONS AND RELATED PHENOMENA

(inc. electron-hole drops)

102264 Quasi-two-dimensional excitons in GaAs/Al$_x$Ga$_{1-x}$As semiconductor multiple quantum well structures. D.S.Chemla (Bell Labs., Holmdel, NJ, USA).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.607-37 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Reviews recent studies on excitons in GaAs/Al$_x$Ga$_{1-x}$As multiple quantum well structures (MQWS). After a theoretical summary, the spectroscopy of quasi-two-dimensional excitons is presented. Experiments at low temperature and high excitation are discussed. Excitons in MQWS can be resolved at room temperature. The behavior of excitons in this unusual temperature range is analyzed and the potential applications to optical signal processing are pointed out. (50 refs.)

102265 Secondary emission due to recombination of excitons near indirect band bottom. I. General feature. T.Iida, M.Sakai, T.Karasawa, T.Komatsu, Y.Kaifu (Dept. of Phys., Osaka City Univ., Osaka, Japan).
J. Phys. C (GB), vol.16, no.23, p.4719-32 (20 Aug. 1983).
The secondary emission, due to recombination of excitons in the vicinity of the indirect band bottom is investigated, where excitons relax their kinetic energy through mutliple scatterings with acoustic phonons and a nonradiative decay process. In this case, the secondary emission can be separated into the two parts: the Raman scattering (RS) and the hot luminescence (HL). The spectral lineshape of the HL directly reflects the exciton distribution near the band bottom. The distribution has been calculated by the Fokker-Planck equation with the source term of exciton supply through the indirect absorption process. It is shown that the excitation spectrum of the RS line and the spectral structure of the HL strongly depend on the two quantities: the kinetic energy of an exciton with the sound velocity and the nonradiative decay rate. General features of RS, HL and their relationship are studied for a system with material constants appropriate to BiI$_3$, since the experiments show that this is an ideal system for the authors' purpose. (11 refs.)

102266 Theory of the exciton bound to an isoelectronic trap in GaP. W.T.Masselink, Yia-Chung Chang (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
Phys. Rev. Lett. (USA), vol.51, no.6, p.509-12 (8 Aug. 1983).
A theoretical calculation for the electronic structure of an exciton bound to a nitrogen trap in GaP is presented. For the first time, the band-structure effect for both the electron and hole and their mutual Coulomb interaction are included simultaneously. It is found that the bare electron is bound by only 0.6 meV instead of 8 meV as usually quoted. Furthermore, this calculation predicts the *A-B* splitting and the oscillator strength of the bound-exciton luminescence in good agreement with the experimental data. (18 refs.)

102267 Picosecond kinetics of the donor bound exciton in Cd$_{1-x}$Mn$_x$Se. J.H.Harris, A.V.Nurmikko (Div. of Engng., Brown Univ., Providence, RI, USA).
Phys. Rev. B (USA), vol.28, no.2, p.1181-3 (15 July 1983).
Dynamics for the donor bound exciton complex in the semimagnetic semiconductor CdMnSe are investigated by picosecond spectroscopy, with emphasis on real-time energy diffusion within the exciton energy range. Direct evidence for the inhomogeneous character of this transition is presented, together with first measurements for the exciton formation and decay rates. (8 refs.)

102268 Coulomb resonance at the Fermi level of the electron-hole liquid in germanium. V.M.Asnin, V.I.Stepanov (A.F. Ioffe Phys.-Tech. Inst., Acad. of Sci., Leningrad, USSR), R.Zimmermann, M.Rosler.
Solid State Commun. (USA), vol.47, no.8, p.655-7 (Aug. 1983).
Using a modulation technique of transmitted probe light a recently predicted enhanced absorption in the electron-hole liquid is confirmed. This resonance is due to the Coulomb interaction acting resonantly at the Fermi edge. Comparison is made with calculations taking into account a screened potential, self-energy shifted bands, and warping of the valence band. (11 refs.)

Analysis of biexcitonic optical bistability in CuCl in the presence of collision broadening .... See Entry 100839

Hamiltonian formalism for giant polaritons .... See Entry 102269

Configuration mixing in the groundstate of Ce .... See Entry 102294

Core-level reflectance spectroscopy of black phosphorus single crystals .... See Entry 102297

Optical properties of fast-diffusion solid-state plasmas .... See Entry 102446

Exciton-induced photoemission from extrinsic surface states: NaI .... See Entry 102456

Magnetically induced spatial dispersion of crystals in the exciton region of the spectrum .... See Entry 102724

^{13}C isotope shifts of anthracene and naphthalene isomers in triplet state optical spectra .... See Entry 102904

Impurity band in dilute mixed molecular crystals .... See Entry 102912

Dynamics of energy of transport in ternary molecular solids. II. Time evolution of naphthalene fluorescence .... See Entry 102922

Dispersive singlet exciton motion in an organic glass .... See Entry 102924

Photoluminescence measurements of Zn-doped Ga$_{1-x}$Al$_x$As grown by metalorganic chemical vapor deposition .... See Entry 102925

Optical and crystallographic properties and impurity incorporation of α_xIn$_{1-x}$As ($0.44<x<0.49$) grown by liquid phase epitaxy, vapor phase epitaxy, and metal organic chemical vapor deposition .... See Entry 102926

Resonant two-photon absorption by exciton polaritons in evaporated CuCl films .... See Entry 102944

Radiative transitions associated with two-acceptor-one-donor complexes in epitaxial GaAs and InP .... See Entry 102945

Stimulated photoluminescence of CdTe .... See Entry 102952

The effect of shielded Coulomb interaction on light absorption in thin semiconductor films .... See Entry 102979

Auger lifetimes for excitons bound to deep impurities in semiconductors .... See Entry 103010

71.36 POLARITONS

(inc. photon-phonon and photon-magnon interactions)

102269 Hamiltonian formalism for giant polaritons. K.C.Liu (Schools of Appl. Phys. & Electrical Engng., Cornell Univ., Ithaca, NY, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2254-6 (15 Aug. 1983).
The author considers the interaction of a radiation field, with excitons at high density, where the excitons cannot be approximated as bosons. In the approach, a dynamically equivalent Hamiltonian is constructed for relegating the nonboson commutation relations to boson commutation relations. For the self-consistent case, the ad hoc effective Hamiltonian can be made diagonal, yielding the eigenenergy of a giant polariton. (11 refs.)

Structural phase transitions and polaritons in low-frequency region .... See Entry 101951

Long range surface plasmons in birefringent media .... See Entry 102274

Long-range surface plasmons in electrode structures .... See Entry 102275

Magnetically induced spatial dispersion of crystals in the exciton region of the spectrum .... See Entry 102724

Resonant two-photon absorption by exciton polaritons in evaporated CuCl films .... See Entry 102944

71.38 POLARONS AND ELECTRON-PHONON INTERACTIONS

(for electron-phonon interactions in lattices, see also 63.20K)

102270 Jahn-Teller effect in itinerant electron systems: the Jahn-Teller polaron. K.-H Hock, H.Nickisch (Inst. fur Festkorperphys., Tech. Hochschule Darmstadt, Darmstadt, Germany), H.Thomas.
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.237-43 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Studies the formation of a Jahn-Teller polaron in a narrow-band conductor with strong Jahn-Teller coupling. It is shown that the competition between the delocalization effect of tunnelling and the localization effect of JT-coupling gives rise to a transition from an itinerant electron state to a JT-polaron state with very effective mass. (6 refs.)

102271 Kinks and polarons in polyacetylene. T.Sano, Y.J.I'Haya (Dept. of Materials Sci., Univ. of Electro-Communications, Tokyo, Japan).
J. Chem. Phys. (USA), vol.79, no.4, p.2060-4 (15 Aug. 1983).
Various defect states in a finite trans-polyacetylene chain are studied by a geometry optimization method with a tight-binding Hamiltonian of Longuet-Higgins and Salem. It is shown that the defect obtained forms a ϕ-four kink or two combined kinks such as a polaron, being independent of chain size whenever the chains are longer than the defect width. The defect formation energy is local in the vicinity of the defect. The creation energies of the kink and polaron at rest have been determined by means of extrapolation to infinite chain size. The results obtained are in good agreement with those estimated from the analytical solutions in the continuum models. (12 refs.)

102272 Non-linear spin-density excitations in 1-D organic polymers. C.Aslangul, D.Saint-James (Ecole Normale Superieure, Univ. Paris VII, Paris, France).
J. Phys. (France), vol.44, no.8, p.953-5 (Aug. 1983).
It is shown that kink and bag-like solitons should exist in 1-D organic polymers when the ground state corresponds to an antiferromagnetic spin density wave. (6 refs.)

102273 Electron-phonon scattering in polyparaphenylene. C.Menendez, F.Guinea (Dept. de Fisica del Estado Solido, Univ. Autonoma de Madrid, Madrid, Spain).
Phys. Rev. B (USA), vol.28, no.4, p.2183-90 (15 Aug. 1983).
Phonons and the effects induced by terms on the electronic spectrum of polyparaphenylene [(C$_6$H$_4$)$_n$], are analyzed. A model of local forces and electronic interactions is used. The results are very insensitive to the long-range structure of the polymer chain. Electron-phonon coupling is also studied within a local formalism which greatly facilitates the calculation and the understanding of the effects of the interactions. It is shown that phonons induce significant changes near the edges of the electronic bands. The gap narrowing, effective-mass enhancement, and mobilities have been calculated. The influence of these polaronic effects on the transport properties of the polymer is considered, as well as its applicability to other conjugated systems. (20 refs.)

The metal-insulator transitions in the Peierls chain .... See Entry 102261

Microwave absorption in amorphous chalcogenide semiconductors .... See Entry 103004

71.45 COLLECTIVE EFFECTS

Determination of the pair potential and the ion-electron pseudopotential for aluminum from experimental structure-factor data for liquid aluminum .... See Entry 101535

Effects of non-locality and surface diffuseness on the electromagnetic response of a vacuum metal interface .... See Entry 102149

Unique labelling of many-electron states in multicentre systems .... See Entry 102221

Bloch electrons in rational and irrational magnetic fields .... See Entry 102231

The metal insulator transition in disordered electron systems .... See Entry 102258

AC-field induced steps in the I-V characteristics of charge density wave transport .... See Entry 102367

Inversion of hot carriers in Landau levels .... See Entry 102404

Theory of the quantized Hall conductance .... See Entry 102429

Magnetic properties of superconducting or normal networks and random walks on percolating clusters .... See Entry 102561

Dispersion of superconducting gap excitations in layered charge density wave systems .... See Entry 102568

71.45G Exchange, correlation, dielectric and magnetic functions, plasmons

102274 Long range surface plasmons in birefringent media. G.I.Stegeman (Optical Sci. Center, Univ. of Arizona, Tucson, AZ, USA).
Appl. Opt. (USA), vol.22, no.15, p.2243-5 (1 Aug. 1983).
Analyzes the propagation properties of surface plasmon polaritons guided by thin metal films bounded by birefringent media. (8 refs.)

102275 Long-range surface plasmons in electrode structures. G.I.Stegeman (Arizona Res. Labs., Univ. of Arizona, Tucson, AZ, USA), J.J.Burke.
Appl. Phys. Lett. (USA), vol.43, no.3, p.221-3 (1 Aug. 1983).
The authors show that surface plasmon polaritons guided by thin metal electrodes can achieve millimeter plus propagation distances in the near infrared. (12 refs.)

102276 Surface plasmon contribution to the static dipole moment of an atom near a surface. P.Grossel, D.van Labeke (Lab. d'Optique, Faculte des Sci. de Reims, Reims, France), J.-M.Vigoureux.
Chem. Phys. Lett. (Netherlands), vol.99, no.3, p.193-6 (5 Aug. 1983).
The contribution of the surface plasmon waves to the static dipole moment of an atom located near a metallic surface is evaluated at every distance. In the near-zone limit this contribution varies as z^{-4}. (21 refs.)

102277 Dynamic correlations in the electron gas. F.Brosens, J.T.Devreese (Dept. of Phys., Univ. Antwerpen, Wilrijk, Belgium).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.223-35 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
For the calculation of many properties of simple metals, the 'jellium' model is widely used as a first approximation. The frequency- and wave vector-dependent dielectric function of this model not only allows to study its dielectric response, but also to calculate several other properties, e.g. the ground state energy, the density-fluctuation excitation spectrum, the pair correlation function. In the last decade, experimental and theoretical evidence revealed the need for a frequency-dependent description of exchange and correlation effects. The authors review a method for introducing these effects starting from the equation of motion for the Wigner distribution function in the presence of a weak external perturbation. The application of the Hartree-Fock decoupling in this equation of motion leads to an integro-differential equation, which is studied with a variational approach, leading to a frequency dependent 'local-field correction' $G(q,\omega)$. The dynamical exchange effects substantially influence the dielectric function. For instance, compared to RPA, the plasmon frequencies in the particle-hole continuum are appreciably lowered. This tendency is confirmed experimentally. Furthermore, in contrast to most other approximations, this method satisfies a large class of consistency requirements and sum rules, for which a dynamical treatment of exchange and correlation is required. (50 refs.)

102278 Magnetic susceptibility of Wigner's crystal. M.A.Kezalov, L.S.Kogan, G.V.Shuster, Sh.A.Kuliev.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.5, p.68-70 (1982). In Russian.
Magnetic susceptibility of Wigner's crystal is calculated. It is shown that the magnet susceptibility jump must be observed at the phase transition of the degenerate electron gas from the metal state in a nonconducting one (Wigner's crystal). This jump measurement is suggested to be used for the discovery of the transition into the nonmetal state in highly doped semiconductors. (6 refs.)

102279 Density-functional theory of excitation spectra of semiconductors: application to Si. C.S.Wang (Dept. of Phys. & Astron., Univ. of Maryland, College Park, MD, USA), W.E.Pickett.
Phys. Rev. Lett. (USA), vol.51, no.7, p.597-600 (15 Aug. 1983).
Presents a general approach to calculation of the quasiparticle excitation energies of semiconductors which includes the energy dependence of the self-energy with a local density-functional approach. Both direct and indirect band gaps in Si are in much better agreement with experiment than are the bands from the ground-state theory. The relatively large corrections arise only after the dielectric screening of the electron gas is modified to account for a gap in the excitation spectrum. (16 refs.)

102280 Fractional quantization of the Hall effect: a hierarchy of incompressible quantum fluid states. F.D.M.Haldane (Dept. of Phys., Univ. of Southern California, Los Angeles, CA, USA).
Phys. Rev. Lett. (USA), vol.51, no.7, p.605-8 (15 Aug. 1983).
With use of spherical geometry, a translationally invariant version of Laughlin's proposed 'incompressible quantum fluid' state of the two-dimensional electron gas is formulated, and extended to a hierarchy of continued-fraction Landau-level filling factors ν. Observed anomalies at $\nu={}^2/_5, {}^2/_7$ are explained by fluids deriving from a $\nu={}^1/_3$ parent. (9 refs.)

102281 Exact high-frequency theory of surface plasmas. De-xin Lu (Dept. of Phys., Northeastern Univ., Boston, MA, USA), K.I.Golden.
Phys. Rev. A (USA), vol.28, no.2, p.976-86 (Aug. 1983).
New frequency-moment sum rules are formulated for the purpose of assessing the behavior of two-dimensional classical electron liquids at high frequencies $[\omega\gg\omega_p(k)]$. For nonzero coupling strength (characterized by γ), the convergence of new fifth-frequency-moment rule $\langle\omega^5\rangle$ is guaranteed at short range. However, in the Vlasov ($\gamma=0$) limit, $\langle\omega^5\rangle$ exhibits marked $1/\gamma$ and Inγ divergences. The ensuing breakdown in the high-frequency structure of the dielectric response function leads to the conclusion that the Vlasov limit is unphysical for two-dimensional classical electron liquids in the high-frequency domain. The authors theory complements the current low-frequency $[\omega\simeq\omega_p(k)]$ theories, all of which reinforce the notion that the reduced dimensionality of surface plasmas considerably enhances short-range correlation and dynamic collisional effects. (24 refs.)

102282 Comments on 'Time-dependent Hartree-Fock formalism for the dielectric function'. S.Das Sarma (Univ. of Maryland, College Park, MD, USA), W.Hanke.
Phys. Rev. B (USA), vol.28, no.2, p.1134-5 (15 July 1983).
For original paper see ibid., vol. 19, p.1720 (1979). The correct formalism for obtaining a dielectric function consistent with the Hartree-Fock approximation is outlined. It is pointed out that a recent calculation by Brener and Fry does violate Ward identities and is not a conserving approximation. To be consistent with the Hartree-Fock single-particle equation the infinite series of 'ladder-bubble' diagrams must be included. (13 refs.)

102283 Possibility of acoustic plasmons in mixed-valence metals and their interaction with phonons. S.K.Sinha (Argonne Nat. Lab., Argonne, IL, USA), C.M.Varma.
Phys. Rev. B (USA), vol.28, no.4, p.1663-6 (15 Aug. 1983).
Mixed-valence metals are characterized by the presence of both the very heavy *f* and the light *s-d* electrons near the Fermi surface. These conditions are propitious for the existence of the plasmon branch with acoustic character. The authors derive the dispersion relation for such modes and consider their interaction with the phonons of the lattice. The longitudinal sound velocity is shown to be strongly reduced by the interaction, as is experimentally observed. It is proposed that ultrasonic experiments be used to directly observe the acoustic plasmons. (19 refs.)

102284 Photoacoustic study of plasmon resonance absorption in a diffraction grating. T.Inagaki, M.Motosuga, K.Yamamori (Dept. of Phys., Osaka Kyoiku Univ., Osaka, Japan), E.T.Arakawa.
Phys. Rev. B (USA), vol.28, no.4, p.1740-4 (15 Aug. 1983).
Plasmon resonance absorption in a 520-line/mm silver-coated diffraction grating was measured as a function of the angle of ruling orientation relative to the plane of photon incidence by a photoacoustic method. The experimental results of absorptance changes as a function of ruling orientation were found to be consistent with predictions from the first-order perturbation theory for roughness-induced photoabsorption. A discrepancy was found, however, between the absorptance values observed and the values calculated from the first-order theory. (35 refs.)

102285 Static structure factor and electron-electron correlations in Be. A comparison of experiment with electron-gas theory. G.Mazzone, F.Sacchetti, V.Contini (Dipartimento Tecnologie Intersettoriali di Base, Centro Ricerche Energetiche della Casaccia, Roma, Italy).
Phys. Rev. B (USA), vol.28, no.4, p.1772-80 (15 Aug. 1983).
The inelastic scattering cross section of metallic Be has been determined from an X-ray scattering experiment. The conditions under which the electronic contribution (static structure factor) can be extracted from such an experiment are discussed together with the approximations which have to be introduced in order to distinguish between core and band contributions. Accordingly, the static structure factor and the exchange and correlation energy of conduction electrons in Be have been determined. These quantities agree within experimental accuracy ($\sim$5%) with current electron-gas theory. From the static structure factor the electron-electron pair-correlation function has been deduced and compared with corresponding calculations for jellium. To this purpose the unavoidable experimental limitations on data accuracy and the theoretical difficulties which are encountered when performing direct first-principles calculations are discussed. (40 refs.)

102286 Dielectric formulation of strongly coupled electron liquids at metallic densities. VII. Spin-dependent correlations. K.Utsumi, S.Ichimaru (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).
Phys. Rev. B (USA), vol.28, no.4, p.1792-7 (15 Aug. 1983).
For pt.VI see Phys. Rev. A, vol.26, p.603 (1982). A parametrized expression for the paramagnetic spin susceptibility of the electron liquid at metallic densities is obtained through investigation of spin-dependent local-field corrections. The spin-susceptibility sum rule and the Pauli-principle restriction on the correlations are carefully taken into account. Physical effects of the exchange and Coulomb-induced correlations are investigated numerically on spin-dependent properties such as the onset of a spin-density-wave instability. (22 refs.)

102287 Dispersion of magnetoplasmons in layered systems. S.Das Sarma (Dept. of Phys. & Astron., Univ. of Maryland, College Park, MD, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2240-3 (15 Aug. 1983).
Dispersion relations for magnetoplasmons are derived for both type-I and type-II superlattice systems within the simple model in which thickness of individual charged layers is neglected. The magnetic field is taken to be in the direction of the superlattice growth, and coupling to LO phonons is retained in the theory. General equations valid within the random-phase approximation are derived, and analytic results correct up to second order in two-dimensional wave number are obtained for the magnetoplasmon dispersion. (14 refs.)

102288 Exchange and correlation potentials in the one-electron equation. H.Suehiro, K.Awa, H.Yasuhara (Dept. of Phys., Hokkaido Univ., Sapporo, Japan).
Solid State Commun. (USA), vol.47, no.8, p.641-4 (Aug. 1983).
The self-energy operator of an electron liquid is examined by including the particle-hole and particle-particle ladder types of vertex corrections to the simplest approximation discussed by Hedin and Lundqvist (1969). It is found that the real part of the self-energy correction $\Sigma(p, \epsilon_p)$ is much more independent of the wavenumber p than that in the simplest approximation because of the strong short-range correlations at metallic densities. The quasi-particle mass ratio m^*/m in the present approximation gives values smaller than 1 in the whole metallic density region. (18 refs.)

102289 Averaged local field intensities in composite films. Z.Kotler, A.Nitzan (Dept. of Chem., Tel Aviv Univ., Tel Aviv, Israel).
Surf. Sci. (Netherlands), vol.130, no.1, p.124-54 (July 1983).
The photophysical properties of molecules adsorbed in composite films (e.g. surface island films) depend on the local electromagnetic field within the film. The ratio between the average field intensity $\langle|E|^2\rangle$ in the film and the intensity $|E_I|^2$ associated with the incident field is a measure of the electromagnetic contribution to the surface influence on molecular photophysical phenomena. This ratio depends on the film composition and morphology on the dielectric properties of the pure components making the film and on the frequency, direction and polarization of the incident radiation. Calculations of this ratio as a function of these parameters for several models of composite films are presented. Image interactions and retardation effects as well as radiative damping and finite size contributions to the dielectric response of the films are taken into account. In addition, an estimate of the field inhomogeneity within the film is obtained by calculating also the ratio of $\langle|E|^2\rangle_{\mathrm{shell}}/|E_I|^2$ associated with the field in thin shells surrounding the dielectric particles which constitute the film. (27 refs.)

102290 Dielectric function of 'undoped' In_2O_3. I.Hamberg, C.G.Granqvist (Phys. Dept., Chalmers Univ. of Technol., Gothenburg, Sweden).
Thin Solid Films (Switzerland), vol.105, no.2, p.L83-6 (15 July 1983).
Presents a detailed determination of the complex dielectric function representative of 'undoped' In_2O_3 in the wavelength range 0.25 $\mu m<\lambda<40$ μm. The effects of the semiconductor band gap and of the lattice vibrations are studied. (15 refs.)

Beyond the local-density approximation in calculations of ground-state electronic properties .... See Entry 100274

Analysis of biexcitonic optical bistability in CuCl in the presence of collision broadening .... See Entry 100839

Regimes of laser-induced periodic surface structure on germanium: radiation remnants and surface plasmons .... See Entry 101761

Neutron scattering study on the structural transition of quasi-one-dimensional conductor $K_{0.3}MoO_3$ .... See Entry 101947

Simplified self-interaction correction applied to the energy bands of neon and sodium chloride .... See Entry 102254

Electron-phonon scattering in polyparaphenylene .... See Entry 102273

Electrons in coupled stereo-irregular chains .... See Entry 102324

Fluctuations of the relaxation time in one-dimensional systems .... See Entry 102366

Fractional quantization of Hall conductance .... See Entry 102436

Quantized Hall conductance in a relativistic two-dimensional electron gas .... See Entry 102438

Remarks on the Laughlin theory of the fractionally quantized Hall effect .... See Entry 102439

Many-body effects on the subband structure of *n*-type surface space-charge layers in InP .... See Entry 102482

Space-charge waves in multilayered heterostructures .... See Entry 102499

Kinetic Ising model for polymer dynamics: applications to dielectric relaxation and dynamic depolarized light scattering .... See Entry 102812

Collective oscillations in the X-ray absorption spectrum of beryllium .... See Entry 102994

71.45J Fermi-Thomas model

Effects of screening on crystal-field magnetoelastic coupling in rare-earth intermetallic compounds .... See Entry 102328

71.45N Calculations of total electronic binding energy

(see also 61.50L Crystal binding)

102291 About the conjugation of semiconductor thermal elements. K.Sh.Kakhramanov.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.4, p.70-5 (1982). In Russian.
It is shown that there exists a decrease of binding energy of the valency electrons in the interval of the eutectic system on the principle of conjugate semiconductor thermal elements at increased temperatures with the use of the eutectic equilibrium. (7 refs.)

102292 Single-ion and pair-interaction potentials near simple metal surfaces. R.N.Barnett, R.G.Barrera, C.L.Cleveland, U.Landman (School of Phys., Georgia Inst. of Technol., Atlanta, GA, USA).
Phys. Rev. B (USA), vol.28, no.4, p.1667-84 (15 Aug. 1983).
Presents a model for semi-infinite simple metals which does not require crystalline order or a single species, and thus is applicable to problems of defect energetics near the surface and random alloy surfaces as well as ideal metal surfaces. The formulation is based on the use of ionic pseudopotentials and linear-response theory. An expression for the total energy is obtained which depends explicitly on ionic species and position. This expression is decomposed into a density-dependent term and single-ion and ionic pair-interaction potential terms. The single-ion potentials oscillate about a constant bulk value, with the magnitude of the oscillation decreasing rapidly away from the surface. The interaction between pairs of ions near the surface is shown to be a noncentral force interaction which differs significantly from the central-force bulk pair potential. The effect of quantum interference in the response of the semi-infinite electron gas to the ions is seen in both the single-ion and the pair-interaction potentials. Results are presented for the simple metals sodium, potassium, and rubidium. (45 refs.)

102293 Multilayer lattice relaxation at metal surfaces: a total-energy minimization. R.N.Barnett, U.Landman, C.L.Cleveland (School of Phys., Georgia Inst. of Technol., Atlanta, GA, USA).
Phys. Rev. B (USA), vol.28, no.4, p.1685-95 (15 Aug. 1983).
Relaxation at simple metal surfaces is studied via minimization of the total energy of a semiinfinite crystal. The expression for the total energy depends explicitly on the ionic positions, and is based on the use of pseudopotential theory and linear response. Electron screening is treated selfconsistently including exchange and correlation effects. From a systematic investigation of the energetics underlying metal surface relaxation, for the low-index surfaces of BCC Na and FCC Al it is concluded that to achieve quantitative surface structural predictions requires the use of the full total-energy expression for the semi-infinite solid. Such an expression must maintain the three-dimensional nature of the system and account properly for the inhomogeneous surface electron density and the self-consistent response of the electron system to the ionic positions (screening). Multilayer relaxation is shown to be essential for quantitative structural predictions and the origins of the phenomena are discussed in detail demonstrating the relative effects of electrostatic terms and band-structure contributions. The results exhibit damped oscillatory multilayer relaxations (the relaxation being particularly pronounced for the open faces) with a period equal to the bulk layer stacking period and agree well with available structural determinations obtained via the analysis of experimental data. (21 refs.)

Parametrized density functionals in the phase theory in alloys of 3D-transition metals .... See Entry 101622

Self-consistent Hellmann-Feynman theorem for tight-binding models .... See Entry 102224

71.50 LOCALIZED SINGLE-PARTICLE ELECTRONIC STATES

(exc. impurities; for localisation in disordered structures, see 71.55J)

102294 Configuration mixing in the groundstate of Ce. M.Schluter, C.M.Varma (Bell Labs., Murray Hill, NJ, USA).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.147-61 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
4f electrons at the beginning of the rare earth series are weakly bound yet highly localized. Their virtual excitations create core change fluctuations which strongly enhance excitonic effects. The dynamic interaction led to a new groundstate which may be viewed as a boundstate of a 4f electron and an f-exciton. The 4f-hole Green's function is also strongly modified and shows two poles instead of one pole in the one-electron picture. The photoemission experiments and the X-ray edge absorption experiments in cerium and its metallic compounds are explained in this model. The new groundstate also provides a basis for the understanding of the γ-α phase transition of cerium. (35 refs.)

102295 Is one-parameter scaling inconsistent? Note on Kumar's note. B.Schuh (Inst. fur Theoretische Phys., Univ. zu Koln, Koln, Germany).
J. Phys. C (GB), vol.16, no.21, p.L741-3 (30 July 1983).
For original paper see ibid., vol.16, p.L109 (1983). A recent claim that the one-parameter scaling theory of localisation contains an inherent inconsistency is refuted. (2 refs.)

102296 Is one-parameter scaling theory of localisation consistent? Comment on Schuh's comment. N.Kumar (Dept. of Phys., Indian Inst. of Sci., Bangalore, India).
J. Phys. C (GB), vol.16, no.21, p.L745-6 (30 July 1983).
For comment see ibid., vol.16, p.L741 (1983). It is maintained that the one-parameter scaling theory is inconsistent with the physics of Anderson localisation. (4 refs.)

102297 Core-level reflectance spectroscopy of black phosphorus single crystals. M.Taniguchi, M.Seki, S.Suga, A.Mikuni, H.Kanzaki (Synchrotron Radiation Lab., Univ. of Tokyo, Tokyo, Japan), Y.Akahama, S.Endo, S.Narita.
Phys. Rev. B (USA), vol.28, no.2, p.1165-7 (15 July 1983).
The 2*p* core reflectance spectra have shown strong anisotropy for $\vec{E}\|a$ and $\vec{E}\|c$. A remarkably sharp doublet structure observed at the 2*p* core threshold for $\vec{E}\|a$ (at 130.33 and 131.20 eV) is assigned to the spin-orbit partner of the 2*p* core excitons with finite binding energy. The difference between the spectra for $\vec{E}\|a$ and $\vec{E}\|c$ is explained on the basis of selection rules for transitions from the 2*p* core levels to particular symmetry points (Z_4^-,Σ_1, and Γ_4^-) of conduction bands. (16 refs.)

102298 π-electron delocalization in poly(*p*-phenylene), poly(*p*-phenylene sulfide), and poly(*p*-phenylene oxide). G.Crecelius (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany), J.Fink, J.J.Ritsko, M.Stamm, H.-J.Freund, H.Gonska.
Phys. Rev. B (USA), vol.28, no.4, p.1802-8 (15 Aug. 1983).
As deduced from electron-energy-loss experiments, the π band in poly(*p*-phenylene) has a width comparable to that in graphite. The π-band width in poly-(*p*-phenylene sulfide) is considerably narrower, and in poly(*p*-phenylene oxide) the π electrons are localized in benzene-derived states. These results are in line with recent theoretical results. In addition, structure in the C $1s$-π^* absorption is shown to be due to chemical shifts of *C* atoms in different coordination. (24 refs.)

102299 Optical instabilities and localized electronic states in hydrogenated amorphous silicon. P.C.Taylor, W.D.Ohlsen (Univ. of Utah, Salt Lake City, UT, USA).
Sol. Cells (Switzerland), vol.9, no.1-2, p.113-18 (June-July 1983).
Optical excitation of hydrogenated amorphous silicon films at high light intensites (100 W cm^{-2} or more) yields an increase in the electron spin resonance (ESR) signal which is metastable at room temperature. Pulsed annealing experiments between 375 and 475K (about 100-200°C) indicate that this ESR signal follows an annealing curve which is similar to that for the optically induced photoluminescence band at 0.8-0.9 eV. The annealing is complete for temperatures above about 475K (200°C). (21 refs.)

Surface reconstruction and adsorbate geometry by surface core level spectroscopy .... See Entry 102129

Electronic structure of some binary uranium and thorium oxides and halides .... See Entry 102251

Coherent Zener oscillations .... See Entry 102401

Time of flight of carriers in simple aromatic hydrocarbon layers. I. Theory .... See Entry 102424

Time of flight of carriers in simple aromatic hydrocarbon layers. II. Comparison with experimental results .... See Entry 102425

Capacitance oscillations in quantized Hall effect .... See Entry 102441

Theory of surface core-level shifts in metals .... See Entry 102476

Electron localization and interaction in bismuth thin films .... See Entry 102524

Reduced paramagnetism in γ-cerium .... See Entry 102620

71.55 IMPURITY AND DEFECT LEVELS

102300 Investigation of impurity levels in n-type indium selenide by means of Hall effect and deep level transient spectroscopy. A.Segura (Dept. de Electricidad y Magnetismo, Facultad de Ciencias Fisicas, Valencia, Spain), K.Wunstel, A.Chevy.
Appl. Phys. A (Germany), vol.A31, no.3, p.139-45 (July 1983).
Reports the results of Hall effect and deep-level-transient-spectroscopy measurements on *n*-type indium selenide samples cleaved from non-intentionally doped material and from chlorine, tin, gallium sulphide or oxygen doped ingots. Some unidentified shallow and deep levels are found. Impurity levels attributed to Cl (310 meV) and to Sn (44 and 120 meV) are also reported. Anomalous degeneracy of electrons at low temperature is discussed. (25 refs.)

102301 Deep levels subsisting in ion implanted silicon after various transient thermal annealing procedures. A.Mesli, J.C.Muller, P.Siffert (Centre de Recherches Nucleaires, Strasbourg, France).
Appl. Phys. A (Germany), vol.A31, no.3, p.147-52 (July 1983).
Deep-level transient spectroscopy has been used to investigate the defects remaining in the ion implanted *p-n* junctions in silicon after various pulsed annealing techniques, including ruby and YAG lasers as well as pulsed electron beams (PEBA). The nature and distribution of the various identified levels are discussed for each procedure as a function of various experimental parameters. (20 refs.)

102302 Comment on the model of the Mg centres in NaCl crystals. A.Watterich, R.Voszka (Res. Lab. for Crystal Phys., Hungarian Acad. Sci., Budapest, Hungary).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.7, p.826-30 (1983).
The structure models of the Mg_2 centre (substitutional Mg^+ ion associated with a vacancy pair) and the Mg_4 centre (Mg^0 atom situated in a vacancy pair) produced in NaCl:Mg crystal by X-irradiation and subsequent F- and thermal bleaching are discussed. The given models explain without any contradiction all the experimental observations. (11 refs.)

102303 Optical experiments on deep centers in semiconductors. H.G.Grimmeiss (AB RIFA, Stockholm, Sweden).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.317-27 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Using chalcogenide doped silicon as an example, the author shows how Fourier spectroscopy applied to both diodes and bulk samples can increase the understanding of electronic properties of deep centers. Results have been obtained by Fourier absorption (ABS), Fourier photoconductivity (PC) and Fourier photo admittance spectroscopy (FPAS). (22 refs.)

102304 The effect of hydrostatic pressure on shallow and deep impurity states in semiconductors. S.Porowski, W.Trzeciakowski (High Pressure Res. Center, Polish Acad. of Sci., Warsaw, Poland).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.331-46 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The influence of hydrostatic pressure on various contributions to the impurity potential is discussed. The pressure dependence of impurity states is described for the potentials containing the slowly-varying term, the short-range term, and both of these terms. The effect of pressure on the impurity-lattice coupling is discussed. All the above considerations are illustrated with appropriate experimental results. (27 refs.)

102305 Defect states in plastically deformed *p*-type silicon crystals investigated by the Hall effect. H.Ono, K.Sumino (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).
J. Appl. Phys. (USA), vol.54, no.8, p.4426-32 (Aug. 1983).
Measurements of Hall effect and DC conductivity have been conducted on plastically deformed *p*-type floating-zone-grown silicon crystals to investigate the energy levels of defects introduced by deformation. The temperature dependence of the carrier concentration is analyzed on the basis of the model in which electrically active centers induced by deformation are assumed to be distributed discretely in the crystal. It is shown that both acceptors and donors having deep energy levels are introduced simultaneously by deformation, the concentrations of which are proportional to the dislocation density. The concentration of the deformation-induced acceptors is found to be 6-7 times as high as that of the deformation-induced donors. The energy levels of these acceptors and donors are approximately at the same position, namely 0.3-0.4 eV above the top of the valence band. (14 refs.)

102306 Defect and impurity states in silicon nitride. J.Robertson (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4490-3 (Aug. 1983).
The electronic levels associated with silicon and nitrogen dangling bonds and Si-H, N-H, and Si-Si units within bulk Si_3N_4 have been calculated using the tight-binding and recursion methods. The Si dangling bond, the Si-H σ state and the Si-Si σ state all lie in the gap. The Si-Si σ state lies in midgap and could be a long-term hole trap. The Si dangling bond state lies just below the conduction band and could act as a very efficient electron trap. (29 refs.)

102307 The F^+ centre in lithium oxide. C.K.Ong (Dept. of Phys., Nat. Univ. of Singapore, Lower Kent Ridge, Singapore).
J. Phys. C (GB), vol.16, no.21, p.4081-5 (30 July 1983).
The author has calculated the absorption energy for the F^+ centre in lithium oxide by using the point-ion model as well as the approximate pseudopotential method formulated by Bartram and co-workers (1968). The result obtained using the point-ion model agrees reasonably well with that from experimental work. However, the result obtained using the approximate pseudopotential calculation is higher than the experimental result by 1 eV. (18 refs.)

102308 A novel perturbative-variational approach and its application to the impurity states in anisotropic crystals—A comment. K.Navaneethakrishnan (School of Phys., Madurai Kamaraj Univ., Madurai, India).
J. Phys. C (GB), vol.16, no.23, p.L843-4 (20 Aug. 1983).
It is pointed out that the approach of Lee et al. (see ibid., vol.15, p.L469, 1982) for the computation of the ground state energies of shallow donors in Si and Ge is similar to a spherical band approximation in the light of an earlier work by Tefft (see Bull. Am. Phys. Soc., vol.13, p.710, 1968). (3 refs.)

102309 Observation of spin-dependent thermal emission from deep levels of semiconductors. M.C.Chen, D.V.Lang (Bell Labs., Murray Hill, NJ, USA).
Phys. Rev. Lett. (USA), vol.51, no.5, p.427-9 (1 Aug. 1983).
The first observation of spin-dependent thermal emission from a deep gap state in a semiconductor is reported. As a result the silicon dangling-bond defects at the Si/SiO_2 interface can be directly correlated with a 0.36-eV-deep hole trap. (10 refs.)

102310 DLTS investigation of electron traps in As-grown and Cd-fired CdS. D.Verity, D.Shaw, F.J.Bryant, C.G.Scott (Dept. of Phys., Univ. of Hull, Hull, England).
Phys. Status Solidi a (Germany), vol.78, no.1, p.267-75 (16 July 1983).
Deep level transient spectroscopy is used to investigate electron traps in as-grown n-CdS and in CdS annealed in Cd vapour or in liquid Cd. Nine electron traps are detected with activation energies in the range $\approx$0.19 to 0.92 eV. Two traps with mean activation energies of 0.19 eV (E_1) and 0.46 eV (E_2) are present in all samples regardless of source or annealing treatment and have also been reported by other workers. Because of their large electron capture cross-sections ($>10^{-14}$ cm^2) and the linear relation between their concentrations and the free electron concentration, E_1 and E_2 are believed to be donor-like associates formed between residual impurities and native defects. (31 refs.)

102311 Deformation-induced point defects in germanium. F.H.Baumann, W.Schroter (IV. Phys. Inst., Univ. Gottingen, Gottingen, Germany).
Philos. Mag. B (GB), vol.48, no.1, p.55-61 (July 1983).
Using a transient capacitive method (deep-level transient spectroscopy), the authors have studied defects introduced into n-type germanium by plastic deformation at temperatures below 0.6 T_m (where T_m is the melting temperature). From the annealing behaviour of a defect with a level at E_c-0.29 eV, they conclude that point-defect clouds surround the dislocation formed during plastic deformation, and that these anneal out at high temperatures. (7 refs.)

102312 Real-space rescaling method for disordered systems. B.W.Southern, A.A.Kumar, J.A.Ashraff (Dept. of Phys., Univ. of Manitoba, Winnipeg, Manitoba, Canada).
Phys. Rev. B (USA), vol.28, no.4, p.1785-91 (15 Aug. 1983).
An exact real-space rescaling approach for disordered tight-binding model Hamiltonians is presented. The method provides a direct way of obtaining the local Green's functions and the local density of states. The behavior of the eigenstates in a given region of energy can be determined from the behavior of the rescaling transformation under iteration. Localized-mode behavior is characterized by a fixed point of the transformation and the inverse localization length can be obtained directly from an analysis of the approach to this fixed point. The problem of a single impurity is studied in detail and the method is compared with the standard treatment of such problems. (12 refs.)

102313 Evidence for shallow bound states in PbTe. A.V.Lewis (Clarendon Lab., Univ. of Oxford, Oxford, England), F.Kuchar, R.J.Nicholas, J.C.Ramage, L.Palmetshofer.
Phys. Rev. B (USA), vol.28, no.4, p.2244-8 (15 Aug. 1983).
For original paper see ibid., vol.21, p.3447 (1980). Data are presented showing structure in the magneto-optical absorption of thin films of *p*-type PbTe, which cannot be explained in terms of free-carrier effects alone. This structure, while having a similar form in many samples, is quantitatively different in samples with different doping. This behavior is strongly suggestive of central cell effects on bound-impurity states rather than of intrinsic many-body effects as recently suggested by McKnight and Drew (1980). (21 refs.)

102314 Evidence for shallow bound states in PbTe: A reply. S.W.McKnight (Dept. of Phys., Northeastern Univ., Boston, MA, USA), H.D.Drew.
Phys. Rev. B (USA), vol.28, no.4, p.2249-51 (15 Aug. 1983).
For original paper see ibid., vol.21, p.3447 (1980); for comment see ibid., vol.28, p.2244 (1983). Line-shape calculations cast doubt on the interpretation offered by Lewis et al. (the preceding comment). (15 refs.)

102315 Shallow donors in CdF_2 crystals and the semiconductor-insulator transition in mixed $Cd_{x-1}Me_xF_2$ fluorites. J.E.Dmochowski, I.Kosacki, J.M.Langer (Inst. of Phys., Polish Acad. of Sci., Warsaw, Poland).
Radiat. Eff. (GB), vol.72, no.1-4, p.139-44 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
The predicted, but as yet unobserved, intradonor absorption spectrum of the hydrogenic-like donors in CdF_2 crystals is presented. The role of phonon coupling in these spectra is discussed. From the data on the insulator-semiconductor transition in $CdPbF_2$ it is concluded that the dominant factor in convertibility of CdF_2 to a semiconducting state is its electron affinity, the largest among the fluorites ($\chi\approx$4 eV). (16 refs.)

102316 Electronic states associated with extended defects in quantum well structures. C.E.T.Goncalves Da Silva (Inst. de Fisica Gleb Wataghin, Univ. Estadual de Campinas, Campinas, Brazil), P.Fulco.
Rev. Bras. Fis. (Brazil), vol.12, no.2, p.325-36 (June 1982).
A simple model for the calculation of bound states associated with extended defects in quantum well structures is developed. The authors consider a particle confined between two plane parallel potential walls and determine the conditions for existence of bound states for two types of defects: infinite 'trench-like' and cylindrical. In a Ga(Al,As)-GaAs-Ga(Al,As) quantum well structure defects capable of producing appreciably bound states must have lateral dimensions of the order of 0.1 μm. (7 refs.)

Lattice relaxation, radiative and non-radiative deexcitation at localized defects .... See Entry 101688

Bound triplet state of the F' center in NaI .... See Entry 101698

Dislocations in germanium: Effects of plasma hydrogenation .... See Entry 101709

Determination of vibronic parameters for GR1 centre in diamond by an optimisation technique .... See Entry 101873

Photo-induced changes in the bulk density of gap states in hydrogenated amorphous silicon associated with the Staebler-Wronski effect .... See Entry 102246

Theory of the exciton bound to an isoelectronic trap in GaP .... See Entry 102266

Single injection current in insulator with traps lying below the Fermi level .... See Entry 102409

Trapping and recombination cross sections for electrons in silver halide .... See Entry 102421

Hall effect studies in germanium doped $Al_xGa_{1-x}As$ .... See Entry 102432

The effect of light soaking on the low temperature photoconductivity of hydrogenated amorphous silicon .... See Entry 102460

The interpretation of photoconductivity measurements in hydrogenated amorphous silicon .... See Entry 102461

Thermal noise in insulator diode with traps lying below the Fermi level under CDDM regime .... See Entry 102472

Al-GaAs(001) Schottky barrier formation .... See Entry 102491

Degradation mechanism of $Mo/GaAs_{0.6}P_{0.4}$ Schottky barriers .... See Entry 102492

Formation of two-impurity complex in dilute alloys observed through perturbed angular correlations of γ rays .... See Entry 102791

Optical absorption in PbTe doped with Cr .... See Entry 102911

Luminescence fatigue of silver chloride crystals .... See Entry 102934

A study of recombination centres in $YAlO_3$, $EuAlO_3$, $LaAlO_3$ and Y_2O_3 using ODMR .... See Entry 102947

Measurements of the emission spectra of LiF during thermoluminescence .... See Entry 102972

Auger lifetimes for excitons bound to deep impurities in semiconductors .... See Entry 103010

Investigations of mechanically induced excited states on cleavage planes of ionic crystals. II. Investigations of the mechanisms of electron emission from cleaved alkali halide crystals and of the influence of surface charges .... See Entry 103037

Annealing behaviour of gamma-ray-induced electron traps in LEC *n*-InP .... See Entry 103180

71.55J Localization in disordered structures

102317 Disorder and interaction. C.Castellani (Istituto di Fisica, Univ. dell'Aquila, L'Aquila, Italy), C.Di Castro, G.Forgacs, E.Tabet.
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.55-60 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
In trying to describe from a theoretical point of view the combined effect of the interaction and the disorder, the main difficulty of the problem lies in the absence of a simple description in terms of an effective Hamiltonian, as a preliminary step to build up a standard renormalization procedure. By imposing general gauge invariance requirements, the authors have shown that the localization transition of a free fermion gas in the presence of impurities can be adequately described in $2+\epsilon$ dimensions within the framework of the usual many-body theory. In this way the linear response theory to an external electromagnetic field was directly renormalised. (10 refs.)

102318 A method for calculating the localisation length, with an analysis of the Lloyd model. R.Johnston, H.Kunz (Ecole Polytech. Federale de Lausanne, Lausanne, Switzerland).
J. Phys. C (GB), vol.16, no.23, p.4565-80 (20 Aug. 1983).
A method is developed to calculate the localisation length in disordered systems. It can be considered to be a generalisation of the method of Herbert, Jones and Thouless (1971-2) for one-dimensional systems, to wires and ν-dimensional lattices. The localisation length can be calculated under some assumptions when the disorder has a Lorentzian probability distribution. No localisation transition is found, that is the localisation length is finite for arbitrarily small non-zero values of the disorder. For other distributions a perturbation expansion is developed, which is valid for large values of disorder and small energies. The dominant term and the first-order correction are calculated. (12 refs.)

102319 Eigenfunction in disordered systems near the mobility edge. A.Brezini (Internat. Center for Theoretical Phys., Trieste, Italy).
J. Phys. C (GB), vol.16, no.24, p.4839-47 (30 Aug. 1983).
A model is proposed to calculate the average probability and the average size of the localisation domain for an electron being localised at a given site in a Cayley tree lattice. The numerical results are presented in the limit of weak disorder in the case of the Cauchy distribution for site energies. Attention is paid to the states near the mobility edge in the localised regime. In parti-

cular, features exhibited in the linear-chain case are observed for the first time for higher dimensions. (18 refs.)

102320 ESR study of effects of pressure treatment, temperature and annealing on the structure of the impurity Cr^{3+} centers in chalcogenide glasses. E.A.Zhilinskaya, V.A.Shanditsev, I.V.Chepeleva, V.N.Lazukin (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
J. Non-Cryst. Solids (Netherlands), vol.57, no.1, p.71-80 (Aug. 1983).
The effects of pressure treatment up to 77 kbar of temperature and of annealing on the structure of the impurity Cr^{3+} centres in glasses As_2Se_3 (I), 5Cu $95As_2Se_3$ (II) and $TlAsS_2$ (III) was studied by the EPR method. The high pressure treatment of (I) and (II) leads to considerable changes by the EPR parameters and their temperature dependences due to the increase of the zero field splittings of the Cr^{3+} energy levels, connected with nonreversible local structure changes in glasses. (16 refs.)

102321 Defect states in amorphous germanium. N.Ishii (Dept of Electrical Engng. & Electronic Engng., Fukui Inst. of Technol., Fukui, Japan), M.Kumeda, T.Shimizu.
Phys. Status Solidi b (Germany), vol.118, no.1, p.K65-8 (1 July 1983).
To examine whether the defects in a-Ge:H are similar ones to those in a-Si:H or not, the calculations for a-Ge were carried out by using the method of Haussman (1966) and Eilebrecht et al. (1976). The interatomic distances for Ge clusters used for the calculation are 2.45/2.35 times as long as those for the corresponding Si clusters. As the parameters of the extended Huckel theory for Ge, the authors have used those which were determined so as to reproduce the band structure of crystalline Ge. (8 refs.)

102322 Connection of localization with the problem of the bound state in a potential well. E.N.Economou, C.M.Soukoulis (Corp. Res. Sci. Lab., Exxon Res. & Engng. Co., Linden, NJ, USA).
Phys. Rev. B (USA), vol.28, no.2, p.1093-4 (15 July 1983).
It is shown that the problem of electron localization in a random potential is formally equivalent to the problem of finding a bound state in a shallow potential well. (8 refs.)

102323 Self-consistent calculation of the quasiparticle lifetime in two-dimensional disordered metals. J.M.B.Lopes dos Santos (Blackett Lab., Imperial Coll. of Sci. & Technol., London, England).
Phys. Rev. B (USA), vol.28, no.2, p.1189-92 (15 July 1983).
A self-consistent calculation of the quasiparticle inverse lifetime in two-dimensional disordered metals is presented in this paper. The author confirms the $T \ln (T_2/T)$ temperature dependence found by Abrahams, Anderson, Lee, and Ramakrishnan (1981) but finds a different prefactor and temperature T_2. In particular, the quasiparticle lifetime is not the same as the weak localization cutoff recently calculated by Fukuyama and Abrahams although it is quite simply related to it. (5 refs.)

102324 Electrons in coupled stereo-irregular chains. S.Stafstrom, R.Riklund, K.A.Chao (Dept. of Phys. & Measurement Technol., Univ. of Linkoping, Linkoping, Sweden).
Phys. Rev. B (USA), vol.28, no.4, p.2199-211 (15 Aug. 1983).
Two interacting stereo-irregular chains of hydrogen atoms coupled at a finite number of bridge points are simulated by a computer and are solved numerically via the unrestricted Hartree-Fock approximation with a modified spin-polarized potential. The electron localization is studied with the inverse participation ratio and the moment analysis. The authors discovered that the eigenstates in the lower part of the spectrum are localized around the bridge points due to the random ionic potential. The resultant random potential is screened by the electrons occupying the intermediate region of the spectrum. Thus electrons near the Fermi energy feel a smooth potential and can tunnel through the bridge points. Connection between the present calculation and conducting polymers is discussed. (45 refs.)

Qualitative theory of stochastic differential equations and quantum mechanics of disordered systems .... See Entry 98802

Irradiation effects in perovskite-type fluorides .... See Entry 101792

Defects induced in single thoria crystals by X and far UV irradiation .... See Entry 101793

F and photochromic centers in $LiYF_4$:Nd crystals .... See Entry 101794

Experimental tests of localization in semiconductors [metal-insulator transition] .... See Entry 102257

The metal insulator transition in disordered electron systems .... See Entry 102258

Kinks and polarons in polyacetylene .... See Entry 102271

Localization and interaction in one dimension .... See Entry 102338

Time of flight experiments with conduction electrons—an application of weak localization .... See Entry 102357

Basic issues in electronic conduction in amorphous semiconductors. II. Electronic transport properties .... See Entry 102369

Dispersive transport from negatively correlated defect centers .... See Entry 102370

The interpretation of the electric and optical properties of a-Si:H films produced by RF glow discharge through dark conductivity, photoconductivity and pulse controlled capacitance-voltage measurements .... See Entry 102381

Deep traps in metal-insulator-chemically vapor-deposited amorphous SiN_x diodes .... See Entry 102512

Electrical conduction in sputtered Si:Al films .... See Entry 102521

Effects of controlled hydrogenation by ion implantation on the localized states in vacuum evaporated amorphous silicon .... See Entry 102530

Electron localization and superconductivity in 2D in metals .... See Entry 102574

Paramagnetic states in doped amorphous silicon and germanium .... See Entry 102745

Optical electron transitions in a two-dimensional disordered semiconductor .... See Entry 102842

Optical properties of F_A and $(F_2)_A$ centres in doped KI .... See Entry 102949

Low energy photoluminescence of pure and doped LiF .... See Entry 102950

Properties of the defect causing solar cell degradation .... See Entry 103695

71.65 POSITRON STATES

(see also 78.70B Positron annihilation)

102325 Localized positron state in a simple metal. O.M.Gol'tyaev, V.M.Osadchiev, S.G.Pozdnyakov (Moscow Engng. Phys. Inst., Moscow, USSR).
JETP Lett. (USA), vol.37, no.2, p.96-9 (20 Jan. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.2, p.79-82 (20 Jan. 1983).
An energetically favored state of a positron in a metal is a new state: a neutral formation of finite dimension. This fact is consistent with experimental data on the positron lifetime and on the angular distribution of annihilation γ-rays. (5 refs.)

71.70 LEVEL SPLITTING AND INTERACTIONS

(see also 75.10 – in magnetic phenomena, 75.30E Exchange and superexchange interactions, 73.20 Electronic surface states)

102326 Electron transfer between magnetic ions in mixed valence binuclear systems. J.-J.Girerd (Lab. de Spectrochemie des Elements de Transition, Univ. de Paris-Sud, Orsay, France).
J. Chem. Phys. (USA), vol.79, no.4, p.1766-75 (15 Aug. 1983).
Describes how the Hubbard model in the atomic limit implemented by taking into account molecular vibrations can give a description of mixed valence binuclear systems with both metallic ions simultaneously magnetic. A Fe^{III} (high spin) binuclear complex would constitute an example. In such systems electron transfer and electron exchange are expected. If the compound belongs to class II (Robin and Day classification) the author finds that the activation energy of the thermal electron transfer and the intensity of the intervalence band are spin dependent but that the energies of spin states are given by the Heisenberg Hamiltonian with a new expression for the exchange parameter. For class III binuclear complexes a quite different behavior is found. The energy of the intervalence band is spin dependent but energies of spin states are no longer given by the Heisenberg Hamiltonian. (38 refs.)

102327 Theoretical calculations of lanthanide 4f⇌4f intensities: three non-degenerate wave processes. O.L.Malta (Dept. de Quimica, Cidade Univ., Recife, Brazil), A.A.S.Da Gamma, S.Canuto.
Rev. Bras. Fis. (Brazil), vol.12, no.4, p.563-83 (Dec. 1982).
By defining a single average energy denominator, ΔE_{AV}, it is shown that a formula for crystal-field induced electric-dipole $4^f \rightleftharpoons 4f$ intensities can be obtained which contains contributions of all possible excited configurations of interest and depends on radial integrals involving only 4*f* wavefunctions. Interference effects between the pseudomultipolar field (the mechanism originally proposed by Jorgensen and Judd (1964) to account for the high sensitivity of certain $4f \rightleftharpoons 4f$ transitions to changes in the chemical environment) and electric dipole mechanisms are also considered. The theory is then applied to the systems $Y_2O_3:Nd^{3+}$ and $LaF_3:Nd^{3+}$. It is concluded that a reliable value for the average energy denominator, ΔE_{AV}, is given by the first opposite parity excited configuration ($4f^{N-1}5d$) and that 'core excitations' as well as interference effects give very important contributions. (42 refs.)

Effective charges of the valence shells on atoms of A15 chemical compounds .... See Entry 101623

Phonon dispersion curves of $CeSn_3$ in the vicinity of the *R*-point .... See Entry 101884

Possibility of acoustic plasmons in mixed-valence metals and their interaction with phonons .... See Entry 102283

Configuration mixing in the groundstate of Ce .... See Entry 102294

Influence of composition on the electronic state of Ce in the intermetallic Ce-Fe-Si system .... See Entry 102359

Intramolecular charge transfer complexes. XXI. Photoconductivity in N(2-hydroxyethyl) carbazolyl methacrylate-methacryloyl-β-hydroxyethyl-3,5-dinitrobenzoate copolymers .... See Entry 102454

Theory of surface core-level shifts in metals .... See Entry 102476

Reduced paramagnetism in γ-cerium .... See Entry 102620

Electron spin resonance of VO^{2+} in K_2SO_4-$ZnSO_4$ glasses .... See Entry 102734

Electron spin resonance on the intermediate valence system $Ce(Rh_xPt_{1-x})_2$ .... See Entry 102742

Urbach rule behavior in strongly absorbing fine particle solids .... See Entry 102902

Coupling between molecular and charge transfer excitations in mixed alkali halide-cyanide crystals .... See Entry 102906

71.70C Crystal and ligand fields

102328 Effects of screening on crystal-field magnetoelastic coupling in rare-earth intermetallic compounds. A.del Moral (Dept. de Electricidad y Electronica, Univ. de Zaragoza, Zaragoza, Spain).
J. Phys. C (GB), vol.16, no.23, p.4637-53 (20 Aug. 1983).
The effect of screening by conduction electrons on the magnetoelastic coupling due to the crystal field in the Laves-phase rare-earth (RE) intermetallics is calculated and applied to $REAl_2$ compounds. The Thomas-Fermi and Hartree approximations for the screening are considered. Tetragonal, orthorhombic and rhombohedral strains are considered through the distortion of the lattice and of the screening and ligand-ion charge densities. The effect of the screening on magnetoelastic parameters is substantial. The introduction of conduction band exchange is able to modify the sign of the tetragonal parameter compared with the bare-ion point-charge model. The Friedel oscillations of the crystal potential modify the sign of the rhombohedral mode as well. A comparison with available magnetoelastic data for the compounds $NdAl_2$, $PrAl_2$ and $TbAl_2$ is presented and good agreement with calculations is obtained if conduction electron band exchange is envisaged. (32 refs.)

102329 $E\otimes\epsilon$-type Jahn-Teller effect of ReO_4^{2-} in KBr crystals: an EPR study. H.Bill, Y.R.Sekhar (Groupe de Phys., Chimie du Solide, Univ. de Geneve, Geneva, Switzerland).
J. Phys. C (GB), vol.16, no.24, p.L889-94 (30 Aug. 1983).
EPR experiments have been carried out on irradiated KBr crystals doped with ReO_4^- ions at 4.2K. They indicate the formation of ReO_4^{2-} ($5d^1$, ^2E ground state) subjected to an $E\otimes\epsilon$-type Jahn-Teller distortion. Uniaxial stress experiment show that the ReO_4^{2-} ion reorientates locally and the spin Hamiltonian parameters are unaltered by the application of the stress. A quadratic stress coupling term cannot be neglected. A model based on the approach of M.C.M. O'Brien is proposed to explain the experimental results. (13 refs.)

102330 Quasistatic long-range correlations on Jahn-Teller centers via the phonon field in K_2ZnF_4:Cu^{2+} at low temperatures. M.V.Eremin, T.A.Ivanova, Yu.V.Yablokov, R.M.Gumerov (Physicotech. Inst., Acad. of Sci., Kazan, USSR).
JETP Lett. (USA), vol.37, no.5, p.268-70 (5 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.5, p.226-8 (5 March 1983).
Correlations are discovered between distortions of Jahn-Teller Cu^{2+} centers in a K_2ZnF_4 crystal at distances exceeding the range of indirect-exchange interactions. (4 refs.)

102331 Vibronic intensities in the electronic spectra of transition metal ions. I. Crystal field calculations for the $^2E_g \rightleftharpoons {}^4A_{2g}$ transitions of Cs_2MnF_6. R.Acevedo (Dept. of Chem. Engng., Univ. of Chile, Santiago, Chile), C.D.Flint.
Mol. Phys. (GB), vol.49, no.5, p.1065-76 (10 Aug. 1983).
The relative vibronic intensities of the vibronic origins due to the three odd parity vibrational modes have been calculated for the $^2E_g \rightleftharpoons {}^4A_{2g}$ transition of the octahedral MnF_6^{2-} ion, using a crystal field model. Two methods for treating the sum over the intermediate odd parity states are considered, the closure approximation and the single $^4T_d{}^2{}_u2p$ state method. It is shown that in the latter limit the relative vibronic intensities depend only on the vibrational force field whereas using closure there is also some dependence on the radial functions employed. Calculations using six different force fields and several radial functions are presented several of which reproduce the experimental relative intensity for both methods, although there is a strong dependence of the calculated intensity on the force field. (37 refs.)

102332 Hyperfine fields of ^{11}B in ferromagnetic $R_ERh_4B_4$ (R_E=Gd,Tb,Dy,Ho). T.Kohara, Y.Kohori, K.Kumagai, K.Asayama (Coll. of Liberal Arts, Kobe Univ., Kobe, Japan).
Phys. Lett. A (Netherlands), vol.96A, no.8, p.425-7 (25 July 1983).
Hyperfine fields of ^{11}B in ferromagnetically ordered Gd-, Tb-, Dy- and $HoRb_4B_4$ have been measured by an NMR in zero-field experiment. The hyperfine fields are explained as a sum of the dipolar field from the surrounding R_E ion, the conduction electron polarization via s-f exchange interaction and the Lorentz field. A preliminary experiment in (Ho-Er)Rh_4B_4 has also been made. (9 refs.)

Effects of a partial relaxation of the crystal lattice on the calculation of the electronic structure of CrF_6^{3-} in 'isolated-cluster' and 'shared-cluster' crystals .... See Entry 101619

Determination of vibronic parameters for GR1 centre in diamond by an optimisation technique .... See Entry 101873

The adsorption of cyclic hydrocarbons on Ru(001). I. Cyclopropane .... See Entry 102175

Jahn-Teller effect in itinerant electron systems: the Jahn-Teller polaron .... See Entry 102270

ESR study of effects of pressure treatment, temperature and annealing on the structure of the impurity Cr^{3+} centers in chalcogenide glasses .... See Entry 102320

Impurity-ligand effects on the magneto-optically measured spin-orbit splitting of trapped electron centres .... See Entry 102334

Influence of composition on the electronic state of Ce in the intermetallic Ce-Fe-Si system .... See Entry 102359

Influence of V on the Fe site spin and charge densities in BCC-iron .... See Entry 102653

Metamagnetism of a noncollinear antiferromagnet: the Jahn-Teller garnet $Ca_3Mn_2Ge_3O_{12}$ .... See Entry 102656

ESR of Mn^{2+} ions in ZnP_2 and structural correlations .... See Entry 102730

Tetragonal distortions in the Jahn-Teller active copper pyridine-N-oxide complexes. Comparison of experimental and theoretical EPR parameters .... See Entry 102736

Hyperfine interactions from EPR of iron in silicon .... See Entry 102738

Cryochemical studies. VII. Electron spin resonance spectrum of Ag_5 .... See Entry 102739

^{57}Fe NMR spectra in domain walls of hexagonal ferrites with magnetoplumbite structure .... See Entry 102758

Pressure effects on the quadrupole coupling constant of ^7Li in first stage lithium graphite .... See Entry 102764

Lattice instability and γ-recoil effects in HfV_2 lattice .... See Entry 102785

Mossbauer and DTA studies of the crystallisation of borosilicate glasses .... See Entry 102789

Magnetic properties and hyperfine interactions in concentrated Fe-Ag alloys .... See Entry 102790

Next-nearest neighbour effects in the Mossbauer spectra of Cr-spinels: An application of partial quadrupole splittings .... See Entry 102792

Zeeman spectroscopy of luminescence from vanadium-doped indium phosphide .... See Entry 102927

The luminescence at 0.839 eV in GaAs:Cr. A split ^5E-$^5T_2$ transition .... See Entry 102928

Effect of hyperfine interaction on the luminescence of Pb^{2+} and Bi^{3+} centers in alkaline-earth chalcogenides .... See Entry 102939

Reactivity in the spinel formation reaction in CuO/Al_2O_3, Fe_2O_3, Cr_2O_3 systems. [Influence of Jahn-Teller effect] .... See Entry 103491

71.70E Spin-orbit coupling, Zeeman, Stark and strain splitting

102333 Magnetic properties of metallic clusters. W.D.Knight (Dept. of Phys., Univ. of California, Berkeley, CA, USA).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.521-8 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The molecular beam deflection profile for sodium trimers Na_3 shows the familiar one Bohr magneton peaks astride a central peak of comparable intensity on the beam axis. The magnetism is attributed to the odd electron spin. Spin rotation and hyperfine interactions produce avoided crossings in the Zeeman diagram. Diabatic transitions occur at the avoided crossings if the beam traverses a region of rapidly changing transverse magnetic field. Results are given for Li_3, Na_3, and K_3, plus a number of mixed alkali trimers and larger sodium polymers. (16 refs.)

102334 Impurity-ligand effects on the magneto-optically measured spin-orbit splitting of trapped electron centres. D.Y.Smith (Solid State Sci. Div., Argonne Nat. Lab., Argonne, IL, USA), H.J.Paus, M.Rapp, W.Wenzel.
Radiat. Eff. (GB), vol.72, no.1-4, p.89-96 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
The spin-orbit interaction of F_A-type centres (F_A, Z_2^+) has been studied experimentally and theoretically. It is found to have a greater anisotropy than anticipated from early experiments on F_A(Na) centres. Nearest-neighbour impurities with sufficiently large spin-orbit interaction may dominate the effect to yield both negative and positive spin-orbit energies depending on the relative orientation of the centres and the measuring light beam. (14 refs.)

Crystal structure and electronic states of dithieno[3,2-*b*:2′,3′-*d*]thiophene .... See Entry 101683

High resolution laser spectroscopy of colour centres .... See Entry 101695

The spin-lattice relaxation and spin-orbit interaction of F center in the relaxed excited state .... See Entry 101700

Dispersion laws for the valence bands of crystals with the sphalerite structure .... See Entry 102237

Time of flight experiments with conduction electrons—an application of weak localization .... See Entry 102357

Tunnelling-conductivity anomalies at low bias voltages in a magnetic field .... See Entry 102582

Paramagnetic states in doped amorphous silicon and germanium .... See Entry 102745

Magneto-optical response of f- and d-states in uraniummonosulfide .... See Entry 102856

Zeeman spectroscopy of luminescence from vanadium-doped indium phosphide .... See Entry 102927

The luminescence at 0.839 eV in GaAs:Cr. A split ^5E-$^5T_2$ transition .... See Entry 102928

The optical properties of $AgInTe_2$ thin films .... See Entry 102980

71.70G Exchange interactions

Electron transfer between magnetic ions in mixed valence binuclear systems .... See Entry 102326

Quasistatic long-range correlations on Jahn-Teller centers via the phonon field in K_2ZnF_4:Cu^{2+} at low temperatures .... See Entry 102330

Hyperfine fields of ^{11}B in ferromagnetic $R_ERh_4B_4$ (R_E=Gd,Tb,Dy,Ho) .... See Entry 102332

EPR study of electronic and magnetic properties of bis(*DL*-α-amino-*n*-butyrato) copper (II). A layered magnetic system .... See Entry 102737

A study of recombination centres in $YAlO_3$, $EuAlO_3$, $LaAlO_3$ and Y_2O_3 using ODMR .... See Entry 102947

71.70J Nuclear states and interactions

102335 Electric field gradient of Ag in Zn. E.van Walle, D.Vandeplassche, C.Nuytten, J.Wouters, L.Vanneste (Dept. of Naturrkunde, Katholieke Univ. Leuven, Leuven, Belgium).
Phys. Rev. B (USA), vol.28, no.2, p.1109-12 (15 July 1983).
The electric quadrupole interaction of $^{110}Ag^m$ implanted in a zinc single crystal has been studied by means of low-temperature nuclear orientation. An electric-field-gradient value of $+1.71(11)\times10^{17}$ V/cm^2 is deduced. This measurement provides a first inclusion of a one-valent probe into the systematics. (21 refs.)

Magnetic properties of metallic clusters .... See Entry 102333

Influence of V on the Fe site spin and charge densities in BCC-iron .... See Entry 102653

Numerical simulation of a phase transition in the nuclear spin system of gallium arsenide with adiabatic demagnetization .... See Entry 102662

Tetragonal distortions in the Jahn-Teller active copper pyridine-N-oxide complexes. Comparison of experimental and theoretical EPR parameters .... See Entry 102736

Hyperfine interactions from EPR of iron in silicon .... See Entry 102738

Free precession of ^{165}Ho nuclei in a single crystal of holmium iron garnet .... See Entry 102759

Pressure effects on the quadrupole coupling constant of ^7Li in first stage lithium graphite .... See Entry 102764

Mossbauer and DTA studies of the crystallisation of borosilicate glasses .... See Entry 102789

Magnetic properties and hyperfine interactions in concentrated Fe-Ag alloys .... See Entry 102790

Next-nearest neighbour effects in the Mossbauer spectra of Cr-spinels: An application of partial quadrupole splittings .... See Entry 102792

Spectroscopic standard for tetrahedrally coordinated ferric iron: γ $LiAlO_2$:Fe^{3+} .... See Entry 102999

72.00 ELECTRONIC TRANSPORT IN CONDENSED MATTER

(for surfaces, interfaces, and thin films, see 73.)

72.10 THEORY OF ELECTRONIC TRANSPORT; SCATTERING MECHANISMS

102336 Incoherent excitation transport in energetically disordered media. R.Parson (Dept. of Chem., MIT, Cambridge, MA, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.3, p.213-16 (5 Aug. 1983).
The Gochanour, Andersen and Fayer treatment (1979) of excitation transport in spatially disordered systems is extended so as to incorporate energetic disorder. (9 refs.)

102337 The quantum Hall effect. II. S.M.Girvin (Surface Sci. Div., NBS, Washington, DC, USA), M.E.Cage.
Comments Solid State Phys. (GB), vol.11, no.2, p.47-58 (1983).
For pt.I see ibid., vol.11, p.1 (1983). The recent surprising observation of a quantization of the Hall resistance in units of h/e^2 in quasi-two-dimensional conductors has necessitated a major rethinking of the theoretical picture of transport in these systems. The central problem is understanding why ideal behavior persists even in the presence of strong disorder. (34 refs.)

102338 Localization and interaction in one dimension. W.Apel, T.M.Rice (Theoretische Phys., ETH, Zurich, Switzerland).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.35 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Summary form only given. A new approach is given to the problem of an interacting impure one-dimensional electronic system. First the inelastic meas free path $l_{in}(T)$, which results from collisions with other electrons is calculated. The elastic mean free path $l_{el}(T)$ due to impurity scattering is obtained from the resistivity of an infinitesimal short sample. Following Thouless (1980), the authors argue that the impurity scattering is classical when $l_{in}(T) \ll l_{el}(T)$. From the temperature dependence of the mean free paths they conclude that for $2g_2\text{-}g_1 <= {}^3/_5 2\pi v_f$ and $g_1 > 0$ (excluding the Peierls transition) this condition is satisfied at sufficiently low temperature and as a result the resistance is proportional to the length of the sample. The value of the resistivity vanishes in the limit $T \to 0$ due to the complete screening of the impurity potential. In the other regime, $l_{in}(T) \gg l_{el}(T)$ and the impurity scattering must be treated quantum mechanically. The resistance diverges exponentially with a positive power (depending on the interaction) of the length. (3 refs.)

102339 Cluster coherent medium theory for transport on random lattices. G.Korzeniewski, D.F.Calef (Dept. of Chem., MIT, Cambridge, MA, USA).
J. Phys. C (GB), vol.16, no.23, p.4599-609 (20 Aug. 1983).
Coherent medium theory for a master equation description of transport on random lattices is extended to includes scattering in clusters larger than two sites (or one bond) exactly. Bond and site-averaged numerical calculations for the square lattice show some features of transport are improved by this method but that larger clusters are needed in order to obtain exact long-time properties. (14 refs.)

102340 Energy transfer processes in non-ohmic hopping conductivity in a strong electric field. A.A.Berezin (Dept. of Engng. Phys., McMaster Univ., Hamilton, Ontario, Canada).
Phys. Lett. A (Netherlands), vol.97A, no.3, p.105-7 (15 Aug. 1983).
Energy transfer processes between jumping current carriers in non-ohmic activationless $F^{-1/4}$-hopping conductivity in a strong electric field are considered. An energy gained during the downward spontaneous hopping of one electron can be radiationlessly transferred to another electron enabling it to make an upward energy hopping transition. It is shown that the contribution from these two-electron four-site energy transfer processes into the total hopping conductivity may be comparable or even exceed the contribution from one-electron radiative tunnel transitions. Numerical estimates are based on an example of beta-rhombohedral crystalline boron which exhibits $F^{-1/4}$-field law. (16 refs.)

102341 Evaluation of the effective-medium theory in a static conduction field. M.Nakamura (Dept. of Electronics, Tamagawa Univ., Tokyo, Japan).
Phys. Rev. B (USA), vol.28, no.4, p.2216-18 (15 Aug. 1983).
The effective-medium theory has been formulated by many authors under various methods. In this paper the author derives the theory for very conductive random media under a constant average current design, using a vector potential with respect to the current density. The author then shows that the theory is equivalently formulated by three requirements. The first two requirements, which have been used previously, are the requirements that the spatial averages of electric field and current density due to each sphere component embedded in the effective medium are equal to the effective or average field and current density. The third requirement is that the signal average of electric power equals the effective or average power. As a result it is recognized that the effective-medium theory has wide applicability and that it satisfies many requirements. (15 refs.)

Size effects in thin films .... See Entry 98674

Inverse scattering by a local impurity in a periodic potential in one dimension .... See Entry 98823

Band-structure effects and resistivity saturation .... See Entry 102234

Disorder and interaction .... See Entry 102317

Basic issues in electronic conduction in amorphous semiconductors. II. Electronic transport properties .... See Entry 102369

72.15 ELECTRONIC CONDUCTION IN METALS AND ALLOYS

102342 Thermoelectric power of graphite intercalation compounds. K.Sugihara (Center for Materials Sci. & Engng., MIT, Cambridge, MA, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2157-65 (15 Aug. 1983).
A model for the temperature variations of the thermoelectric power (TEP) of acceptor graphite intercalation compounds (GICs) is presented. At low temperatures, the TEP in GICs increases monotonically with T, then levels off above ~200K in striking contrast to that of pristine graphite. The diffusion contribution to the TEP is proportional to T and its magnitude is small as compared with that of the observed data. This observed behavior is attributed to the phonon drag effect. In the temperature region where the TEP is weakly temperature dependent, phonon relaxation is mainly controlled by the Rayleigh scattering due to point defect. The resultant TEP, which is composed of the phonon drag and diffusion terms, leads to a nearly T-independent value. Since the cross-sectional diameter of the Fermi surface in GICs is larger than that of pristine graphite, the relaxation rate of the Rayleigh scattering, which is given by $1/t_l(q)=fq^3$, becomes very large at high temperatures ($T>100$K). At low temperatures, where the boundary scattering plays a dominant role, the TEP is proportional to T^3. Detailed calculations are carried out by solving the phonon-carrier-coupled Boltzmann equation. (21 refs.)

Staebler-Wronski effects in hydrogenated amorphous $Si_{1-x}Ge_x$ .... See Entry 102459

72.15C Electrical and thermal conduction in amorphous and liquid metals and alloys

102343 *s-d*-band conductivity in liquid La. L.E.Ballentine, J.E.Hammerberg (Dept. of Phys., Simon Fraser Univ., Burnaby, BC, Canada).
Phys. Rev. B (USA), vol.28, no.2, p.1103-4 (15 July 1983).
The electrical conductivity of liquid La is computed numerically from a linear combination of atomic orbitals description of a cluster of 364 atoms. Contrary to an earlier suggestion that the conduction should be mainly due to *s* states, the authors find that the *d* states are dominant. Although the diffusivity of *s* states is about 2.5 times greater than that of *d* states, the density of *d* states is so much greater than the density of *s* states that the conduction is mainly by *d* states. (9 refs.)

102344 Thermal diffusivity and thermal conductivity of solid and liquid titanium. P.V.Gel'd, S.A.Il'inykh, S.G.Taluts, V.E.Zinov'ev (S.M. Kirov Ural Polytech. Inst., Sverdlovsk, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.948-9 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.602-4 (Nov. 1982).
The thermal diffusivity was measured by the authors' variant of the method of plane temperature waves. A constant electron flux bombarding the plane of a thin metallic plate is modulated by an audiofrequency voltage, and the parameter measured is the delay in the phase of the temperature wave on the opposite face of the specimen, as recorded by a photodetector and a high-sensitivity phase meter. In the equipment used, the electron-beam power could be increased rapidly, permitting measurements to be carried out with high heating rates (up to $v=1000$K/sec). This allowed studies at temperatures unattainable by stationary methods, since with such a heating rate even in the liquid state the planar specimens underwent no marked change in shape. (8 refs.)

Low temperature properties of metallic glasses .... See Entry 101563

Study of structural relaxation of $ni_{78}Si_8B_{14}$ metallic glass by electrical resistivity and thermal expansion .... See Entry 101570

Structure and properties of evaporated amorphous films consisting of transition metal-metalloid alloys .... See Entry 102193

Tensor of effective electrical conductivity for medium with two-layer particles of dispersed phase .... See Entry 102475

72.15E Electrical and thermal conduction in crystalline metals and alloys

102345 Thermal conductivity of niobium and molybdenum single crystals at low temperatures. A.Gladun, C.Gladun, H.Vinzelberg (Central Inst. of Solid State Phys. & Materials Res., Acad. of Sci., Dresden, Germany).
Acta Phys. Acad. Sci. Hung. (Hungary), vol.53, no.3-4, p.383-94 (1982). [received: Aug. 1983] (CRYOSEM '81. Second International Seminar on Low Temperature Physics, Visegrad, Hungary, 8-10 Oct. 1981).
The thermal conductivity of Nb and Mo single crystals was measured in the temperature range of 0.05-20K and 2-71K, respectively. (35 refs.)

102346 Thermal conductivity of amorphous iron alloys at low temperatures. G.Pompe, M.Gaafar, M.Falz, P.Buttner (Dept. of Low Temperature Phys., Tech. Univ. Dresden, Dresden, Germany).
Acta Phys. Acad. Sci. Hung. (Hungary), vol.53, no.3-4, p.401-9 (1982). [received: Aug. 1983] (CRYOSEM '81. Second International Seminar on Low Temperature Physics, Visegrad, Hungary, 8-10 Oct. 1981).
The thermal conductivity of ferromagnetic amorphous iron alloys ($Fe_{40}Ni_{40}P_{14}B_6$, $Fe_{80}B_{20}$, $Fe_5Co_{75}B_{20}$) was measured in the temperature range 2-100K. It was shown that there is a significant dependence of the phonon thermal conductivity on structure relaxation. (22 refs.)

102347 Anomalies of the electrical resistivity of Ni_3Fe alloys containing Nb, Ta and V. R.P.Vasil'eva, T.M.Panakhov, F.S.Guseinov (M.V. Lomonosov State Univ., Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1209-11 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
Nickel-iron Permalloys were alloyed with niobium, tantalum, and vanadium in amounts up to 12.5 at.%. The temperature dependences of the resistivity were determined for a variety of samples. The anomalies were interpreted in terms of the energy band structure and the changes in the resistivity with the composition were studied. (4 refs.) *A.T.*

102348 The low-temperature electrical resistivity of alloys with ferro-and antiferromagnetic interaction. N.I.Kourov, Yu.N.Tsiovkin, N.V.Volkenshtein.
Fiz. Nizk. Temp. (USSR), vol.9, no.7, p.731-6 (July 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The electrical resistivity of $(Pd_xPt_{1-x})_3$ Fe and $Pt_3Mn_xFe_{1-x}$ alloys in the range of the concentration phase transition from antiferromagnetic state ($x=0$) to ferromagnetic one ($x=1$) is investigated. It is shown that along with the phonon contribution, the temperature dependent part of ρ has the contributions which are proportional to T^2 and $T^{1/2}$. The last contribution is associated with the interference of electron-electron interaction and elastic electron scattering due to the static inhomogeneities. The influence of the ferro-antiferromagnetic transition on the concentration dependence of the residual resistivity is discussed. (17 refs.)

102349 Temperature dependence of excess carrier density and thermopower in tin-doped bismuth. Pseudo-parabolic model. J.Heremans (Lab. PCES, Univ. Catholique de Louvain, Louvain-la-Neuve, Belgium), O.P.Hansen.
J. Phys. C (GB), vol.16, no.23, p.4623-36 (20 Aug. 1983).
Measurements of the Hall effect and magnetoresistance of four tin-doped bismuth samples in the temperature range 4.2-300K and in magnetic fields up to 6 T have been made. The resistivity data are converted to conductivities. These are reported and used to evaluate the temperature dependence of the excess carrier density and of the thermopower. The evaluation is performed with the Fermi energy as the only adjustable parameter within the pseudo-parabolic model which the authors have previously introduced. The excess carrier density is found to decrease with temperature, and this feature is used to analyse the data in terms of an acceptor energy level. A relation valid for all samples is found between this level and the Fermi level. For the thermopower agreement is found between the calculated values and the experimental ones reported in the literature. (25 refs.)

102350 The electrical resistivities of Li and Rb below 1K. Z.-Z.Yu, M.Haerle, J.W.Zwart, J.Bass, W.P.Pratt,Jr., P.A.Schroeder (Dept. of Phys., Michigan State Univ., East Lansing, MI, USA).
Phys. Lett. A (Netherlands), vol.97A, no.1-2, p.61-4 (8 Aug. 1983).
Measurements of the temperature dependence of the electrical resistivity of Li and Rb below 1K reveal strong deviations from the simple T^2 variation expected for electron-electron scattering. The source of these deviations is not yet known, but they may be associated with low energy excitations of defects such as dislocations. (22 refs.)

102351 Deviations of Matthiessen's rule in some PdAu alloys. J.Ray, G.Chandra (Tata Inst. of Fundamental Res., Bombay, India).
Phys. Lett. A (Netherlands), vol.97A, no.3, p.108-10 (15 Aug. 1983).
The low temperature electrical resistivity of $Pd_{1-c}Au_c$ alloys (c=0.1, 0.22, 0.38, 0.69, 0.82 and 1.1 at.%) have been studied in detail between 1.5 and 300K. Deviations from Matthiessen's rule (DMR) have been analysed on the basis of a two-band model, and the agreement is found to be reasonably good. The parameter γ was found to decrease monotonically with temperature, and no anomalous maximum was observed as with earlier studies of PdTi. The variation of β shows a weak temperature dependence. The limitations of the model are also discussed. (9 refs.)

102352 Electrical properties of the metastable $Mn_{1.11}Al_{0.89}$ alloy. B.Babic, M.Stojic, J.Konstantinovic ('Boris Kidric' Inst. of Nuclear Sci., Vinca, Belgrade, Yugoslavia).
Phys. Status Solidi a (Germany), vol.78, no.1, p.K77-80 (16 July 1983).
Electrical resistivity and Hall effect measurements have been performed on the $Mn_{1.11}Al_{0.89}$ alloy in order to get some information about the electronic properties, particularly free carrier concentration, which should be correlated with the magnetic and structural properties of the alloy. (5 refs.)

102353 Experimental investigation of the amplitudes of quantum oscillations in the transport coefficients of Al. R.Fleetcher (Dept. of Phys., Queen's Univ., Kingston, Ontario, Canada).
Phys. Rev. B (USA), vol.28, no.4, p.1721-6 (15 Aug. 1983).
The transverse resistivity (both thermal and electrical) and the thermopower of Al have been made at fields of up to 8 T in the liquid-helium temperature range. The results show that the oscillations are related by known factors to a precision of a few percent. The agreement between theory and experiment suggests that phonon drag plays no observable role in the thermoelectric oscillations. There is an unresolved problem of precisely how the many-body effects are incorporated in the theory, though this does not affect the conclusions of this investigation in any way. (14 refs.)

102354 Influence of impurities on the electrical resistivity of zirconium and its alloys (with Ag, Pt, Ti). B.N.Aleksandrov.
Russ. Metall. (GB), no.4, p.50-6 (1981). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.4, p.59-66 (1981). [received: June 1983]
Examines the value $\Delta\rho/C$ for carbon contents $C' \rightarrow O$, i.e. in strongly diluted alloys. The experimental values $\Delta\rho/C$ were determined for 21 impurity elements based primarily on published measurements of the electric resistivity at room temperature. The nature of the change in $\Delta\rho/C$ from the distribution of the interface impurity-transition metal was established for three numbers of the periodic table, and it is shown that the influence of the impurity on the ρ of zirconium increases with the increase in the number in the periodic table: $3 \rightarrow 4 \rightarrow 5$ with a maximum $\Delta\rho/C$ value obtained for Re, Mn and, evidently, Tc. The assumption is advanced that the curve of the dependence of $\Delta\rho/C$ on the order number in the periodic table of the impurity element reflects the valency change of these elements (transition metals). (23 refs.)

Size effects in thin films .... See Entry 98674

Influence of the shape and transmission regime of current pulses on the plastic strain of zinc crystals .... See Entry 101849

Low-temperature lattice thermal conductivity of heavily deformed metallic alloys .... See Entry 102084

Thermal diffusivity and thermal conductivity of solid and liquid titanium .... See Entry 102344

Magnetic field and strain dependences of the tin whiskers resistance .... See Entry 102356

Kinetic and electronic properties of $Ni_3(Fe_{1-x}Ta_x)$ and $Ni_3(Fe_{1-x}V_x)$ alloys .... See Entry 102358

Electrical resistivity and reduced temperature coefficient of polycrystalline metallic thin films .... See Entry 102526

Microstructure and superconducting properties of helium-saturated niobium-titanium alloy .... See Entry 102548

Temperature dependences of the magnetic susceptibility, magnetization, and electrical resistivity of solid solutions of the $GdZn_xMg_{1-x}$ system .... See Entry 102630

Nonlinearities of laser heating of metals .... See Entry 103006

Influence of the annealing temperature on changes in the properties of hydrogen-phase-hardened palladium exhibiting hydride brittleness .... See Entry 103172

Effects of SME cycle on the mechanical properties of the TiNi alloys .... See Entry 103219

Effect of small additions of titanium and boron on the electrical and mechanical properties of an electroconductor aluminum alloy .... See Entry 103220

72.15G Galvanomagnetic and other magnetotransport effects

102355 Measurement of the magnetoresistance of indium and $Fe_{40}Ni_{40}B_{20}$, $Fe_{30}Ni_{40}Cr_{10}B_{20}$ alloys by pulse technique in high magnetic fields. P.Czarnecki, M.Surma (Inst. of Phys., A. Mickiewicz Univ., Poznan, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.1, p.31-8 (July 1983).
The method of magnetoresistance measurements of metals and metallic alloys in pulsed magnetic fields of high intensity is presented. The accuracy of the sample magnetoresistance $\Delta\rho/\rho_0$ result is of ±12% and ±5% for $\Delta\rho/\rho_0$ values of 10^{-3} and 10^{-1}, respectively. The magnetoresistance of indium and $Fe_{40}Ni_{40}B_{20}$, $Fe_{30}Ni_{40}Cr_{10}B_{20}$ amorphous alloys is analysed. (14 refs.)

102356 Magnetic field and strain dependences of the tin whiskers resistance. Yu.P.Gaidukov, N.P.Danilova, E.V.Nikiforenko.
Fiz. Nizk. Temp. (USSR), vol.9, no.7, p.722-30 (July 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The influence of dimensions, magnetic field and simple extension on the resistance of white tin whiskers is studied. Elastic strain measurements were conducted at maximum relative elongations 2-4% in magnetic fields up to $H=55$ kOe at $T=4.2$K. Samples were oriented along [001] and (100) axes, the thickness of the samples varied between 0.8 and 4.3 μm. Size effects in the resistance and magnetoresistance of whiskers were observed. The main effect is the absence of high anisotropy of the magnetoresistance (which is typical for bulk samples) up to $Hd \approx 2$Oe. cm. The elastic twinning of the (001) samples was observed when extending to 4%. Experimental data on elastic strain up to 2% of the $\langle 100 \rangle$ samples do not testify to the existence of the $2^1/_2$ order transition. (24 refs.)

102357 Time of flight experiments with conduction electrons—an application of weak localization. G.Bergmann (IFF, KFA Julich, Julich, Germany).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.17-25 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Magneto-resistance measurements on a thin disordered (two-dimensional) film correspond to a time of flight experiment with conduction electrons. It allows the determination of the inelastic lifetime, the spin-orbit coupling time and the magnetic scattering time of the conduction electrons. (22 refs.)

102358 Kinetic and electronic properties of $Ni_3(Fe_{1-x}Ta_x)$ and $Ni_3(Fe_{1-x}V_x)$ alloys. T.M.Panakhov, F.S.Guseinov, R.P.Vasil'eva.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.4, p.89-92 (1982). In Russian.
Concentration dependencies of abnormal Hall effect and electrical resistivity were studied in two systems of ternary alloys $Ni_3(FeV)$ and $Ni_3(FeTa)$. Abnormal Hall constant R_s-was established to have a linear dependence on p during alteration in Ta, V alloys. Packing $(s+d)$ degree of alloy bands was determined in terms of spin direction in charge carriers. Formation of superstructural transformations in $Ni_3(FeV)$ was shown to be associated with packing $(s+d)$ character of carrier bands. (12 refs.)

Temperature dependence of excess carrier density and thermopower in tin-doped bismuth. Pseudo-parabolic model .... See Entry 102349

Electrical properties of the metastable $Mn_{1.11}Al_{0.89}$ alloy .... See Entry 102352

Pressure-temperature phase diagrams of several $(TMTTF)_2X$ compounds: stabilisation of a highly conducting metallic state under pressure in $(TMTTF)_2Br$ .... See Entry 102362

The influence of electron-libron scattering on the transport properties of quasi-one-dimensional metals .... See Entry 102363

Thermodynamic derivation of the Hall current and the thermopower in quantising magnetic field .... See Entry 102433

On the memory-function formulation of the dynamic conductivity for two-dimensional electrons in a magnetic field .... See Entry 102434

Electron localization and interaction in bismuth thin films .... See Entry 102524

Studies on Co-Sn-Te thin films .... See Entry 102525

Electrical resistivity and reduced temperature coefficient of polycrystalline metallic thin films .... See Entry 102526

Electron localization and superconductivity in 2D in metals .... See Entry 102574

Temperature and magnetic field dependence of magnetization and magnetoresistance in amorphous Fe-Ni based alloys .... See Entry 102696

72.15J Thermoelectric effects

102359 Influence of composition on the electronic state of Ce in the intermetallic Ce-Fe-Si system. E.M.Levin, O.I.Bodak, Yu.V.Zhipa, M.M.Vashchishchuk.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.6, p.78-81 (1983). In Ukrainian.
Intermetallic CeFeSi and $CeFe_2Si_2$ are studied for differential thermo-emf structure and microstructure; initial components of $CeFe_2Si_2$ in synthesis were taken with the deviation from stoichiometric composition within 20-22 at.% Ce, 35-45 at.% Fe and 45-35 at.% Si. Electronic state of cerium, analyzed by the model of conduction electron resonance scattering in the case of $4f$-level splitting into sublevels under the effect of the crystalline field, depends on the fixed intermetallic composition and is not practically sensitive to deviations in the component content from the stoichiometric composition within the mentioned limits. (9 refs.)

Size effects in thin films .... See Entry 98674

Temperature dependence of excess carrier density and thermopower in tin-doped bismuth. Pseudo-parabolic model .... See Entry 102349

Experimental investigation of the amplitudes of quantum oscillations in the transport coefficients of Al .... See Entry 102353

The influence of electron-libron scattering on the transport properties of quasi-one-dimensional metals .... See Entry 102363

Thermodynamic derivation of the Hall current and the thermopower in quantising magnetic field .... See Entry 102433

Thermoelectric power of aluminum films .... See Entry 102522

Studies on Co-Sn-Te thin films .... See Entry 102525

Electrical resistivity and reduced temperature coefficient of polycrystalline metallic thin films .... See Entry 102526

72.15L Relaxation times and mean free paths

Time of flight experiments with conduction electrons—an application of weak localization .... See Entry 102357

Fluctuations of the relaxation time in one-dimensional systems .... See Entry 102366

Electron localization and interaction in bismuth thin films .... See Entry 102524

72.15N Collective modes, e.g. in one-dimensional conductors

102360 Conducting polymers: solitons or not?. D.Baeriswyl (Seminar fur Theoretische Phys., ETH, Zurich, Switzerland).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.639-53 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
A review is given on the soliton model and its possible relevance for the interpretation of experiments in conducting polymers. It is argued that solitonic states, although being very attractive due to their simplicity and apparent ability to explain several experiments, are strongly distorted by various perturbations. Furthermore predictions based on the soliton model are often not specific enough to predict them using more conventional reasoning. (73 refs.)

102361 Effect of dopant on the physicochemical and electrical properties of organic conducting polymers. G.Tourillon, F.Garnier (Lab. de Photochimie Solaire, CNRS, Thiais, France).
J. Phys. Chem. (USA), vol.87, no.13, p.2289-92 (23 June 1983).
Electrochemically synthesized polythiophene and poly-substituted thiophene have been characterized by visible, IR, and XPS spectroscopy, and compared to polypyrrole. A high intrachain conductivity, increasing with the doping level, is demonstrated for the thiophene derivatives, which show a marked

metallic behavior. On the other hand, the relatively low macroscopic conductivity, measured on pressed pellets, is related to poor interchain contacts and to morphological inhomogeneities. (21 refs.)

102362 Pressure-temperature phase diagrams of several $(TMTTF)_2X$ compounds: stabilisation of a highly conducting metallic state under pressure in $(TMTTF)_2Br$. S.S.P.Parkin, F.Creuzet, D.Jerome (Lab. de Phys. des Solides, Univ.-Paris-Sud, Orsay, France), J.M.Fabre, K.Bechgaard.
J. Phys. (France), vol.44, no.8, p.975-84 (Aug. 1983).
Needle axis resistivity measurements on several TMTTF (tetramethyltetrathiafulvalene) salts of the form $(TMTTF)_2X$, with $X=Br$, ClO_4, PF_6, are presented for pressures up to 32 kbar. The pressure-temperature phase diagrams of all three materials are similar with the stabilization under pressure of a metallic state to low temperatures (~20K), below which there is a well defined metal-insulator transition. For $(TMTTF)_2Br$ and M-I transition is completely suppressed for pressures above some critical pressure $P_c \sim 25$ kbar and the compound is metallic to the lowest temperatures considered in this study, ~1K. Significant differences are found between samples grown from different chemical solvents: in one case the samples have resistance ratios exceeding 400 at 25 kbar with a conductivity greater than 10^6 $(\Omega cm)^{-1}$ at 4K, the highest values yet reported for any organic conductor. In the other case the samples show a possible superconducting transition near 3.5K at 25 kbar, but have smaller resistance ratios ($\lesssim 100$). For the latter samples at 25 kbar there is no saturation of the resistance in the low temperature regime, whereas for the former the resistance saturates below 10K. These results suggest slightly different critical pressures for these salts. P_c are much higher for the ClO_4 and PF_6 salts ($>$ 35 kbar). Magnetoresistance measurements have been made on samples of $(TMTTF)_2Br$ as a function of pressure, for field applied along the c^* axis. The magnetoresistance progressively increases with increasing pressure obtaining substantial values $((\rho(80\ kG)-\rho(H=0))/\rho(H=0) \sim 2\text{-}4)$ near P_c. These results establish that under pressure the physical properties of the $(TMTTF)_2X$ salts become increasingly to resemble those of their selenium counterparts, $(TMTSeF)_2X$. (20 refs.)

102363 The influence of electron-libron scattering on the transport properties of quasi-one-dimensional metals. W.Schiller, E.Chilla (Sektion Phys., Tech. Univ. Dresden, Dresden, Germany).
J. Phys. C (GB), vol.16, no.21, p.L747-53 (30 July 1983).
Starting from the formalism of force-correlation functions the electrical resistivity R, the thermoelectric power S and the Hall coefficient R_H are calculated for a system containing electron-libron scattering. In the framework of a two-band model these transport quantities can be calculated in the case of weak scattering and high temperatures. The results obtained for R, S and R_H are compared qualitatively with measurements on TTF-TCNQ. (22 refs.)

102364 Effect of defects on phase transitions in tetraselenotetracene chloride, $(TSeT)_2Cl$. P.A.Kononovich, V.N.Laukhin, S.I.Pesotskii, I.F.Shchegolev, A.G.Khomenko (Inst. of Chem. Phys., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.2, p.92-6 (20 Jan. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.2, p.77-9 (20 Jan. 1983).
High-quality single crystals of the organometallic compounds $(TSeT)_2Cl$ have been synthesized. The metal-semimetal phase transition in these samples has several new features. (10 refs.)

102365 One-dimensionality in glassy carbon. D.F.Baker, R.H.Bragg (Dept. of Materials Sci. & Mineral Engng., Univ. of California, Berkeley, CA, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2219-21 (15 Aug. 1983).
A negative $T^{-1/2}$ dependence of a component of the electrical conductivity, indicative of one-dimensional transport, was found in glassy carbon heat treated at temperatures less than 2200°C. The microstructure, as examined in lattice images in the transmission electron microscope, the Porod-law dependence obtained in small-angle scattering, and the decrease in the d_{002}-spacing interlayer as measured by X-ray diffraction (above this critical temperature) support this thesis. (38 refs.)

102366 Fluctuations of the relaxation time in one-dimensional systems. L.V.Chebotarev (Kharkov State Univ., Kharkov, USSR).
Solid State Commun. (USA), vol.47, no.7, p.549-53 (Aug. 1983).
The direct interaction of electrons with impurity field is represented as an interelectronic interaction of a special kind which is called 'dissipative'. This type of interaction is responsible for the relaxation process and generally leads to fluctuations of the relaxation time. The probability distribution function for the mean free time of electrons is found in the white-noise approximation for a one-dimensional conductor. It is shown that the dielectric response function can be obtained in this case by averaging the relevant expression over the fluctuations of the relaxation time. (8 refs.)

102367 AC-field induced steps in the I-V characteristics of charge density wave transport. E.Ben-Jacob (Inst. for Theoretical Phys., Univ. of California, Santa Barbara, CA, USA).
Solid State Commun. (USA), vol.47, no.8, p.603-6 (Aug. 1983).
The author makes further predictions on the response of the charge density wave (CDW), based on the classical model and including an inertia term. Showing the analogy of the latter with the Stewart-McCumber (RSJ) model for Josephson junctions, he predicts the appearance of Shapiro-like steps in the I-V characteristics of the CDW in the presence of an AC field. The predictions are presented in a form suitable for direct comparison with experiment. (32 refs.)

102368 Electrical conductivity of doped poly(1-methyl 2,5-pyrrolylene). P.Kovacic, I.Khoury (Dept. of Chem., Univ. of Wisconsin, Milwaukee, WI, USA), R.L.Elsenbaumer.
Synth. Met. (Switzerland), vol.6, no.1, p.31-8 (June 1983).
Poly(1-methyl 2,5-pyrrolylene) was synthesized by coupling of the Grignard reagent of 1-methyl 2,5-dibromopyrrole with $Ni(AcAc)_2$ catalyst. Conductivities of the doped polymers lie in the range, 10^{-}-10^{-6} ohm^{-1} cm^{-1}. The effect of several polymerization variables on conductivity was determined. The doped material is stable in air for at least 2 months, and the parent polymer is moldable and solution processable. Rationalizations are presented for conductivity in relation to polymer structure. (37 refs.)

Recent publications in the area of organic conductors and related phenomena .... See Entry 98681

Tetramethyldithiadiselenafulvalene (TMDTDSF): properties of its hexafluorophosphate salt and alloys with tetramethyltetraselenafulvalene .... See Entry 101681

Neutron scattering study on the structural transition of quasi-one-dimensional conductor $K_{0.3}MoO_3$ .... See Entry 101947

Electrical conductivity and film morphology of TCNQ salt dispersion in polymer matrix .... See Entry 102520

Electrical conductivity of β-$Na_{0.33}V_2O_5$ thin films .... See Entry 102541

Electrical conductivity of a quasi-one-dimensional superconductor .... See Entry 102564

Magnetic properties of new organic metals. Introduced by the example of the fluoranthene-radical cation salts .... See Entry 102760

72.15Q Scattering mechanisms and Kondo effect

(see also 75.20H Local moments in dilute alloys)

Point-contact spectroscopy .... See Entry 102494

72.20 CONDUCTIVITY PHENOMENA IN SEMICONDUCTORS AND INSULATORS

(for nonelectronic thermal conduction, see 66.70)

Correlation of changes in the electrical conduction and dielectric constant in naphthalene due to magneto-electret formation .... See Entry 102796

72.20D General theory, scattering mechanisms

102369 Basic issues in electronic conduction in amorphous semiconductors. II. Electronic transport properties. D.Emin (Sandia Nat. Labs., Albuquerque, NM, USA).
Comments Solid State Phys. (GB), vol.11, no.2, p.59-72 (1983).
For pt.I see ibid., vol.11, p.35 (1983). In crystals, charge carriers generally either self-trap to form small polarons or remain quasifree. In amorphous semiconductors this dichotomy is somewhat modified. None the less, the densities-of-state of these two situations differ qualitatively from one another. In the quasifree (Mott-CFO) model excess charges either move in extended states as quasifree (high-mobility) carriers or reside in localized states within the bandtails. Charges in the bandtails may move directly between localized states via phonon-assisted hopping. In the small-polaron picture the self-trapped carriers move between severely localized states via multiphonon-assisted hopping. The author addresses steady-state transport properties of these two models. In particular, the general principles of phonon-assisted transitions are described and applied to bandtail and small-polaron hopping motion. Then the Peltier heat, obtained in a Seebeck effect (thermoelectric power) measurement, and the Hall effect are discussed. Analysis of these basic transport measurements in the chalcogenide glasses implies that the small-polaron picture is applicable there. (33 refs.)

102370 Dispersive transport from negatively correlated defect centers. B.A.Khan, D.Adler (Dept. of Electrical Engng. & Computer Sci., MIT, Cambridge, MA, USA).
J. Non-Cryst. Solids (Netherlands), vol.57, no.1, p.81-9 (Aug. 1983).
The transient current response arising from time-of-flight experiments on a material whose trapping levels are predominantly associated with a well-defined negatively correlated defect is calculated. The resulting behavior is controlled by the relative magnitude of two characteristic times, the transit time, τ_1 and the time necessary for interconversion of a neutral acceptor to a neutral donor τ. If $\tau_t<\tau$, nondispersive transport results. In contrast, if $\tau_t>\tau$, two kinks characterize $I(t)$. The current is initially independent of time, but eventually becomes dispersive, decaying as $t^{-1/2}$ prior to τ_t and as $t^{-3/2}$ afterwards. The dispersion results from the spread of times necessary to interconvert the neutral defects. (14 refs.)

102371 The Monte Carlo method for the solution of charge transport in semiconductors with applications to covalent materials. C.Jacoboni, L.Reggiani (Istituto di Fisica, Univ. di Modena, Modena, Italy).
Rev. Mod. Phys. (USA), vol.55, no.3, p.645-705 (July 1983).
This review presents in a comprehensive and tutorial form the basic principles of the Monte Carlo method, as applied to the solution of transport problems in semiconductors. Sufficient details of a typical Monte Carlo simulation have been given to allow the interested reader to create his own Monte Carlo program, and the method has been briefly compared with alternative theoretical techniques. Applications have been limited to the case of covalent semiconductors. Particular attention has been paid to the evaluation of the limited to the case of covalent semiconductors. Particular attention has been paid to the evaluation of the integrated scattering probabilities, for which final expressions are given in a form suitable for their direct use. A collection of results obtained with Monte Carlo simulations is presented, with the aim of showing the power of the method in obtaining physical insights into the processes under investigation. Special technical aspects of the method and updated microscopic models have been treated in some appendixes. (177 refs.)

102372 Low-temperature conductivity of a two-dimensional disordered semiconductor under power localization conditions. V.L.Bonch-Bruevich, To Tkhi Bik Nguet (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Sov. Phys. J. (USA), vol.25, no.11, p.966-8 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.24-6 (Nov. 1982).
An estimate is given of the temperature dependence of the conductivity under conditions when the Fermi level is in the 'power' localization domain. (7 refs.)

Non-linear transport and transient properties of semiconductors under high electric field .... See Entry 102402

Inversion of hot carriers in Landau levels .... See Entry 102404

Hole transport in pure and doped GaAs .... See Entry 102414

Time of flight of carriers in simple aromatic hydrocarbon layers. I. Theory .... See Entry 102424

Time of flight of carriers in simple aromatic hydrocarbon layers. II. Comparison with experimental results .... See Entry 102425

Magnetic-impurity oscillations in gallium arsenide .... See Entry 102452

Field ionised impurity scattering in an AlGaAs/GaAs two-dimensional electron gas .... See Entry 102497

72.20F Low-field transport and mobility; piezoresistance

102373 On the exact calculation of the specific electrical conductivity of semiconducting slabs. P.Debreceni, I.Kirschner, M.F.Kotkata, G.Kovacs, T.Porjesz (Dept. for Low Temperature Phys., Roland Eotvos Univ., Budapest, Hungary).
Acta Phys. Acad. Sci. Hung. (Hungary), vol.53, no.3-4, p.361-70 (1982). [received: Aug. 1983] (CRYOSEM '81. Second International Seminar on Low Temperature Physics, Visegrad, Hungary, 8-10 Oct. 1981).
A model is proposed for the exact calculation of the specific electrical conductivity of a semiconuducting slab between two circular metallic electrodes. The assumed mixed boundary conditions and the derived dual integral equations lead to a Fredholm integral equation of the second type for infinite slabs. The latter is solved numerically and the results are discussed in terms of a correction function plotted against the ratio of the slab thickness to the electrode radius in the range of 0.01-10. A resistor network has been used to verify the calculations. A good agreement has been found with previously published results in some range of thickness-radius function. (13 refs.)

102374 Electronic conduction in lead oxides and at metal/oxide interfaces. A.Lemaigre, P.Mirebeau, M.Chemla (Univ. Pierre et Marie Curie, Paris, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.15, p.1151-6 (25 April 1983). In French.
The electrical resistivity of polycrystalline α and β PbO_2 is near 10^{-3} and 10^{-4} Ω.cm respectively. Also, the contact resistance of these oxides with gold is only 10^{-2} Ω.cm^2. However, the junction Pb/PbO_2 has the appearance of a barrier whose resistivity is more than 1 Ω.cm^2, which is attributed to the formation of a lower oxide at the interface. In the presence of acid, the conductance of this junction is increased by a factor of 20, which may be due to the doping of the oxide by protons. (12 refs.)

102375 Determination of the equilibrium $US_{2\alpha} \rightleftarrows US_{2\beta}$ and variations of the electrical properties of these two sulfides as function of sulfur pressure between 600 and 1000°C. D.Carton, A.Dybantsa (Lab. des Materiaux Semiconducteurs, UER Sci. Exacte Naturelles, Amiens, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.19, p.1493-6 (30 May 1983). In French.
The variations of electrical conductivity and thermoelectric power of $US_{2\alpha}$ and $US_{2\beta}$ as functions of sulfur pressure and temperature enable the authors to determine the equilibrium between the two phases. $US_{2\alpha}$ is an electronic semiconductor of pure n type whereas $US_{2\beta}$ is also an electronic semiconductor but exhibiting a p-n transition. (13 refs.)

102376 Modeling of carrier mobility against carrier concentration in arsenic-, phosphorus-, and boron-doped silicon. G.Masetti (Dept. of Electronics, Univ. of Ancona, Ancona, Italy), M.Severi, S.Solmi.
IEEE Trans. Electron Devices (USA), vol.ED-30, no.7, p.764-9 (July 1983).
New carrier mobility data for both arsenic- and boron-doped silicon are presented in the high doping range. The data definitely show that the electron mobility in As-doped silicon is significantly lower than in P-doped silicon for carrier concentrations higher than 10^{19} cm^{-3}. By integrating these data with those previously published, empirical relationships able to model the carrier mobility against carrier concentration in the whole experimental range examined to date (about eight decades in concentration) for As-, P-, and B-doped silicon are derived. Different parameters in the expression for the n-type dopants provide differentiation between the electron mobility in As- and P-doped silicon. Finally, it is shown that these new expressions, once implemented in the SUPREM II process simulator, lead to reduced errors in the simulation of the sheet resistance values. (25 refs.)

102377 Resistivity and mobility of GaP at 300K. Y.C.Kao, O.Eknoyan (Electrical Engng. Dept., Texas A&M Univ., College Station, TX, USA).
IEEE Trans. Electron Devices (USA), vol.ED-30, no.7, p.855-7 (July 1983).
Resistivity and mobility data of GaP at 300K are presented in a unified form as a function of impurity concentration for the first time. The data are determined from sheet Hall coefficient and resistivity measurements obtained using the van der Pauw method. The results are given over a wide range of concentrations ranging from unitentionally doped to degenerate conditions. The maximum values of the electron and hole mobility, μ_n, and μ_p, are found to be 160 and 135 cm^2/V.s, respectively. (11 refs.)

102378 The DC conductivity of polyphenylacetylene below room temperature. A.P.Bhatt, W.A.Anderson (Dept. of Electrical & Computer Engng., State Univ. of New York, Amherst, NY, USA), E.T.Kang, P.Ehrlich.
J. Appl. Phys. (USA), vol.54, no.7, p.3973-6 (July 1983).
The temperature dependence of the DC conductivity for doped and undoped cispolyphenylacetylene (PPA) is analyzed at temperatures of 110 to 300K. The DC conductivity (σ_{DC}) data of arsenic pentafluoride-doped and iodine-doped samples suggest two major current conduction processes separated by a characteristic temperature (T_c) of about 257K, which is independent of the doping level. At $T<T_c$, σ_{DC} is independent of the temperature within experimental error. At $T>T_c$, σ_{DC} is activated with an activation energy that, for PPA-AsF_5, varies from 0.86 eV to 0.51 eV for doping levels of 2×10^{-3} to 7×10^{-2} moles dopant/moles monomer, respectively. PPA annealed at 130°C, which is known to undergo isomerization and cyclization reactions, has a T_c of about 210K, and σ_{DC} does not respond to doping. Possible conduction mechanisms are discussed. (17 refs.)

102379 Effect of molecular rotation upon charge transport between disordered carbazole units. J.H.Slowik, I.Chen (Xerox Webster Res. Center, Webster, NY, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4467-73 (Aug. 1983).
A calculation of intermolecular transfer integrals J for carbazole molecules shows that J varies by orders of magnitude when the molecular planes are rotated. The angular variation of J is used to estimate the corresponding changes in the transition rates. It is suggested that in certain cases the electronic transition occurs after thermally activated hindered rotation. Furthermore, the rotational energy barrier may be a principal component of the rather large electronic transport activation energy which is observed experimentally when carriers move by hopping in certain amorphous organic materials. (19 refs.)

102380 Highly doped sputtered amorphous silicon without hydrogen. R.W.Fane, Y.Zaka (Dept. of Phys., Univ. of Aston, Birmingham, England).
J. Non-Cryst. Solids (Netherlands), vol.57, no.1, p.1-7 (Aug. 1983).
A method of producing high resistivity amorphous silicon ($\sim10^8$ Ω cm) by sputtering without any addition of hydrogen or halogen is described. Such material has been doped n-type using tantalum, to give conductivity values in excess of 1 (Ω cm)$^{-1}$. (17 refs.)

102381 The interpretation of the electric and optical properties of a-Si:H films produced by RF glow discharge through dark conductivity, photoconductivity and pulse controlled capacitance-voltage measurements. R.Martins, A.G.Dias, L.Guimaraes (Centro de Fisica Molecular, Univ. de Lisboa, Lisboa, Portugal).
J. Non-Cryst. Solids (Netherlands), vol.57, no.1, p.9-22 (Aug. 1983).
This paper deals with the interpretation of transport properties of amorphous silicon hydrogenated films (a-Si:H) through dark conductivity, photoconductivity and pulse controlled capacitance-voltage measurements. a-Si:H films were produced by RF glow discharge coupled either inductively or capacitively to a 3% SiH_4/Ar mixture at different crossed electromagnetic static fields. The data concerned with the dark activation energy, photoactivation energy, variation of the density of localized states and photosensitivity, $(\sigma_{ph}/\sigma_d)_{25°C}$, of a-Si:H films can account for their optoelectronic properties which are strongly dependent on the deposition parameters. The authors also observed that crossed electromagnetic static fields applied during film formation influences hydrogen incorporated in a different manner than previously proposed. (21 refs.)

102382 Electrical and optical properties of RF-SP a-Ge:O:(H) deposited from GeO_2. Y.Takano, H.Ozaki (Dept. of Electrical Engng., Waseda Univ., Tokyo, Japan).
J. Non-Cryst. Solids (Netherlands), vol.57, no.1, p.119-27 (Aug. 1983).
The electrical and optical properties of a-Ge:O:(H) prepared from sintered GeO_2 are investigated. Unlike SiO_2, GeO_2 can be reduced with H_2 gas. The properties of a-Ge:O:(H) thus prepared can be changed widely with the H_2 gas pressure, approaching those of a-Ge. It is found that, in addition to these changes, a configurational change from Ge-O-Ge to oxygen-vacancy complex occurs with increasing the H_2 gas pressure. (11 refs.)

102383 Electrical conductivity and phase transitions of the solid electrolyte system $(Cs_{1-y}Rb_y)Cu_4Cl_3(I_{2-x}Cl_x)$. S.Geller, A.K.Ray (Dept. of Electrical Engng., Univ. of Colorado, Boulder, CO, USA), K.Nag.
J. Solid State Chem. (USA), vol.48, no.2, p.176-88 (1 July 1983).
Results of electrical conductivity measurements, thermal analysis, and X-ray diffraction studies indicate the existence of four phases, between 295K and the melting points, in the system $(Cs_{1-y}\text{-}Rb_y)Cu_4Cl_3I_2$. These phases are designated α, α', β, γ in order of decreasing temperature. The α phase is isostructural with α-$RbAg_4I_5$; the α' phase is also cubic and very likely belongs to space group $P2_13$, a subgroup of $P4_132$ and $P4_332$ to which the α phase belongs. There is a high probability that the $\alpha'\rightarrow\alpha$ transition is continuous. The $\alpha'\rightarrow\alpha$ transition is not discernible in the conductivity measurements or thermal analysis; therefore the line of α'-α transitions is presently unknown. The β phase transforms to the α', and the γ phase transforms to the β phase when $y\leq0.36$; the γ phase transforms to the α phase when $y\geq0.36$. That is, there is a triple point at $y=0.36$, $T=399$K. The γ-β, β-α', and γ-α transitions are all hysteretic and are therefore first order. The conductivities of the β phases are relatively low and the enthalpies of activation relatively high. The conductivity of the β phase decreases with increasing y. The β phase probably belongs to space group $R3$, in which the Cu^+ ions can be ordered. The α and α' phases are the true solid electrolytes; the conductivities are high, >0.73 Ω^{-1}-cm^{-1} at 419K, and the enthalpies of activation of motion of the Cu^+ ions low, 0.11 eV. In the system $CsCu_4Cl_3(I_{2-x}Cl_x)$, $0\leq x\leq0.25$, the Cl^- for I^- substitutions affect the transitions to only a small extent relative to the stoichiometric compound. The β phase occurs for all x and transforms to α'. (17 refs.)

102384 Transport studies of S-Se amorphous semiconductors. M.F.Kotkata (Phys. Dept., Ain Shams Univ., Cairo, Egypt), M.H.El-Fouly, A.Z.El-Behay, L.A.El-Wahab.
Mater. Sci. & Eng. (Switzerland), vol.60, no.2, p.163-71 (Aug. 1983).
The homogeneous glass-forming region for air-quenched melts in the binary chalcogenide system S-Se is reported together with metastable melt crystallization temperatures and differential thermal analysis data for glass powder heated at different rates in a nitrogen atmosphere under standardized conditions. The compositional dependence of the electrical activation energy, the density of the glass transition temperature were measured in an effort to correlate the chemical binding with the physical properties. Myuller's valence theory of the electrical conductivity of glasses was applied to calculate the 'steric factor' β defining the degree of departure of σ_0(exp) from σ_0(theor). A thermodynamic technique was used to study the devitrification process for different amorphous compositions of the system S-Se. New data concerning the compositional dependence of the non-isothermal crystallization kinetics parameters are presented and discussed. (23 refs.)

102385 Electrical studies on $(Mo/W)Se_2$ single crystals. I. Electrical resistivity. M.K.Agarwal, P.D.Patel, O.Vijayan (Dept. of Phys., Sardar Patel Univ., Vallabh Vidyanagar, India).
Phys. Status Solidi a (Germany), vol.78, no.1, p.133-6 (16 July 1983).
The electrical resistivity of the single crystal solid solutions $Mo_xW_{1-x}Se_2$ ($0\leq x\leq1$), grown by a direct vapour transport technique is studied in the temperature range from 300 to about 600K. The room temperature values of resistivity are 1.43 Ω cm for p-type 2H-WSe_2 and 2.36 Ω cm for p-type 2H-$MoSe_2$. The study reveals that the crystals are intrinsic semiconductors in the temperature range of investigation. (19 refs.)

102386 Variable-range-hopping conduction in a strong magnetic field. R.Mansfield, H.Tokumoto (Dept. of Phys., Bedford Coll., London, England).
Philos. Mag. B (GB), vol.48, no.1, p.L1-4 (July 1983).
Shklovskii (1982) has recently proposed a new theory to account for variable-range hopping in a strong magnetic field which allows for multiple scattering while tunnelling in a transverse magnetic field. A temperature dependence of resistivity $p_0 \exp(T_0/T)^{1/2}$ is obtained in agreement with the results of Tokumoto et al. (1982) on n-InSb in the magnetic freeze-out region. This letter discusses the application of this theory to these results. (3 refs.)

102387 n-type $CdCr_2Se_4$: a Mott extrinsic semiconductor. M.Heritier (Lab. de Phys. des Solides, Univ. de Paris-Sud, Orsay, France).
Phys. Rev. B (USA), vol.28, no.2, p.1136-7 (15 July 1983).
Recent photoemission studies in $CdCr_2Se_4$ give direct evidence for the transport of excess electrons in a narrow d band. This implies that the large anomalies in optical and transport properties near the Curie point are not due to s-d exchange, but to strong d-electron correlations. (19 refs.)

102388 Activity coefficient and the Einstein relation. P.T.Landsberg (Dept. of Electrical Engng., Univ. of Florida, Gainesville, FL, USA), A.G.Guy.
Phys. Rev. B (USA), vol.28, no.2, p.1187-89 (15 July 1983).
A connection between the activity coefficient of current carriers and the Einstein relations is established by two methods, one based on normal semiconductor concepts and one based on irreversible thermodynamics. The connection holds for all densities of states, for Fermi degeneracy, and in the presence of heavy doping. (13 refs.)

102389 Electrical conductivity and optical transmission of phases of the Li_2S-Sb_2S system. Correlation between structure and physical properties. J.Olivier-Fourcade, L.Izghouti, J.-C.Jumas, E.Philippot (Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
Rev. Chim. Miner. (France), vol.20, no.3, p.385-95 (1983). In French.
Electrical conductivity and optical transmission measurements show a high-resistivity semiconductor behaviour for compounds of the Li_2S-Sb_2S_3 system with a crystal structure built up from ribbons, sheets or tridimensional networks based on large SbS_5E units with a weak activity of the lone pair E. For $Li_{3x}Sb_{6-x}S_9$ solid solution, with $x=0.333$ and 0.5, the higher electrical conductivity for $x=0.333$ is explained by the existence of a partly occupied antimony site which is filled up by lithium cations when $x=0.5$. The lithium antimonates are different from most of the other alkaline antimonates because the lithium and antimony atoms, with closely related radii, are located in the same kind of crystallographic sites. (11 refs.)

102390 Solid-gas interaction influence on the conductivity of molybdenum sulphides in the vicinity of an order-disorder transition. P.Belougne, J.C.Giuntini, J.V.Zanchetta (Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
Rev. Chim. Miner. (France), vol.20, no.3, p.426-37 (1983). In French.
The study of the electrical conductivity of molybdenum sulfides MoS_{2+x} $(0\leq x\leq 1)$ (DC, AC conductivity and temperature dependence) shows the existence of an order-disorder pseudotransition appearing during the thermal treatment (TT) of the samples. This pseudotransition takes place around 700°C. The solid-gas interaction (mainly with water) determined by conductivity measurements, shows a different behaviour of the sulfides according as TT is lower or higher than 700°C. In the case of amorphous and poorly organized compounds (TT<700°C) the results suggest a dismutation of Mo^{5+} into Mo^{4+} and Mo^{6+} ions. These last ions would be active sites participating in a hopping conduction mechanism. When TT>700°C, the adsorption of water leads to an explicative mechanism, founded on its decomposition. (27 refs.)

102391 Low temperature hopping diffusion in doped semi-conductors. J.G.Ramos (Inst. de Fisica 'Gleb Wataghin', Univ. Estadual de Campinas, Sao Paulo, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.4, p.619-25 (Dec. 1982).
Mott's law for the low temperature hopping conductivity is reconsidered to take account of the fact that the site wave functions are more localized than the hydrogenic-like wave functions. With Gaussian-like functions a $T^{-2/5}$ law for the logarithm of the conductivity is obtained, in good agreement with experimental data. The low temperature diffusion coefficient, of *n*-CdS, which can be measured through spin flip Raman scattering in doped semiconductors is shown to have the same temperature behavior, in the temperature range from 10K to 50K. (13 refs.)

102392 Charge transport at mid-gap in trans-$(CH)_x$: An electrochemical study. J.H.Kaufman, T.-C.Chung, A.J.Heeger (Inst. for Polymers & Organic Solids, Univ. of California, Santa Barbara, CA, USA).
Solid State Commun. (USA), vol.47, no.8, p.585-9 (Aug. 1983).
Electrochemical studies demonstrate that ~300 ppm of charge (equal to the number of neutral solitons in undoped trans-$(CH)_x$) is removed at mid-gap. These charges are transported through the polyacetylene electrode via hopping among states at the center of the energy gap, in agreement with Kivelson's theory. From analysis of the data, the authors have been able to determine the soliton creation energy, $E_s\simeq 0.5$ eV, which is in good agreement with the theoretical value, $E_s=(2/\pi)\Delta$. (21 refs.)

102393 Influence of the character of carbon black distribution on electrical conductivity of binary blend of polymers. Yu.S.Lipatov, E.P.Mamunya, N.A.Gladyreva, E.V.Lebedev.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.7, p.1483-9 (July 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The electrical conductivity of a polymer composition based on PE-POM blend and carbon black has been studied as a function of the character of filler distribution. For the formation of composition by means of dilution of POM—carbon black blend by the second polymeric component—PE—the localization of the filler on the boundary of blend components proceeds resulting in the formation of a conductive network of the filler and permitting one to attain the high values of electrical conductivity at small content of carbon black. (20 refs.)

Cryostat for combined investigation of kinetic and photoelectrical properties of semiconductors within the range from 2 to 650K .... See Entry 99111

Contactless determination of the conductivity in semi-insulators .... See Entry 99131

Structure and electronic properties of molten $TlAsSe_2$ .... See Entry 101525

Theory of doping in chalcogenide glasses .... See Entry 101577

Tetramethyldithiadiselenafulvalene (TMDTDSF): properties of its hexafluorophosphate salt and alloys with tetramethyltetraselenafulvalene .... See Entry 101681

Conductivity and 'negative *U*' for ionic grain boundaries .... See Entry 101716

Iron-ion—implantation effects in MgO crystals .... See Entry 101730

Impurity compensation in $Ga_{1-x}Al_xAs$ alloys .... See Entry 101739

Electronic phenomena in mechanical relaxation of semiconducting oxide glasses .... See Entry 101855

Homogeneity of semi-insulating GaAs substrates for GaAs IC .... See Entry 101991

Studies on electronic processes in graphite during the last decade in Japan .... See Entry 102248

Electron-phonon scattering in polyparaphenylene .... See Entry 102273

One-dimensionality in glassy carbon .... See Entry 102365

Basic issues in electronic conduction in amorphous semiconductors. II. Electronic transport properties .... See Entry 102369

Poole-Frenkel centres in dielectrics. Kind and space density in plasma-polymerized organosilicon films .... See Entry 102405

Impact ionization in rare earth doped CdF_2 crystals .... See Entry 102407

Monte Carlo simulations of geminate-pair dissociation in discrete anisotropic lattices .... See Entry 102419

Dynamics of photohole trapping in silver chloride .... See Entry 102420

Hall effect studies in germanium doped $Al_xGa_{1-x}As$ .... See Entry 102432

Electrical properties of low-compensation GaAs .... See Entry 102437

Transport properties of highly excited semiconductors .... See Entry 102444

Photoconductivity and dark conductivity of hydrogenated amorphous silicon .... See Entry 102455

Optoelectronic characterization of undoped amorphous silicon thermistor .... See Entry 102463

Electrical conduction in sputtered Si:Al films .... See Entry 102521

Hall mobility in undoped microcrystalline Si:H,Cl films .... See Entry 102527

Mechanism of dispersive transport in hydrogenated amorphous silicon .... See Entry 102531

Laser-recrystallized polycrystalline silicon resistors for integrated circuit applications .... See Entry 102535

Transport and magnetic properties of layered rare earth disilicides .... See Entry 102619

Optical and electrical properties of RF-sputtered indium-tin oxide films .... See Entry 102976

Microwave absorption in amorphous chalcogenide semiconductors .... See Entry 103004

72.20H High-field and nonlinear effects

102394 The energy relaxation time and electron temperature of hot electrons in n-Ge. H.Stramska (Inst. of Experimental Phys., Warsaw Univ., Warsaw, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.1, p.55-8 (July 1983).
Measurements of the DC conductivity at 77K lattice temperature vs. electric field for n-Ge are analyzed to determine the energy relaxation time τ_ϵ and electron temperature T_e of hot carriers. A relatively simple technique for computing the energy relaxation time dependence on the electric field is proposed. A theory starting from Boltzmann transport equation is used in the experimental determination of the energy relaxation time. The electron temperature vs. electric field is also determined. (6 refs.)

102395 High field conduction in solution-grown polyvinylidene fluoride (PVF_2) films. P.C.Mehendru, S.Chand (Nat. Phys. Lab., New Delhi, India).
Indian J. Pure & Appl. Phys., vol.21, no.6, p.323-6 (June 1983).
Current-voltage (*I-V*) characteristics of PVF_2 films grown from the solution and characterized by having $(\alpha+\beta)$ crystalline modification have been studied as a function of temperature and thickness in the M-P-M sandwich configuration. The *I-V* curves show two distinct regions of conduction, namely the comparatively low-field ohmic region with a slope ~1 and the high field non-ohmic region with a slope ≤ 2. The high field non-ohmic behaviour has been attributed to the tunnelling of charge carriers into or via the traps, the tunneling process being a thermally activated one. (18 refs.)

102396 High field single injection current in solid state diode with shallow traps by exact method. A.S.Verma, Y.K.Sharma, R.S.Agrawal, C.S.Agrawal (Dept. of Phys., RBS Coll., Agra, India).
Indian J. Pure & Appl. Phys., vol.21, no.6, p.357-8 (June 1983).
An exact method is used to evaluate the current-voltage characteristic of a single injection solid state diode with shallow traps operating in a high field regime. A set of curves are drawn for various values of the parameter characterizing the shallow traps. (5 refs.)

102397 Remnant conductivity in polymer semiconductors of polynaphthol and polyhydroquinone. S.Kh.Khalilov, Sh.G.Gamidov, Yu.G.Nurullaev.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.5, p.99-102 (1982). In Russian.
After the application of a strong electric field ($>10^5$V/cm) high electron conductivity is retained for a long time. The obtained data are explained by the specific influence of the electric field upon the potential barriers between the polyjunction regions. (14 refs.)

102398 Propagation of strong electromagnetic waves in Kane semiconductors. M.M.Babaev, T.M.Gasymov, A.A.Katanov, F.K.Kocharli, V.A.Pogrebnyak.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.6, p.72-82 (1982). In Russian.
Propagation of a strong (heated) electromagnetic waves in nondegenerate semiconductors with an isotropic nonparabolic spectrum of the electrons is investigated. Expressions for the damping of the field and carriers temperature have been established under the conditions of a nonlinear normal and anomalous skin-effects both in the presence and absence of the nonquantized magnetic field. The effect self-action of the plane waves is studied, and it is shown that in the presence of strong magnetic fields under the condition of circularly polarized waves the real part of the dielectric permittivity does not depend on the electron temperature T_e and parabolicity degree. The heating of the electrons by electromagnetic waves is studied. It is shown that under the normal skin-effect in the strong magnetic field T_e does not depend on the nonparabolicity degree and in the strong heating case $T_e\sim E^2$, if the electrons are scattered by acoustical phonons (both for the deformation and piezoelectric potential interactions). In other cases nonparabolicity of the spectrum essentially affects T_e, damping depths, the self-action factors of the field and the electron temperature. (8 refs.)

102399 Effects of keV electron irradiation on the avalanche-electron generation rates of three donors on oxidized silicon. C.-T.Sah, J.Y.-C.Sun, J.J.-T.Tzou (Dept. of Electrical Engng., IL, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4378-81 (Aug. 1983).
After keV electron beam irradiation of oxidized silicon, the avalanche-electron-injection generation rates and densities of the bulk compensating donor, the interface states, and the turnaround trap all increase. Heating at 200°C can anneal out these three donor-like traps; however, it cannot restore the generation rates back to their original and lower pre-keV electron irradiation values. The experimental results also indicate that all three traps may be related to the same mobile impurity species whose bonds are loosened by the keV electrons and then broken or released by the avalanche injected electrons. (13 refs.)

102400 The relation between contact potential and planar conduction as a-Si:H films undergo gas adsorption or temperature changes. J.Abelson, G.de Rosny (LPNHE, Ecole Polytech., Palaiseau, France).
J. Phys. (France), vol.44, no.8, p.993-1003 (Aug. 1983).
When the free surface of an amorphous silicon thin film is exposed to water vapour, the contact potential and planar conductance simultaneously change. For three examples, the authors correlate the two measurements and interpret them in terms of adsorbate induced changes of the surface potential, similar to field effect experimental analysis. During temperature cycles, there is a strong correlation between non-linear portions of the log conductance versus $1/T$ plots and the variation of the contact potential. (14 refs.)

102401 Coherent Zener oscillations. P.Roblin, M.W.Muller (Dept. of Electrical Engng., Washington Univ., St Louis, MO, USA).
J. Phys. C (GB), vol.16, no.23, p.4547-54 (20 Aug. 1983).
Studies quasiclassical solutions of a quantum system, a crystal electron in a uniform steady electric field. Classical solutions can be formed from wave-packets of Houston functions or Stark states which are tightly localised in both position and crystal momentum. The position and momentum can be localised initially within the uncertainty principle. However while the momen-

tum uncertainty is conserved with time the position uncertainty oscillates with the Zener period. It is maximal as the inflection points of the band structure. The departure from the initial value of the position uncertainty depends on the band structure and is inversely proportional to the field. For fields lower than ~ 10 kV cm^{-1} the electron can only be tightly localised for times short compared with low-field scattering times. For fields higher than ~ 10 kV cm^{-1} the electron can be tightly localised throughout the whole Zener orbit. (6 refs.)

102402 Non-linear transport and transient properties of semiconductors under high electric field. N.Sawaki (Dept. of Electronics, Nagoya Univ., Nagoya, Japan).
J. Phys. C (GB), vol.16, no.23, p.4611-22 (20 Aug. 1983).
The current in a semiconductor under a high electric field is studied by solving the Liouville equation. The formal theory is developed using the Stark ladder representation, and the infinite series of a perturbation expansion for the weak electron-phonon coupling is evaluated. The effect of an electric field on the scattering matrix is studied in terms of the self-energy due to higher-order scatterings. It is shown that the real part of the self-energy, as well as the imaginary part, has a role in the transport properties. The results are applied to the velocity overshoot and the ballistic effect in a short semiconductor device. It is found that the velocity overshoot is realised by the inelastic nature of the scattering while the ballistic effect arises from the variation of the self-energy with time or the correlation effect. (26 refs.)

102403 A model for impact ionisation in wide-gap semiconductors. B.K.Ridley (Dept. of Phys., Univ. of Essex, Colchester, England).
J. Phys. C (GB), vol.16, no.23, p.4733-51 (20 Aug. 1983).
Mean free paths associated with the scattering of electrons and holes are derived from experiments on impact ionisation in wide-gap semiconductors using the lucky-drift model. It is found that the mean free path for an electron or hole in any semiconductor obeys a simple universal law which implies a common phonon energy for electron and hole scattering and a dependence of mean free path on threshold energy ($\lambda \propto E_i^{-1/2}$). The latter dependence is plausible in terms of a simple view of scattering of high-energy carriers in a nonparabolic band. This universal model is derived on the basis of experimental data reported by various authors in Si, Ge, GaAs, and InP. Results for GaSb and its alloys appear to be anomalous, whereas data from GaInAs in InGaAsP tend to support the model. The model predicts the ratio of ionisation coefficients $k=\beta/\alpha$ and its dependence on field and temperature. It is shown that k in any semiconductor is determined by only the ratio of threshold energies of electrons and holes. A comparison with reported values is made and brief discussions of the spin-orbit resonance effect in AlGaSb and of the enhancement in GaAs/AlGaAs multilayers are given. (44 refs.)

102404 Inversion of hot carriers in Landau levels. V.A.Kozlov, L.S.Mazov, I.M.Nefedov, M.R.Zabolotskikh (Inst. of Appl. Phys., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.3, p.170-4 (5 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.3, p.142-4 (5 Feb. 1983).
A method is proposed for creating an inverted population of hot carriers in Landau levels of the light subband in crossed **E** and **B** fields. Impurity scattering in this case facilitates inversion and for it 'ultrapure' semiconductors are not required. (11 refs.)

102405 Poole-Frenkel centres in dielectrics. Kind and space density in plasma-polymerized organosilicon films. J.Tyczkowski, M.Kryszewski (Centre of Molecular & Molecular Studies, Polish Acad. of Sci., Lodz, Poland).
Phys. Status Solidi a (Germany), vol.78, no.1, p.259-65 (16 July 1983).
Measurements of anomalous transient 'photocurrents' are proposed to determine the kind (donor or acceptor) and spatial density of generation centres in dielectrics with the Poole-Frenkel electrical conduction mechanism. The results for plasma-polymerized hexamethyldisiloxane (pp HMDSO) are described as an example. It is shown that generation centres are acceptors and their space density is about 10^{24} m^{-3} in vacuum. It is found that water molecules give rise to an increase of this density. (23 refs.)

102406 The Frenkel thermal-field emission in $EuGa_2S_4$ single crystals. O.B.Tagiev (Inst. of Phys., Acad. of Sci., Baku, Azerbaidzhan SSR), G.M.Niftiev, I.M.Askerov.
Phys. Status Solidi a (Germany), vol.78, no.1, p.K43-6 (16 July 1983).
Deals with the results of an investigation of the Frenkel thermal-field emission in $EuGa_2S_4$ single crystals in strong electric fields ($E \geq 10^4$ V/cm) in the temperature range from 270 to 327K. $EuGa_2S_4$ single crystals were obtained by the method of gas-transport reaction. Specimen contacts having (specimen thickness ≈ 70 μm) a resistivity on the order of $\approx 10^{10}$ Ωcm were made as sandwiches by fusing-in indium. (7 refs.)

102407 Impact ionization in rare earth doped CdF_2 crystals. V.Dallacasa, C.Paracchini (Istituto di Fisica, Univ. di Parma, Parma, Italy).
Radiat. Eff. (GB), vol.72, no.1-4, p.265-9 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
CdF_2 insulating crystals doped with Gd and Eu exhibit electrical conduction and electroluminescence under d.c. high fields. The electrical conduction is due to electrons hopping through discrete coulombic centres by means of a Poole-Frenkel effect. The electroluminescence takes place because of impact processes. The impact rate w is correlated to the electrical current and then evaluated as a function of the applied field F and the temperature T. The experimental relation $w=A\ \exp(-aT/F^{1/2})+B\ \exp(-\mathrm{b}b/F^{1/2})$ is obtained and it is interpreted on the basis of the conduction model, where electrons are scattered by charged impurity centres. (8 refs.)

102408 Third harmonic generation in a semiconductor with a negative differential conductivity. V.V.Zaitsev, P.V.Tyapukhin (Kuibyshev State Univ., Kuibyshev, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.9, p.775-8 (Sept. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.9, p.1075-9 (Sept. 1982).
The problem of transforming amplitude fluctuations of an input pump signal into fluctuations of a generated harmonic is investigated in the example of third harmonic generation in a semiconductor with a negative differential conductivity (NDC). An averaging method is used to derive a system of equations for the amplitudes and spectral densities of the amplitude fluctuations of the interacting waves. It is shown that frequency multipliers using an NDC semiconductor can have a high multiplication efficiency (exceeding 100%) and simultaneously suppress the amplitude fluctuations of the input signal. (9 refs.)

Energy transfer processes in non-ohmic hopping conductivity in a strong electric field .... See Entry 102340

Two-point correlations of diffusion noise sources of hot carriers in semiconductors .... See Entry 102473

Electroformed states in an Au-NaF-Au thin film structure .... See Entry 102519

Effects of controlled hydrogenation by ion implantation on the localized states in vacuum evaporated amorphous silicon .... See Entry 102530

Effect of CuO addition on the electrical and dielectrical properties of semiconducting barium titanate ceramics .... See Entry 102826

72.20J Charge carriers: generation, recombination, lifetime, and trapping

102409 Single injection current in insulator with traps lying below the Fermi level. Y.K.Sharma, V.S.Raghav (Phys. Dept., RBS Coll., Agra, India).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.7, p.810-15 (1983).
Analytical expressions for the current-voltage characteristics have been given for an insulator containing a significant amount of traps lying below the Fermi level. The mobility of the current carriers varies with concentration in the insulator. The complete current-voltage characteristic can be divided into four regimes which have power laws for the characteristic from linear law in pure Ohm's law regime to cube law in the space-charge-limited trap-free regime. There is a very large change in current occurring over a restricted change in voltage. (5 refs.)

102410 The electrical conduction process in antimony trisulfide semiconducting thin films. Nam-Ki Min, Ha-Yong Park.
Trans. Korean Inst. Electr. Eng., vol.32, no.3, p.99-105 (1983). In Korean.
The mechanism of electrical conduction in thin films of antimony-trisulfide is briefly investigated. Three regions are distinguished in the experimental current(I)-voltage(V) relationship. With low voltages the I-V characteristic is ohmic, but at higher voltages the I-V characteristic exhibits an $I\ \alpha V^2$ dependence, then an $I\ \alpha V^3$ dependence. The square law (V^2) dependence can be accounted for by means of the singlecarrier(hole) space-charge-limited current. The cube law (V^3) dependence arises as a result of the double injection due to the electron injection through tunnelling from the cathode at a critical voltage. (13 refs.)

102411 Comparison of band-to-band Auger processes in InGaAsP. A.Sugimura (Musashino Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Tokyo, Japan).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.6, p.930-2 (June 1983). (8th IEEE International Semiconductor Laser Conference, Ottawa, Ont., Canada, 13-15 Sept. 1982).
The relation between different types of band-to-band Auger processes in InGaAsP is studied. According to a nonparabolic band model that makes use of $\bar{k}.\bar{p}$ perturbation theory, the Auger effect involving the excited split-off band (CHSH process) is dominant. The Auger effect involving the excited light hole band (CHLH process) is far less than the effect of the CHSH process or the Auger effect involving the excited conduction band (CHCC process). A simple parabolic band model overestimates the CHCC process by about one order of magnitude, and the CHLH process by more than ten orders of magnitude. (11 refs.)

102412 Theory of electron-hole kinetics in amorphous semiconductors under illumination: application to solar cells. R.E.Lagos, H.Suhl, T.Tiedje (Corporate Res. Sci. Labs., Exxon Res. & Engng. Co., Linden, NJ, USA).
J. Appl. Phys. (USA), vol.54, no.7, p.3951-7 (July 1983).
A general kinetic theory of the generation and recombination of electron-hole pairs for an illuminated amorphous semiconductor with an arbitrary distribution of gap states is presented. The basic assumptions of the theory are first, that sharp mobility edges separate localized states from extended states, and second that the localized states can communicate with each other only via the extended states. In the limit that mobile carriers are concentrated at the band edges, the coupled nonlinear integral equations for the occupation functions can be reduced to quadratures. The theory is applied to calculate the current-voltage characteristic of amorphous silicon solar cells, in the 'lumped circuit' model where the spatial dependence is neglected. The open circuit voltage, the fill factor and the upper limit for the solar conversion efficiency of such devices are calculated as functions of the gap density of states. (49 refs.)

102413 Electric conduction of low density polyethylene induced by high dose rate gamma rays. S.Mochizuki, N.Tamura, K.Yahagi (JAERI, Gunma-ken, Japan).
J. Appl. Phys. (USA), vol.54, no.8, p.4433-8 (Aug. 1983).
Radiation induced conduction in low density polyethylene under gamma-ray irradiation at high dose rates, 1×10^3 to 1×10^4 Gy/h, was studied. After irradiation was initiated, the induced current quickly plateaus, but then subsequently begins to increase slowly with time until it attains an equilibrium value. The effect of the polarity and magnitude of the electric field and of the temperature upon time dependence of the induced current were investigated. The slowly increasing induced current can be explained by thermal detrapping from relatively deep traps; the trap depth is calculated to be ca. 0.8 eV. The induced current of the sample increases as its crystallinity increases. It was revealed that a sample with high crystallinity has shallow traps and consequently has many charge carriers and increases its induced current. (12 refs.)

102414 Hole transport in pure and doped GaAs. H.J.Lee (Dept. of Phys., Jeonbuk Nat. Univ., Jeonju, Korea), D.C.Look.
J. Appl. Phys. (USA), vol.54, no.8, p.4446-52 (Aug. 1983).
Uses a two-band model (heavy and light holes) to calculate the transport properties of *p*-type GaAs. The scattering mechanisms included are acoustic-mode deformation potential, acoustic-mode piezoelectric potential, polar- and nonpolar-mode deformation potential, ionized impurity, and space charge. Interband scattering is included explicitly for the optical phonons and phenomenologically for the acoustic phonons. The intraband polar optical-mode scattering, for which a relaxation time cannot be defined, was calculated by using the numerical method of Fletcher and Butcher (1972). The acoustic deformation-potential parameter and the coupling coefficient for interband scattering were calculated by fitting the theory to Hall-mobility data for both pure and doped samples. The authors have determined ionized-impurity and space-charge contributions for two of the samples, one doped with Cr and exhibiting an 0.33-eV activation energy (Cr^{4+}/Cr^{3+}), and the other heat-treated and exhibiting an 0.14-eV activation energy. The transport fit was carried out self-consistently with a statistical fit of the p vs. T data, to determine the relevant donor and acceptor concentrations. Individual plots of the mobility contributions from the various scattering mechanisms are also presented. Finally, useful plots of the Hall mobility and Hall r factor, as functions of carrier density and compensation ratio, are provided to aid others in the analysis of their samples. An important conclusion of this study is that the light-hole band strongly influences the transport properties, even though its density of states is small compared to that of the heavy-hole band. (28 refs.)

102415 Effect of photoelectrochemical etching on charge collection efficiency in CdS: An electron beam induced current study. G.Hodes, D.Cahen (Weizmann Inst. of Sci., Rehovot, Israel), H.J.Leamy.
J. Appl. Phys. (USA), vol.54, no.8, p.4676-8 (Aug. 1983).
Parallel secondary electron and charge collection images of a CdS/Au Schottky barrier show that photoetching of the CdS improves the charge collection efficiency. This is explained in terms of preferential removal of (near) surface recombination centers by the photoetching. Evidence is given that lack of photoetching of specific areas of the surface is due to the fact that such areas are photoelectrochemically inactive, possibly because of poor electrical contact with underlying CdS, and combined photoetching and scanning electron microscopy investigation is suggested as a way to check semiconductors for inactive regions. (11 refs.)

102416 On the phase-breaking time of electrons in a disordered two-dimensional system. Z.Ovadyahu (Dept. of Phys., Ben-Gurion Univ. of the Negev, Beer-Sheva, Israel).
J. Phys. C (GB), vol.16, no.23, p.L845-8 (20 Aug. 1983).
Measurements of the inelastic mean free path in two-dimensional indium oxide films are reported. The results suggest that the phase-breaking time in this material varies as T^{-1}, which agrees with the dependence predicted by several theoretically known scattering mechanisms. On the other hand, the actual values of the inelastic mean free path, at the same temperature, seem to be essentially independent of the films bulk resistivity. This latter feature may suggest the existence of a phase-breaking mechanism characterised by a scattering time that is proportional to the resistivity. (17 refs.)

102417 Numerical approach to non-equilibrium carrier relaxation in picosecond and subpicosecond physics. J.Collet, T.Amand, M.Pugnet (Lab. de Phys. des Solides, INSA, Toulouse, France).
Phys. Lett. A (Netherlands), vol.96A, no.7, p.368-74 (18 July 1983).
Presents a numerical resolution of the time-dependent Boltzmann equation which describes the electron relaxation kinetics in direct gas semiconductors under subpicosecond optical excitation. The calculation is specialized to GaAs. The authors investigate, around the Motte density, the conditions of internal thermalization and energy relaxation of electrons, which depend strongly on the plasma concentration. (22 refs.)

102418 Electrical properties of shallow implanted layers in silicon. B.N.Mukashev, Zh.A.Kusainov, K.Kh.Nusupov, S.Zh.Tokmoldin (Inst. of High energy Phys., Acad. of Sci., Alma-Ata, Kazakh SSR).
Phys. Status Solidi a (Germany), vol.78, no.1, p.K19-22 (16 July 1983).
The authors present the results of an electric property study of thin layers in silicon formed by low-energy implantation of boron, arsenic, and antimony ions. The implantations between 5 to 50 keV were carried out with an ion accelerator at normal operation. The dependence of the effective surface carrier concentration on the isochronal annealing temperature obtained for different energy arsenic implants but for the same dose (2×10^{14} cm^{-2}) is given. Identical results are observed for layers implanted by antimony ions. (16 refs.)

102419 Monte Carlo simulations of geminate-pair dissociation in discrete anisotropic lattices. B.Ries, G.Schonherr, H.Bassler (Fachbereich Phys. Chem., Philipps-Univ. Marburg, Marburg, Germany), M.Silver.
Philos. Mag. B (GB), vol.48, no.1, p.87-106 (July 1983).
Field- and temperature-assisted dissociation of carrier pairs produced by the absorption of radiation has been simulated for perfectly isotropic (3D) and perfectly linear (1D) systems composed of a discrete array of hopping sites, as well as for systems with anisotropic hopping rates parallel and perpendicular to a preferred direction. For the 3D and 1D systems the exact solutions of the Onsager formalism are recovered. In neither case is Poole-Frenkel behaviour observed. The dissociation yield increases with increasing separation a of the hopping sites. The governing parameter is $\Delta U/kT$, where ΔU, which is a function of a, is the difference in potential energy between the sites at which a carrier starts its random walk and the nearest neighbour site in the direction of the field. Agreement with experimental data for organic solids indicates that the assumption of field-independent hopping rates implicitly contained in both simulations and analytic theory is justified. Anisotropy of the carrier transport coefficient has a marked effect on the zero-field dissociation yield. On the basis of the computer results, an analytical expression is proposed that relates $\phi(E=0)$ and $\mu_{\parallel}/\mu_{\perp}$. The effect of finite sample size on the zero-field yield is also treated quantitatively. (37 refs.)

102420 Dynamics of photohole trapping in silver chloride. E.Laredo, W.B.Paul, S.-E.Wang, L.G.Rowan, L.Slifkin (Dept. of Phys., Univ. of North Carolina, Chapel Hill, NC, USA).
Radiat. Eff. (GB), vol.72, no.1-4, p.97-102 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
EPR experiments on photoholes in both AgCl:Cu and AgCl:Cu and AgCl:Pd show the existence of an activation energy barrier, of height near 1.8 meV, in the transition to the localized self-trapped state. The self-trapped hole then migrates athermally via the small-polaron band, for temperatures below 30K, and by phonon-assisted hopping for temperatures above 35K. In the hopping regime, the activation energy is 61 MeV, suggesting that the binding energy is about 0.1 eV. From the pre-exponential factor, one estimates that the electron transfer integral is about 1% of the energy of the pertinent acoustical phonon. Experiments on AgX:Cu in which 1% of the halide is Br^- show that all of the self-trapped holes ultimately migrate to sites with 2 bromide neighbors. Upon annealing, these disappear with complex kinetics and an activation energy of about 180 meV. In AgCl:Pd,Fe, the temperature-dependence of the efficiencies of production of trapped photocarrier centers is determined and correlated with the dynamics of migration of the self-trapped hole and the cation vacancy. (16 refs.)

102421 Trapping and recombination cross sections for electrons in silver halide. J.F.Hamilton (Res. Labs., Eastman Kodak Co., Rochester, NY, USA).
Radiat. Eff. (GB), vol.72, no.1-4, p.103-6 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
In a currently accepted model for formation of the photographic latent image, the photoefficiency is determined by the relative cross sections for electron capture at a silver site and at a bound hole. Comparison with sensitivity data shows that these cross sections are nearly identical. The two types of competing centers have sets of shallow Coulombic levels with equal initial cross sections, but re-escape of the electron from these levels should be more probable than transition to the deep level, and it is not clear why the final capture probabilities should be equal for the two very different centers. (20 refs.)

102422 Aspects of *e-e-h* Auger recombination in silicon. V.Grivickas (Kapsukas Vilnius State Univ., Vilnius, Lithuanian SSR).
Sov. Phys.-Collect. (USA), vol.22, no.2, p.63-6 (1982). Translation of: *Litov. Fiz. Sb. (USSR)*, vol.22, no.2, p.83-8 (1982).
Considers the effect of the structure of the valence band on the probability of e-e-h Auger recombination in nondegenerate silicon. It is found that the statistical distribution of combining holes is responsible for the relatively large Auger coefficient C_n and the weak temperature dependence $C_n(T)$ for carrier concentrations $n_0 \lesssim 10^{18}$ cm^{-3}. (12 refs.)

102423 Influence of carbon and hydrogen segregation on the electrical properties of grain boundaries in polycrystalline silicon sheets. O.Rallon, M.Aucouturier (Lab. de Metall. Phys., Univ. Paris-Sud, Paris, France), C.Texier-Hervo, M.Mautref, C.Belouet.
Sol. Cells (Switzerland), vol.9, no.3, p.149-57 (Aug. 1983).
In the article the properties of grain and twin boundaries in polycrystalline silicon layers grown by the ribbon-against-drop process are reported; the thermal diffusion of phosphorus, the electrical activity of these defects and their passivation by hydrogen are discussed. Autoradiography experiments did not evidence any significant intergranular diffusion of phosphorus; crossed electron-beam-induced current (or light-beam-induced current) and autoradiography experiments strongly suggest that the recombination at grain and twin boundaries is dominated by impurities. Finally, it is shown that the hydrogen passivation is associated with retarded diffusion and large segregation effects. (17 refs.)

102424 Time of flight of carriers in simple aromatic hydrocarbon layers. I. Theory. G.W.Bak (Inst. of Phys., Tech. Univ. of Lodz, Lodz, Poland).
Thin Solid Films (Switzerland), vol.105, no.2, p.177-81 (15 July 1983).
It has been found that the drift velocity of carriers in polycrystalline layers of simple aromatic hydrocarbons increases proportionally to the electric field and saturates at a field of 2×10^6 V m^{-1}. In addition it has been inferred that the predominant conduction mechanism in polycrystalline simple aromatic hydrocarbon layers is a hopping process between localized states within the 'impurity' band at the Fermi level. A simple model to explain the phenomenon was put forward earlier. The problem is discussed more exactly, using the assumption that so-called 'difficult' jumps of carriers play a significant role in the transport of carriers in polycrystalline simple aromatic hydrocarbon layers. (12 refs.)

102425 Time of flight of carriers in simple aromatic hydrocarbon layers. II. Comparison with experimental results. G.W.Bak (Inst. of Phys., Tech. Univ. of Lodz, Lodz, Poland).
Thin Solid Films (Switzerland), vol.105, no.2, p.183-6 (15 July 1983).
For pt.I see ibid., vol.105, p.177 (1983). The change in the average distance between the localized states at the Fermi level, which form hopping paths, was calculated as a function of the electric field. The results of the calculations were used to obtain the dependence of the carrier drift velocity on the electric field. A comparison with experimental results was also made. (6 refs.)

102426 Continuous bifurcation and dissipative structures associated with a soft mode recombination instability in semiconductors. E.Scholl (Inst. fur Theoretische Phys., RWTH Aachen, Aachen, Germany).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.204-11
There exist numerous physical, chemical and biological examples of nonlinear dynamical systems which exhibit bifurcation and dissipative structures far from equilibrium. The author considers a semiconductor, subject to generation, recombination, and diffusion of carriers, with an externally applied electric field. This field heats the electrons up, and drives the system far from thermal equilibrium. The steady state is determined by the balance of various nonlinear generation and recombination processes, among which impact ionization of free or bound carriers represents the essential autocatalytic step. The dissipative dynamical system described by the semiconductor transport equations may give rise to soft-mode instabilities, saddle-node and Hopf bifurcations, limit cycle oscillations, bifurcation of spatially inhomogeneous dissipative structures, and nonequilibrium phase transitions between low and high current states. (11 refs.)

Contactless determination of the conductivity in semi-insulators .... See Entry 99131

Minority carrier lifetime and luminescence efficiency of 1.3 μm InGaAsP-InP double heterostructure layers .... See Entry 100759

Carrier dependent parameters in a silicon optical waveguide . See Entry 100888

Measurement of grain boundary parameters by laser-spot photoconductivity .... See Entry 101721

Oxygen-induced recombination centers in as-grown Czochralski silicon crystals .... See Entry 101737

Impurity compensation in $Ga_{1-x}Al_xAs$ alloys .... See Entry 101739

DLTS investigation of electron traps in As-grown and Cd-fired CdS .... See Entry 102310

The energy relaxation time and electron temperature of hot electrons in n-Ge .... See Entry 102394

High field single injection current in solid state diode with shallow traps by exact method .... See Entry 102396

Poole-Frenkel centres in dielectrics. Kind and space density in plasma-polymerized organosilicon films .... See Entry 102405

Electrical properties of low-compensation GaAs .... See Entry 102437

Light-induced effects in amorphous silicon material and devices .... See Entry 102458

Staebler-Wronski effects in hydrogenated amorphous $Si_{1-x}Ge_x$ .... See Entry 102459

The effect of light soaking on the low temperature photoconductivity of hydrogenated amorphous silicon .... See Entry 102460

Origin of the photo-induced changes in hydrogenated amorphous silicon .... See Entry 102462

Noise spectroscopy in amorphous silicon films .... See Entry 102474

Electrical conductivity, structure and Hall effect measurements of InSe films .... See Entry 102543

Electrical properties of polystyrene doped with leucomalachite green for correlation with its electrothermographic behaviour .... See Entry 102802

Electrical and dielectric properties of poly(vinylbutyral). III. Effect of iodine doping on thermally stimulated discharge behavior .... See Entry 102808

Characterization of grain boundaries in polycrystalline solar cells using a computerized electron beam induced current system .... See Entry 103689

Effects of optical stress on the properties of sputtered amorphous silicon solar cells and thin films ....See Entry 103693

X-ray photoelectron spectroscopy studies of copper diffusion behaviour and related degradation phenomena in thin film CdS:Cu_2S solar cells ....See Entry 103698

Stability of Pd/Nb_2O_5/amorphous hydrogenated silicon solar cells ....See Entry 103699

On the effective minority carrier diffusion length of polycrystalline silicon solar cells ....See Entry 103700

Optimization of substrate thickness for interdigitated back contact silicon solar cells ....See Entry 103703

Simple method for the determination of the minority carrier diffusion length in metal/insulator/semiconductor solar cells ....See Entry 103704

72.20M Galvanomagnetic and other magnetotransport effects

102427 Crystal symmetry effects of the conduction tensor. P.Debreceni, I.Kirschner, T.Porjesz (Dept. for Low-Temperature Phys., Roland Eotvos Univ., Budapest, Hungary).
Acta Phys. Acad. Sci. Hung. (Hungary), vol.53, no.3-4, p.395-400 (1982). [received: Aug. 1983] (CRYOSEM '81. Second International Seminar on Low Temperature Physics, Visegrad, Hungary, 8-10 Oct. 1981).
Some considerations are given about the Onsager-Kohler relations with respect to the linear dependence or independence of the magnetoresistivity (MR) effects. The symmetry properties of the heat conductivity tensor are investigated to elucidate a possible experimental proof of the Onsager-Kohler relations. (14 refs.)

102428 Negative magnetoresistance in graphite and its alloys with small potassium concentration. L.Yu.Matzui, E.I.Khar'kov.
Fiz. Nizk. Temp. (USSR), vol.9, no.7, p.760-3 (July 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
Temperature and field dependences of negative magnetoresistance in disordered graphites and their alloys with small impurity of potassium have been investigated in the temperature range 4.2-300K and magnetic fields up to 60 *kOe*. Obtained data are compared with theory considering quantum additions to conductivity in the magnetic field as due to localization effects of electrons and interference of electron-electron and impurity scattering. (10 refs.)

102429 Theory of the quantized Hall conductance. B.I.Halperin (Inst. of Theoretical Phys., Univ. of California, Santa Barbara, CA, USA).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.75-102 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The quantized Hall conductance occurs in two dimensional electron systems at low temperatures and strong magnetic fields. When the Fermi level is between two Landau levels, the longitudinal resistivity ρ_{xx} is observed to vanish, while the Hall conductance $1/\rho_{xy}$ is quantized in precise integer multiples of the unit e^2/h. These effects can be explained using an essentially one-electron analysis. Recently, however, 'anomalous' Hall conductance plateaus have been discovered at certain simple fractions ν of the unit e^2/h, in a situation where a Landau level is partially filled. Explanation of this effect requires that the electrons form a new type of correlated quantum liquid with a commensurate locking term (i.e. a downward cusp) in the energy at the corresponding filling fractions. (45 refs.)

102430 Effect of magnetic field on the drain current of JFET BFW-61. N.M.Murthy, P.M.Reddy, S.V.Subrahmanyam (Dept. of Phys., Sri Krishnadevaraya Univ. Coll., Anantapur, India).
Indian J. Pure & Appl. Phys., vol.21, no.6, p.363-4 (June 1983).
The effect of magnetic field (B) on the drain current of FET BFW-61 has been studied. A decrease in drain current on the application of magnetic field has been observed in all the three cases studied, namely B parallel to current flow ($B\|$), B perpendicular to the current flow and along the width of the crystal ($B\perp W$) and B perpendicular to the current flow and along the thickness of the crystal ($B\perp T$). The change in drain current on the application of B has been found to be in the order when $B\perp T > B\| \simeq B\perp W$. The results have been explained as due to the combined effects of Hall effect and magnetoresistance. (11 refs.)

102431 The galvano and the thermomagnetic effects in semiconductors for the scattering of the charge carriers on the polar optical phonons. M.I.Aliev, F.M.Gashimzade.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.5, p.71-7 (1982). In Russian.
The transverse magnetoresistance $\Delta\rho/\rho$ and Nernst-Ettinghausen $Q^{\perp}$ effects in semiconductors for the case of arbitrary values of magnetic fields and the temperature are considered. The consideration is made by the introduction of the approximate time of relaxation for the scattering of the charge carriers on the polar optical phonons. The results of the numerical calculations of and $Q^{\perp}$ for p-type GaAs are compared with the experimental data. (6 refs.)

102432 Hall effect studies in germanium doped $Al_xGa_{1-x}As$. A.W.Nelson, P.N.Robson (Dept. of Electrical & Electronic Engng., Univ. of Sheffield, Sheffield, England).
J. Appl. Phys. (USA), vol.54, no.7, p.3965-72 (July 1983).
Germanium doping of $Al_xGa_{1-x}As$ has been studied over the range x=0.22-0.40 by measuring the Hall effect in epitaxial layers grown by liquid phase epitaxy. Hall measurements were carried out in the temperature range 70-300K and the resulting mobilities and carrier densities were analyzed as a function of temperature. These analyses have shown that the Hall to drift mobility ratio in this material, previously assumed to be around unity, is ~0.6 and that Ge produces two acceptor levels in $Al_xGa_{1-x}As$. The dominant acceptor level has an activation energy which increases monotonically with x and has a value of ~160 meV at $x=0.40$. A shallow level of much lower concentration has also been found at an energy of 20-40 meV above the valence band edge. In addition the authors have found the level of compensation in the material to be low. (34 refs.)

102433 Thermodynamic derivation of the Hall current and the thermopower in quantising magnetic field. P.Streda, L.Smrcka (Inst. of Phys., Czechslovak Acad. of Sci., Praha, Czechoslovakia).
J. Phys. C (GB), vol.16, no.24, p.L895-9 (30 Aug. 1983).
Expressions describing the Hall conductivity and the thermopower of a two-dimensional system in high magnetic fields are derived using the thermodynamic arguments. The main attention is paid to the quantum regime, in which the Fermi energy is lying in an energy gap between two neighbouring Landau levels. It is found, in this case, that the Hall conductivity and the thermopower arise as a response of surface magnetisation currents in the sample to the applied electric field and the thermal gradient. (9 refs.)

102434 On the memory-function formulation of the dynamic conductivity for two-dimensional electrons in a magnetic field. Y.Shiwa, A.Isihara (Dept. of Phys., State Univ. of New York, Buffalo, NY, USA).
J. Phys. C (GB), vol.16, no.24, p.4853-64 (30 Aug. 1983).
By considering electron-electron and electron-impurity scattering, a new exact formula for the memory function of AC conductivity based upon a projection operator formalism is obtained for two-dimensional electron systems in a magnetic field. This formula is free from an undesired divergence, and leads to various approximate expressions used in the literature in the limit of small impurity concentration or strong magnetic field. (18 refs.)

102435 Population inversion due to separate shift and heating of light and heavy holes in semiconductors. Yu.K.Pozhela, E.V.Starikov, P.N.Shiktorov (Semiconductor Phys. Inst., Acad. of Sci., Lithuanian SSR).
Phys. Lett. A (Netherlands), vol.96A, no.7, p.361-4 (18 July 1983).
A new model for hole-population inversion insensitive to low-temperature optical-phonon scattering is proposed. The differences of hole temperatures and the separate shift of their distribution functions in momentum space are shown to be sufficient for the population inversion at a certain momentum. Thus, population inversion is also possible at room temperature, which is confirmed by Monte Carlo calculations for p-type Ge in crossed E and B fields. (13 refs.)

102436 Fractional quantization of Hall conductance. R.Tao, D.J.Thouless (Dept. of Phys., Univ. of Washington, Seattle, WA, USA).
Phys. Rev. B (USA), vol.28, no.2, p.1142-4 (15 July 1983).
It is shown how the correlation energy of a system of two-dimensional electrons in a strong magnetic field may be enhanced if the electrons are in a regular array of the Landau orbitals. This gives an energy gap if the proportion ν of occupied orbitals is a simple fraction without giving rise to charge-density waves which may pin the system. The gap is determined self-consistently. Such a state can give rise to the plateaux in the Hall conductance observed at fractional multiples of e^2/h. (12 refs.)

102437 Electrical properties of low-compensation GaAs. D.C.Look (Univ. Res. Center, Wright State Univ., Dayton, OH, USA), P.C.Colter.
Phys. Rev. B (USA), vol.28, no.2, p.1151-3 (15 July 1983).
Recently the authors have reproducibly grown vapor-phase epitaxial GaAs, with less than 10% compensation, in an $AsCl_3$-Ga-H_2 reactor. The low-temperature electrical properties of such samples are quite interesting, with neutral-impurity scattering and screening being much more important than usual. The Hall mobility is typically above 10^5 cm^2/V sec at 5K and has two maxima as a function of temperature, the usual one near 50K and another near 9K. The latter phenomenon has not been observed before, to the authors' knowledge. The mobility and carrier concentration temperature dependences for a low-compensation sample and a normal-compensation sample are theoretically fitted to determine the donor and acceptor concentrations. The low-compensation sample has $N_A/N_D=0.06\pm0.03$. (14 refs.)

102438 Quantized Hall conductance in a relativistic two-dimensional electron gas. A.H.MacDonald (Eidgenossische Tech. Hochschule Honggerberg, Zurich, Switzerland).
Phys. Rev. B (USA), vol.28, no.4, p.2235-6 (15 Aug. 1983).
The formula for the quantized Hall conductance in a two-dimensional electron gas is often derived by solving the Schrodinger equation for an electron in crossed electric and magnetic fields, and taking the expectation value of the current operator in its eigenstates. In this report the author demonstrates explicitly, by using the Dirac equation, that there are no relativistic corrections to this expression, at least in the ideal case. This is true even if the drift velocity of the electrons approaches the speed of light or the Landau level splitting approaches the electron rest-mass energy and holds despite the appearance of a classical correction to the cyclotron frequency. (16 refs.)

102439 Remarks on the Laughlin theory of the fractionally quantized Hall effect. P.W.Anderson (Bell Labs., Murray Hill, NJ, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2264-5 (15 Aug. 1983).
An extension of the Laughlin theory of the anomalous quantum Hall effect to allow for integer numerators for the occupation fraction is proposed. (3 refs.)

102440 The quantized Hall effect. H.L.Stormer (Dept. of Electronic & Optical Properties of Solids, Bell Labs., Murray Hill, NJ, USA).
Science (USA), vol.220, no.4603, p.1241-6 (17 June 1983).
Quantization of the Hall effect is one of the most surprising discoveries in recent experimental solid-state research. At low temperatures and high magnetic fields the ratio of the Hall voltage to the electric current in a two-dimensional system is quantized in units of h/e^2, where h is Planck's constant and e is the electronic charge. Concomitantly, the electrical resistance of the specimen drops to values far below the resistances of the best normal metals. (16 refs.)

102441 Capacitance oscillations in quantized Hall effect. J.Bok, M.Combescot (Groupe de Phys. des Solides, Ecole Normale Superieure, Paris, France).
Solid State Commun. (USA), vol.47, no.8, p.611-13 (Aug. 1983).
The authors show that in the conditions where the quantized Hall effect is observed, capacitance oscillations of the junction should be present. A comparison between the plateaux of Hall resistance and the amplitude of the capacitance oscillations gives the amount of localized states in the two-dimensional electron gas. (8 refs.)

102442 Inductive coupling caused by Hall eddy currents in a semiconductor cylinder. J.Pozela, R.Tolutis, T.Ebersonas, Z.Jankauskas (Inst. of Semiconductor Phys., Acad. of Sci., Lithuanian SSR).
Sov. Phys.-Collect. (USA), vol.22, no.2, p.39-44 (1982). Translation of: *Litov. Fiz. Sb. (USSR)*, vol.22, no.2, p.50-6 (1982).
A theoretical determination is presented of the inductive coupling between crossed inductance coils, due to an isotropic semiconductor core in the form of a cylinder in a constant magnetic field. It is shown that this coupling, as in the case of a core in the form of a thin semiconductor plate, is related in fairly simple fashion to the electrical parameters of the semiconductor. The theoretical calculations are confirmed experimentally. It is shown that it is possible to measure the mobility of charge carriers in the cylindrical specimen. (3 refs.)

Size effects in thin films ....See Entry 98674

Cryostat for combined investigation of kinetic and photoelectrical properties of semiconductors within the range from 2 to 650K ....See Entry 99111

Zn incorporation in $Ga_{1-x}Al_x$ As grown by liquid phase epitaxy and its electrical properties ....See Entry 101728

Impurity compensation in $Ga_{1-x}Al_xAs$ alloys ....See Entry 101739

Studies on electronic processes in graphite during the last decade in Japan ....See Entry 102248

Fractional quantization of the Hall effect: a hierarchy of incompressible quantum fluid states ....See Entry 102280

Investigation of impurity levels in n-type indium selenide by means of Hall effect and deep level transient spectroscopy .... See Entry 102300

Defect states in plastically deformed *p*-type silicon crystals investigated by the Hall effect .... See Entry 102305

The quantum Hall effect. II .... See Entry 102337

Basic issues in electronic conduction in amorphous semiconductors. II. Electronic transport properties .... See Entry 102369

Variable-range-hopping conduction in a strong magnetic field .... See Entry 102386

Hole transport in pure and doped GaAs .... See Entry 102414

Valley splitting on tilted Si(100) surfaces .... See Entry 102479

Quantum oscillations in strained-layer superlattices .... See Entry 102503

Hall mobility in undoped microcrystalline Si:H,Cl films .... See Entry 102527

Electrical and structural properties of pulse laser-annealed polycrystalline silicon films .... See Entry 102528

Magnetoresistance thickness dependence of n-InSb .... See Entry 102540

Electrical conductivity, structure and Hall effect measurements of InSe films .... See Entry 102543

Optical and electrical properties of RF-sputtered indium-tin oxide films .... See Entry 102976

72.20N Thermomagnetic effects

Cryostat for combined investigation of kinetic and photoelectrical properties of semiconductors within the range from 2 to 650K .... See Entry 99111

The galvano and the thermomagnetic effects in semiconductors for the scattering of the charge carriers on the polar optical phonons .... See Entry 102431

72.20P Thermoelectric effects

102443 The transition metal influence on some physical properties of $Sn_{1-x}Mn_xTe$ (where Me=Mn, Cr, Fe, Ni, Co) alloys. M.A.Alidzhanov, I.R.Gurbanov, M.G.Saidov, K.Dovletov, A.P.Gurshumov.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.5, p.103-5 (1982). In Russian.
The influence of partial tin replacement with the transition metals Me (M=Mn Cr, Fe, Ni, Co) on physical properties of SnTe was researched for the first time. It is determined, that in all five replacements the maximum thermo-EMF is discovered at a $x=0.02$ composition, but further increase of the content in solid solutions leads to the decrease of thermo-EMF monotonously, that can be explained by decrease of the Fermi energy. A similar regularity is discovered in the current carrier concentration dependencies on the composition at room temperature. (7 refs.)

Cryostat for combined investigation of kinetic and photoelectrical properties of semiconductors within the range from 2 to 650K .... See Entry 99111

Structure and electronic properties of molten $TlAsSe_2$ .... See Entry 101525

Tetramethyldithiadiselenafulvalene (TMDTDSF): properties of its hexafluorophosphate salt and alloys with tetramethyltetraselenafulvalene .... See Entry 101681

Thermoelectric power of graphite intercalation compounds .... See Entry 102342

Basic issues in electronic conduction in amorphous semiconductors. II. Electronic transport properties .... See Entry 102369

Determination of the equilibrium $US_{2\alpha} \rightleftarrows US_{2\beta}$ and variations of the electrical properties of these two sulfides as function of sulfur pressure between 600 and 1000°C .... See Entry 102375

Thermodynamic derivation of the Hall current and the thermopower in quantising magnetic field .... See Entry 102433

Preparation and properties of $La_{1-x}CoO_3$ ($0.2 \leq x \leq 0.6$) .... See Entry 102470

Thermoelectric power in InAs films obtained by flash evaporation .... See Entry 102538

72.30 HIGH-FREQUENCY EFFECTS; PLASMA EFFECTS

102444 Transport properties of highly excited semiconductors. G.Mahler (Inst. fur Theoretische Phys., A. Forchel, Univ. Stuttgart, Stuttgart, Germany).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.875-80 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
It is shown that under specific stationary excitation conditions in surface excited semiconductors, spatial regions of 'inverse diffusion' may be created, in which the particle-hole current flows in the direction of increasing density. The cross-over to normal diffusion is directly related to experimental observations. (5 refs.)

102445 The quantum magnetic size effect in cylindrical conductors. S.S.Nedorezov (Phys.-Tech. Inst. of Low Temperatures, Acad. of Sci., Kharkov, Ukrainian SSR).
Phys. Lett. A (Netherlands), vol.96A, no.8, p.417-18 (25 July 1983).
Quantum magnetic size oscillations of the electron characteristics of cylindrical conductors are associated with the Fermi surface anisotropy. The oscillations predicted may be a source of important information of the electron energy spectrum of conductors. (3 refs.)

102446 Optical properties of fast-diffusion solid-state plasmas. A.Forchel, H.Schweizer (Phys. Inst., Univ. Stuttgart, Stuttgart, Germany), G.Mahler.
Phys. Rev. Lett. (USA), vol.51, no.6, p.501-4 (8 Aug. 1983).
Transmission and emission spectra of fast-diffusing nonequilibrium electron-hole plasmas in semiconductors are calculated with use of displaced Fermi distributions. The carrier drift significantly alters the plasma spectra and removes previously reported incomprehensible discrepancies between experimental and theoretical plasma parameters, indicating the necessity to reinterpret entirely the spectroscopic data from nonequilibrium plasmas. (16 refs.)

102447 Phenomenological theory of drift characteristics and high-frequency mobility of superlattices. V.A.Malyshev (Tagan Rog Radiotech. Inst., USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.9, p.779-82 (Sept. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.9, p.1080-4 (Sept. 1982).
In the framework of one-dimensional phenomenological analysis of the drift and heating equations in the limits of the miniband, the author obtains and analyzes the relations which determine, in a generalized form, the drift characteristic and the complex high-frequency small-signal mobility of superlattices, without specifying the dispersion law. (8 refs.)

Cohesive Properties of Semiconductors under Laser Irradiation. Proceedings of the NATO Advanced Study Institute .... See Entry 98653

Size effects in thin films .... See Entry 98674

Carrier dependent parameters in a silicon optical waveguide . See Entry 100888

Picosecond time-resolved detection of plasma formation and phase transitions in silicon .... See Entry 101765

Femtosecond time resolved reflectivity of optically excited silicon .... See Entry 101766

Instability of the electron-hole plasma and its possible relation with melting .... See Entry 101770

Thermodiffusion—a new approach to plasma self-confinement .... See Entry 101777

Calculation of electronic specific heat by the collective electron oscillations in metals and their different phases .... See Entry 101996

Exact high-frequency theory of surface plasmas .... See Entry 102281

Propagation of strong electromagnetic waves in Kane semiconductors .... See Entry 102398

Inversion of hot carriers in Landau levels .... See Entry 102404

Space-charge waves in multilayered heterostructures .... See Entry 102499

Collective oscillations in the X-ray absorption spectrum of beryllium .... See Entry 102994

72.40 PHOTOCONDUCTION AND PHOTOVOLTAIC EFFECTS; PHOTODIELECTRIC EFFECTS

102448 Photovoltaic effect in sensitized crystal violet dyes. G.D.Sharma, A.K.Tripathi, S.C.Mathur, D.C.Dube (Dept. of Phys., Indian Inst. of Technol., New Delhi, India).
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.433-6 (Aug. 1983).
The authors studied the photovoltaic effect in sensitized and pure crystal violet dye using conducting glass/sensitizer/dye/metal electrode systems. It is shown that the carrier generation during photoexcitation takes place at the dye-sensitizer contact. (6 refs.)

102449 About negative residual photoconductivity of indium-selenide single crystals. A.Sh.Abdinov, Ya.G.Gasanov.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.4, p.80-4 (1982). In Russian.
The spectral distribution, temperature, light intensity and field dependence of negative residual photoconductivity in indium-selenide single crystals are investigated. The results are explained on the basis of two-barrier models. (9 refs.)

102450 Some peculiarities of V-A characteristics of selenium single crystals under illumination. A.I.Isaev, D.Sh.Abdinov.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.5, p.78-82 (1982). In Russian.
Volt-ampere characteristics of hexagonal selenium single crystals at 77K illuminated by light of various intensity and wavelength were experimentally investigated. It is discovered, that the illumination of the samples with the light of 0.64-0.78 μm wavelength leads to generation of low frequency current, when a constant electric field applied to sample exceeds some critical value. (8 refs.)

102451 Temperature dependent light induced conductivity changes in hydrogenated amorphous silicon. Jin Jang (Dept. of Phys., Kyung Hee Univ., Seoul, Korea), Choochon Lee.
J. Appl. Phys. (USA), vol.54, no.7, p.3943-50 (July 1983).
The light induced changes for undoped and phosphorus doped hydrogenated amorphous silicon films deposited by DC glow discharge decomposition have been studied. It is observed that the conductance change after illumination is large for the undoped films deposited near the cathode, and deposited with high silane flow rate. The 0.1%-0.5% phosphorus doped samples show the increase of dark- and photoconductance after illumination. The rate of dark- and photoconductance change are observed to be accelerated as the temperature during the illumination is elevated. The activation energies for the recovery of the conductance changes are observed to be 1.5 and 1.0 eV for undoped and 0.1% phosphorus doped films, respectively. The field effect measurements for 0.1-μm-thick undoped *a*-Si:H film before and after the illumination show that the gap state density is not changed after illumination. The results are explained on the basis of material heterogeneity. The trapping regions, considered to be contained in tissue, should be assumed to exist in the material to explain the results. The transfer of electrons (or holes for *p* type samples) between islands and the trapping regions give rise to the light induced changes in conduction. (25 refs.)

102452 Magnetic-impurity oscillations in gallium arsenide. V.N.Zverev (Inst. of Solid State Phys., USSR).
JETP Lett. (USA), vol.37, no.2, p.109-12 (20 Jan. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.2, p.89-92 (20 Jan. 1983).
Oscillations that are periodic in the inverse magnetic field, which are due to inelastic scattering of electrons by neutral excited donors, were observed while studying low-temperature photoconductivity of *n*-GaAs. (4 refs.)

102453 The influence of triazaindolisine on the microwave photoconductivity of AgBr emulsion grains. F.Callens, W.Maenhour-Van Der Vorst (Lab. voor Kristallografie en Studie van de Vaste Stof, Rijksuniversiteit Gent, Gent, Belgium).
Phys. Status Solidi a (Germany), vol.78, no.1, p.K47-52 (16 July 1983).
Triazaindolisine (TAI) is a well-known stabilizing agent in photography. The role of a stabilizer is to retard sensitometric change during storage. The authors report on photoconductivity measurements of AgBr emulsions with and without addition of TAI. The difference between the (100) and (111) orientation, and the interaction between the ionic conductivity and the photoconductivity is confirmed. (7 refs.)

102454 Intramolecular charge transfer complexes. XXI. Photoconductivity in N(2-hydroxyethyl) carbazolyl methacrylate-methacryloyl-β-hydroxyethyl-3,5-dinitrobenzoate copolymers. C.I.Simionescu, V.Barboiu, M.Grigoras ('P.Poni' Inst. of Macromolecular Chem., Jassy, Rumania).
Polym. Bull. (Germany), vol.9, no.10-11, p.537-42 (April 1983).
The photoconductivity was studied on donor-acceptor copolymers of various compositions. The measurements were carried out on pellet samples in which the charge carriers were continuously injected by a shallow illumination with a xenon lamp. It was found that the photoconductivity decreases with the

acceptor unit content increase, two relative maxima being however evidenced at 25-35% and 60-70% respectively. It was supposed that the two maxima are due to the dependence of the drift mobility on the copolymer composition. It was observed that the polarity of voltage applied across the samples has a minor effect on the conductivity measurements. (9 refs.)

102455 Photoconductivity and dark conductivity of hydrogenated amorphous silicon. W.Beyer (Institut fur Grenzflachenforschung und Vakuumphysik, Kernforschungsanlage Julich, Julich, Germany), B.Hoheisel.
Solid State Commun. (USA), vol.47, no.7, p.573-6 (Aug. 1983).
The study of plasma-deposited hydrogenated amorphous silicon films prepared in various deposition systems and under the use of different gases (SiH_4, SiD_4, Si_2H_4) shows a unique correlation between the photoconductivity and the dark conductivity of undoped and lightly doped films grown under optimized conditions. Deviations from this relation occur at high doping levels, in particular for boron doping, as well as upon annealing. They are attributed to an increased density of gap states due to hydrogen depletion. (27 refs.)

102456 Exciton-induced photoemission from extrinsic surface states: NaI. L.Ernst (Kaliforschungs-Inst., Kali und Salz AG, Hannover, Germany).
Surf. Sci. (Netherlands), vol.130, no.1, p.155-62 (July 1983).
Spectral photocurrents emitted by NaI(001) crystal faces subsequent to air and ultrahigh vacuum cleavage have been measured in the near-ultraviolet excitation region at room temperature. On the air-cleaved face, on which a hydrate layer forms, a broad surface state band exists within the energy gap with an upper edge at about 3.5 eV below the vacuum level. In general the major part of the states are empty, but may be filled by illuminating the sample at a wavelength corresponding to the lowest exciton peak: excitons can decay by dissociation at the surface, populating empty surface states. The excitons may also release photoelectrons, presumably from imperfections of the crystal samples used in the experiments. These photoelectrons lead to an enhancement of the photocurrent at $h\nu > 5.1$ eV. (14 refs.)

102457 Models of photogeneration in amorphous selenium. V.J.Gaidelis (Vilnius Sci. Res. Inst. of Electrography, Vilnius, Lithuanian SSR).
Sov. Phys.-Collect. (USA), vol.22, no.2, p.82-7 (1982). Translation of: *Litov. Fiz. Sb. (USSR)*, vol.22, no.2, p.109-16 (1982).
A comparison is made of the available experimental data regarding the photogeneration quantum yield in amorphous Se in amorphous Se with two theoretical models: the Onsanger model and the jump photogeneration model. It is shown that the experimental data for amorphous Se obtained by condensation onto cold substrates (20°C) in the region of fields less than 5×10^4 V/cm are not in agreement with the Onsanger model in either the case of an initial pair distribution characterized by one value of the initial distance between carriers or the case of exponential pair distribution with respect to distances. Analytic expressions are obtained for the quantum yield as a function of field strength for the jump model of photogeneration. It is shown that the jump model is in good agreement with the experimental data over the entire range of fields investigated, at exciting light wavelengths from 450 to 620 nm. (13 refs.)

102458 Light-induced effects in amorphous silicon material and devices. D.E.Carlson, A.R.Moore, D.J.Szostak, B.Goldstein, R.W.Smith, P.J.Zanzucchi, W.R.Frenchu (RCA Labs., Princeton, NJ, USA).
Sol. Cells (Switzerland), vol.9, no.1-2, p.19-23 (June-July 1983).
The authors have studied the stability of hydrogenated amorphous silicon (a-Si:H) using several new techniques such as diffusion length measurements, photovoltage profiling and IR absorption via multiple internal reflections. They find that prolonged illumination generally causes a decrease in the diffusion length and an increase in the space charge density of undoped a-Si:H films. (9 refs.)

102459 Staebler-Wronski effects in hydrogenated amorphous $Si_{1-x}Ge_x$. G.Nakamura, K.Sato, Y.Yukimoto (Semiconductor Res. & Dev. Dept., Mitsubishi Electric Corp., Itami, Japan).
Sol. Cells (Switzerland), vol.9, no.1-2, p.75-84 (June-July 1983).
Photo-induced defects in hydrogenated amorphous silicon (a-Si:H) and hydrogenated amorphous $Si_{1-x}Ge_x$ (a-$Si_{1-x}Ge_x$:H) created by prolonged light exposure and their effect on opto-electronic properties are studied. The nearly constant carrier lifetime in a-$Si_{1-x}Ge_x$:H with increasing germanium content shows that the states created by germanium dangling bonds in as-deposited a-$Si_{1-x}Ge_x$:H are situated near midband and that the spread of their distribution within the band gap may be small compared with that of the photoinduced metastable defect states. A relatively small Staebler-Wronski effect is observed in a-Si_{1-xGx}:H. However, the density of photoinduced states in a-$Si_{1-x}Ge_x$:H is of about the same order of magnitude as that in a-Si:H. The reason for this seems to be that the large density of states created by germanium dangling bonds masks the effect of light-induced defects. (15 refs.)

102460 The effect of light soaking on the low temperature photoconductivity of hydrogenated amorphous silicon. P.E.Vanier (Div. of Metall. & Materials Sci., Brookhaven Nat. Lab., Upton, NY, USA).
Sol. Cells (Switzerland), vol.9, no.1-2, p.85-93 (June-July 1983).
Exposure of intrinsic and lightly doped glow discharge hydrogenated amorphous silicon to white light at an intensity of about 100 mW cm^{-2} for several hours (light soaking) induces changes in the temperature dependence of the photoconductivity. These changes which can be reversed by heating to 200°C are different for samples with different Fermi levels E_F but can in each case be explained by an increase in the density of states in the lower half of the gap. These states are different from the states 1 and 2 previously inferred from the temperature dependence of the photoconductivity. For E_F near midgap, no increase in the density of dangling bonds is seen after light soaking. The behavior of slightly n-type samples can be explained by shifts of E_F and the resulting changes in occupation of existing dangling bonds. In p-type samples, increased recombination probably occurs through the light-induced states, which are not dangling bonds. (14 refs.)

102461 The interpretation of photoconductivity measurements in hydrogenated amorphous silicon. W.Pickin (Inst. de Investigaciones en Materiales, Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
Sol. Cells (Switzerland), vol.9, no.1-2, p.95-111 (June-July 1983).
A theory of steady state photoconductivity in trap-dominated materials is formulated in terms of a recombination rate that is an integral of Shockley-Read terms and a global charge neutrality condition that involves the occupation statistics of hole and electron traps. Application of the theory to hydrogenated amorphous silicon is complicated by lack of necessary data, especially on transition rates between band and trap, and various assumptions for these are used to derive the recombination rate. Weak assumptions for the transition rates, coupled with asymmetry in the gap density of states in this material, lead to a simple description of the electron trap statistics. This simplicity allows a relationship to be established between the photoconductive response time and the gap density of states. Various experiments on photoconductivity and its response time are analysed in these terms. Possible origins for light-induced changes in photoconductivity in hydrogenated amorphous silicon are considered. (21 refs.)

102462 Origin of the photo-induced changes in hydrogenated amorphous silicon. D.Adler (Dept. of Electrical Engng. & Computer Sci., MIT, Cambridge, MA, USA).
Sol. Cells (Switzerland), vol.9, no.1-2, p.133-48 (June-July 1983).
The electronic properties of hydrogenated amorphous silicon films are discussed in detail. Particular attention is paid to the changes induced by photogeneration of excess free carriers. Previous models which have been proposed to account for such effects are classified and criticized. An alternative explanation, which is based on the unique electronic structure of hydrogenated amorphous silicon, is proposed and analyzed. In this model, no new defects are created by the light, but rather the photo-induced effects follow from a metastable trapping of the excess free carriers at charged spinless defects which are present at equilibrium. (45 refs.)

102463 Optoelectronic characterization of undoped amorphous silicon thermistor. M.Sameh Said (Dept. of Electrical Engng., Univ. of Toledo, Toledo, OH, USA).
23rd Midwest Symposium on Circuits and Systems, Toledo, OH, USA, 4-5 Aug. 1980 (North Hollywood, CA, USA: Western Periodicals 1980), p.238-41
Photoconductive studies are linked with electrical conductivity measurements in forming a transport model in a-Si bulk conductor. Reproducibility tests show its validity as a thermistor up to 70°C. (29 refs.)

102464 On the spectral response of undoped amorphous silicon photoconductor. M.Sameh Said (Dept. of Electrical Engng., Univ. of Toledo, Toledo, OH, USA).
23rd Midwest Symposium on Circuits and Systems, Toledo, OH, USA, 4-5 Aug. 1980 (North Hollywood, CA, USA: Western Periodicals 1980), p.242-5
The absorption edge of amorphous silicon is studied by using the spectral photoconductivity technique in different sets of silane pressure. Increased silane pressure shifts the absorption edge to higher energy. A physical explanation of this result is presented. (23 refs.)

Cryostat for combined investigation of kinetic and photoelectrical properties of semiconductors within the range from 2 to 650K ...... See Entry 99111

Integrated-optics photodetector utilizing the external photoelectric effect in a Schottky barrier ...... See Entry 99189

Relaxation processes in emulsion microcrystals of silver halides with adsorbed dyes ...... See Entry 99221

A nondestructive method for predicting laser emission wavelength from photocurrent spectra of GaAlAs double heterostructure wafers ...... See Entry 100758

Composition of the general formula $Na_xLn_{1/3}Nb_{1-x}Ti_xO_3(0 \leq x \leq 2/3)$. Correlation between structural evolution and photoelectric properties ...... See Entry 101672

Measurement of grain boundary parameters by laser-spot photoconductivity ...... See Entry 101721

Photo-induced changes in the bulk density of gap states in hydrogenated amorphous silicon associated with the Staebler-Wronski effect ...... See Entry 102246

Optical instabilities and localized electronic states in hydrogenated amorphous silicon ...... See Entry 102299

Optical experiments on deep centers in semiconductors ...... See Entry 102303

The interpretation of the electric and optical properties of a-Si:H films produced by RF glow discharge through dark conductivity, photoconductivity and pulse controlled capacitance-voltage measurements ...... See Entry 102381

Poole-Frenkel centres in dielectrics. Kind and space density in plasma-polymerized organosilicon films ...... See Entry 102405

Theory of electron-hole kinetics in amorphous semiconductors under illumination: application to solar cells ...... See Entry 102412

Numerical approach to non-equilibrium carrier relaxation in picosecond and subpicosecond physics ...... See Entry 102417

Comparative study of surface acoustic wave and photocurrent spectroscopies in GaP ...... See Entry 102466

Dark relaxation of surface charge of an organic photosemiconducting layer ...... See Entry 102488

Peripheral photoresponse of a *p-n* junction ...... See Entry 102500

Photoelectrochemical study of $(Ti,V)O_2$ and $(Ti,Nb)O_2$ alloys ...... See Entry 102504

Comparison of photoelectrochemical properties of n-TiO_2 films obtained by different production methods ...... See Entry 102506

Grain boundary phenomena in n-type CdTe films grown by hot wall vacuum evaporation ...... See Entry 102533

Currents generated in pyroelectrics by γ irradiation ...... See Entry 102825

Magneto-optical response of f- and d-states in uraniummonosulfide ...... See Entry 102856

Stability of p-i-n hydrogenated amorphous silicon solar cells to light exposure ...... See Entry 103690

Light-induced effects in indium tin oxide/n-i-p hydrogenated amorphous silicon solar cells ...... See Entry 103691

Light-induced instability of amorphous silicon photovoltaic cells ...... See Entry 103692

Effects of optical stress on the properties of sputtered amorphous silicon solar cells and thin films ...... See Entry 103693

Analysis of photoinduced changes in the performance of amorphous silicon solar cells ...... See Entry 103694

Properties of the defect causing solar cell degradation ...... See Entry 103695

72.50 ACOUSTOELECTRIC EFFECTS

102465 Acoustic second harmonic generation in piezoelectric semiconductors: Effect of nonuniform electric field intensity. P.Palanichamy, S.P.Singh (Phys. Dept., Indian Inst. of Technol., New Delhi, India).
J. Appl. Phys. (USA), vol.54, no.7, p.3958-64 (July 1983).
Acoustic second harmonic generation is studied theoretically in nondegenerate piezoelectric semiconductors in the presence of DC electric field longitudinal to the direction of propagation of the acoustic wave. The static electric-field intensity and the carrier concentration inside the semiconductor are taken as nonuniform even in trap-free samples. This assumption used in the authors' theory modifies the results obtained by the earlier theories considerably. It is also found that the power thus calculated for the second harmonic flux in terms of the power associated with the fundamental flux is enhanced. Comparison with the available experimental results shows a qualitative agreement. The authors have used the phenomenological theory and that restricts their analysis to the low frequency region. (17 refs.)

102466 Comparative study of surface acoustic wave and photocurrent spectroscopies in GaP. I.J.Fritz (Sandia Nat. Labs., Albuquerque, NM, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4457-62 (Aug. 1983).
Optical-excitation spectra of several GaP samples have been obtained using transverse acoustoelectric spectroscopy in the separated-medium surface-wave configuration. The results are compared with data obtained on the same samples using photocurrent spectroscopy of Au Schottky-barrier diode structures. Despite differences in the two measurement techniques, the observed spectral features are quite similar, and these features are in good agreement with photocurrent, photoconductivity, surface-wave and optical-absorption data in the literature. Both techniques are useful for probing the near-surface properties of semiconductors. However, the surface-wave technique, which is newer and less widely utilized, has an advantage in not requiring electrical contact to the sample. The surface-wave technique thus can provide quick, nondestructive characterization of photoexcitation processes in epitaxial layers and surface-modified regions of semiconductors. (14 refs.)

102467 Transverse acousto-EMF as a function of acoustically stimulated adsorption on the surface of a semiconductor. A.J.Jucys, R.N.Giriuniene, E.P.Garska (Kapsukas Vilnius State Univ., Vilnius, Lithuanian SSR).
Sov. Phys.-Collect. (USA), vol.22, no.2, p.77-81 (1982). Translation of: *Litov. Fiz. Sb. (USSR)*, vol.22, no.2, p.102-8 (1982).
In a laminar-$LiNbO_3$-CdS structure with a gap, the acoustically stimulated adsorption of electron-acceptor particles from the gas phase on the surface of semiconductor CDS has been investigated. By measuring the transverse acousto-EMF, contact-free monitoring by means of acoustic surface waves (ASW) of the evolution of the electrical properties (conductivity, photosensitivity, capacitance) of the CdS surface in the process of acoustically stimulated adsorption is possible. Measurements of the behavior of the transverse acousto-EMF establish that the ASW in a mode of continuous generation (CG) alter the adsorption rate, the adsorptivity of the surface, and the relationship between the reversible and irreversible forms of chemisorption. It is shown that acoustically stimulated adsorbed promotes a substantial change in the surface conductivity, photosensitivity, and surface capacitance. The results are explained on the basis of the electron theory of chemisorption and acoustoelectronics. (11 refs.)

72.55 MAGNETOACOUSTIC EFFECTS

102468 Size magnetoacoustic effect for shear waves in metals. V.M.Gokhfel'd, V.G.Peschanskii (Physicotech. Inst., Acad. of Sci., Donetsk, Ukrainian SSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1066-9 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A calculation is made of the absorption coefficient Γ of a transverse acoustic wave propagating across a thin ($0 \leq z \leq d$) metal film along the direction of an external magnetic field H. The relative magnitude of the oscillations of $\Gamma(H,d)$ is considerably greater than in the case of longitudinal acoustic vibrations and, together with the smooth part of Γ, it rises steeply under conditions of acoustic generation of a helical electromagnetic wave. (7 refs.) *A.T.*

72.60 MIXED CONDUCTIVITY AND CONDUCTIVITY TRANSITIONS

102469 Electrical conductivity and high resolution electron microscopy studies of WO_{3-x} crystals with $0 \leq x \leq 0.28$. W.Sahle, M.Nygren (Dept. of Inorganic Chem., Univ. of Stockholm, Stockholm, Sweden).
J. Solid State Chem. (USA), vol.48, no.2, p.154-60 (1 July 1983).
WO_{3-x} crystals with $0 \leq x \leq 0.28$ have been studied by means of HREM and electrical conductivity measurements. Semiconducting behavior with and E_a of the order 0.06 eV was observed for crystals which, according to the HREM study, contained {102} *CS* planes ($x \simeq 0.03$). Plots of conductivity vs. $1/T$ for WO_3 and WO_{3-x} containing disordered {102} *CS* planes are also presented. Metallic behavior was found for crystals with ordered {103} *CS* planes ($x \simeq 0.11$), for $W_{12}O_{34}$ ($x=0.167$), and for $W_{18}O_{49}$ ($x=0.28$). (26 refs.)

102470 Preparation and properties of $La_{1-x}CoO_3$ ($0.2 \leq x \leq 0.6$). I.F.Kononyuk, S.P.Tolochko, V.A.Lutsko, V.M.Anishchik (Inst. for Phys. & Chem. Res., Byelorussian State Univ., Minsk, USSR).
J. Solid State Chem. (USA), vol.48, no.2, p.209-14 (1 July 1983).
The preparatory conditions for the oxide compositions $La_{1-x}Ca_xCoO_{3-\delta}$ have been determined along with their crystallographic, thermochemical, and electrical properties. Single phase solid solutions of the perovskite structure form at $x<0.6$. It has been established that the compounds obtained in the open air atmosphere are oxygen deficient, the deficit increasing with x and temperature. The specific resistivity at $x=0.2$-0.6 is $(1\text{-}2) \times 10^{-3}$ ohm.cm; it increases with the concentration of oxygen vacancies. At $0.3 \leq x \leq 0.6$ the *p*-type conductivity is metallic in character with low temperature resistivity coefficients of the order $(1\text{-}5) \times 10^{-4}$ K^{-1} in the interval 20-700°C. (13 refs.)

102471 Effect of hydrogen pressure on the nature of the conductivity of solid lithium hydride. V.B.Ptashnik, T.Yu.Dunaeva, Yu.M.Baikov (A.F. Ioffe, Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Electrochem. (USA), vol.18, no.10, p.1186-90 (Oct. 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.10, p.1335-9 (Oct. 1982).
The component conductivities in the electrolysis of solid lithium hydride have been determined in the 200-680°C temperature range. The transference number of the ions has been obtained as a function of temperature. In the low-temperature region, p-type conductivity predominates; n-type predominates in the high temperature region. The kinetics of hydrogen absorption by lithium hydride in the absence of a current was determined by the reaction of gas phase hydrogen with a thin film of metallic lithium. (16 refs.)

Tetramethyldithiadiselenafulvalene (TMDTDSF): properties of its hexafluorophosphate salt and alloys with tetramethyltetraselenafulvalene .... See Entry 101681

Electrical switching effects in Na_2O/SiO_2 glasses .... See Entry 102044

Superionic conduction in the solid-solution electrode $AgCrS_2$ .... See Entry 102051

The metal insulator transition in two-dimensional systems with charged impurities .... See Entry 102263

Shallow donors in CdF_2 crystals and the semiconductor-insulator transition in mixed $Cd_{x-1}Me_xF_2$ fluorites .... See Entry 102315

Pressure-temperature phase diagrams of several $(TMTTF)_2X$ compounds: stabilisation of a highly conducting metallic state under pressure in $(TMTTF)_2Br$ .... See Entry 102362

Effect of defects on phase transitions in tetraselenotetracene chloride, $(TSeT)_2Cl$ .... See Entry 102364

Experiment and theory for switching in $Al/V_2O_5/Al$ devices .... See Entry 102518

Electrical characteristics of contact of polycrystalline and monocrystalline silicon films with the same type of conductance .... See Entry 102529

Electrical properties of polystyrene doped with leucomalachite green for correlation with its electrothermographic behaviour .... See Entry 102802

72.70 NOISE PROCESSES AND PHENOMENA

102472 Thermal noise in insulator diode with traps lying below the Fermi level under CDDM regime. V.S.Raghav, Y.K.Sharma, C.S.Agarwal (Dept. of Phys., RBS Coll., Agra, India).
Curr. Sci. (India), vol.52, no.9, p.404-7 (5 May 1983).
The effects of space charge and traps on the thermal noise in one carrier insulator diode with traps lying below the Fermi level have been studied using the regional approximation method. The mobility of the current carriers is proportional to the carrier density. The noise is highly suppressed by the space charge present in the device. (12 refs.)

102473 Two-point correlations of diffusion noise sources of hot carriers in semiconductors. J.P.Nougier, J.C.Vaissiere, C.Gontrand (Centre d'Electronique de Montpellier, Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
Phys. Rev. Lett. (USA), vol.51, no.6, p.513-16 (8 Aug. 1983).
The authors show that, contrary to the usual assumption, the local noise sources at two different points are not uncorrelated, but indeed are correlated over short distances, of the order of magnitude of a fraction of a micrometer. The two-point correlation function is expressed for hot carriers in semiconductors when randomizing scatterings are involved. The expression of the frequency-dependent diffusion coefficient for hot carriers is given as an explicit integral form involving the distribution function. (8 refs.)

102474 Noise spectroscopy in amorphous silicon films. J.C.Anderson (Dept. of Electrical Engng., Imperial Coll. of Sci. & Technol., London, England).
Philos. Mag. B (GB), vol.48, no.1, p.31-45 (July 1983).
Electrical noise due to trapping and detrapping of electrons in hydrogenated a-Si:H films is a potential source of information on trapping densities, energy and transport parameters. In this paper the noise signal is analysed by sampling, auto-correlation and Fourier transformation, in terms of 'noise spectroscopy'. Chemical rate theory has been used to derive 'attempt-to-escape' frequencies. For intrinsic films, values for the trap density and the temperature coefficient of the activation energy are obtained. For doped films, trap density, hopping activation energy and mobility values are obtained. Limited experimental results for an intrinsic and n-type film are reported and are found to be in fair agreement with values given in the literature. (13 refs.)

Physical kinetics of quantum electrodynamic $(1/\omega)$-noise .... See Entry 98961

72.80 CONDUCTIVITY OF SPECIFIC SEMICONDUCTORS AND INSULATORS

(see also 81.40R Electrical and magnetic properties related to materials treatment)

72.80C Elemental semiconductors

Carrier dependent parameters in a silicon optical waveguide . See Entry 100888

Oxygen-induced recombination centers in as-grown Czochralski silicon crystals .... See Entry 101737

IR laser-induced deposition of silicon thin films .... See Entry 102213

Energy-band distortion in highly doped silicon .... See Entry 102247

Optical instabilities and localized electronic states in hydrogenated amorphous silicon .... See Entry 102299

Optical experiments on deep centers in semiconductors .... See Entry 102303

Defect states in plastically deformed *p*-type silicon crystals investigated by the Hall effect .... See Entry 102305

Modeling of carrier mobility against carrier concentration in arsenic-, phosphorus-, and boron-doped silicon .... See Entry 102376

Highly doped sputtered amorphous silicon without hydrogen .... See Entry 102380

The interpretation of the electric and optical properties of a-Si:H films produced by RF glow discharge through dark conductivity, photoconductivity and pulse controlled capacitance-voltage measurements .... See Entry 102381

Electrical and optical properties of RF-SP a-Ge:O:(H) deposited from GeO_2 .... See Entry 102382

The energy relaxation time and electron temperature of hot electrons in n-Ge .... See Entry 102394

The relation between contact potential and planar conduction as a-Si:H films undergo gas adsorption or temperature changes .... See Entry 102400

Electrical properties of shallow implanted layers in silicon .... See Entry 102418

Aspects of *e-e-h* Auger recombination in silicon .... See Entry 102422

Some peculiarities of V-A characteristics of selenium single crystals under illumination .... See Entry 102450

Temperature dependent light induced conductivity changes in hydrogenated amorphous silicon .... See Entry 102451

Photoconductivity and dark conductivity of hydrogenated amorphous silicon .... See Entry 102455

Models of photogeneration in amorphous selenium .... See Entry 102457

Optoelectronic characterization of undoped amorphous silicon thermistor .... See Entry 102463

On the spectral response of undoped amorphous silicon photoconductor .... See Entry 102464

Noise spectroscopy in amorphous silicon films .... See Entry 102474

Valley splitting on tilted Si(100) surfaces .... See Entry 102479

Electrical conductivity of a low-temperature two dimensional medium .... See Entry 102486

Classical magnetoresistance of a two-dimensional electron gas in a one-dimensional superlattice .... See Entry 102487

Contact resistivity of TiN on p^+-Si and n^+-Si .... See Entry 102517

Hall mobility in undoped microcrystalline Si:H,Cl films .... See Entry 102527

Electrical and structural properties of pulse laser-annealed polycrystalline silicon films .... See Entry 102528

Electrical characteristics of contact of polycrystalline and monocrystalline silicon films with the same type of conductance .... See Entry 102529

Effects of controlled hydrogenation by ion implantation on the localized states in vacuum evaporated amorphous silicon .... See Entry 102530

Mechanism of dispersive transport in hydrogenated amorphous silicon .... See Entry 102531

Interpretation of DC characteristics of phosphorus-doped polycrystalline silicon films: conduction across low-barrier grain boundaries .... See Entry 102534

Laser-recrystallized polycrystalline silicon resistors for integrated circuit applications .... See Entry 102535

Influence of carbon addition on the electrical and structural properties of phosphorus and boron doped silicon layers .... See Entry 102536

Peculiarities of induced potential in silicon layers .... See Entry 102537

A study of the electrical and luminescence characteristics of a novel Si-based thin film electroluminescent device .... See Entry 102960

Light-induced effects in indium tin oxide/n-i-p hydrogenated amorphous silicon solar cells .... See Entry 103691

Light-induced instability of amorphous silicon photovoltaic cells .... See Entry 103692

Analysis of photoinduced changes in the performance of amorphous silicon solar cells .... See Entry 103694

On the effective minority carrier diffusion length of polycrystalline silicon solar cells .... See Entry 103700

Optimization of substrate thickness for interdigitated back contact silicon solar cells .... See Entry 103703

72.80E III-V and II-VI semiconductors

Contactless determination of the conductivity in semi-insulators .... See Entry 99131

Zn incorporation in $Ga_{1-x}Al_x$ As grown by liquid phase epitaxy and its electrical properties .... See Entry 101728

Impurity compensation in $Ga_{1-x}Al_xAs$ alloys .... See Entry 101739

Homogeneity of semi-insulating GaAs substrates for GaAs IC .... See Entry 101991

Epitaxial growth of $Hg_{0.7}Cd_{0.3}Te$ by laser-assisted deposition .... See Entry 102190

Effects of growth temperature and substrate orientation on the entry of tellurium into epitaxial gallium arsenide films .... See Entry 102209

DLTS investigation of electron traps in As-grown and Cd-fired CdS .... See Entry 102310

Resistivity and mobility of GaP at 300K .... See Entry 102377

Hole transport in pure and doped GaAs .... See Entry 102414

Effect of photoelectrochemical etching on charge collection efficiency in CdS: An electron beam induced current study .... See Entry 102415

Numerical approach to non-equilibrium carrier relaxation in picosecond and subpicosecond physics .... See Entry 102417

The galvano and the thermomagnetic effects in semiconductors for the scattering of the charge carriers on the polar optical phonons .... See Entry 102431

Hall effect studies in germanium doped $Al_xGa_{1-x}As$ .... See Entry 102432

Electrical properties of low-compensation GaAs .... See Entry 102437

Magnetic-impurity oscillations in gallium arsenide .... See Entry 102452

Comparative study of surface acoustic wave and photocurrent spectroscopies in GaP .... See Entry 102466

Transverse acousto-EMF as a function of acoustically stimulated adsorption on the surface of a semiconductor .... See Entry 102467

Laser annealed ohmic contact to n^+-GaAs .... See Entry 102505

Grain boundary phenomena in n-type CdTe films grown by hot wall vacuum evaporation .... See Entry 102533

Thermoelectric power in InAs films obtained by flash evaporation .... See Entry 102538

The influence of heating on the characteristics of the electron-excited conduction in gallium phosphide films .... See Entry 102539

Magnetoresistance thickness dependence of n-InSb .... See Entry 102540

Annealing behaviour of gamma-ray-induced electron traps in LEC *n*-InP .... See Entry 103180

In situ investigations of the metal-compound semiconductor interaction by mass spectrometry and electrical resistance measurements .... See Entry 103617

72.80G Transition-metal compounds

Contactless determination of the conductivity in semi-insulators .... See Entry 99131

DLTS investigation of electron traps in As-grown and Cd-fired CdS .... See Entry 102310

Electrical studies on $(Mo/W)Se_2$ single crystals. I. Electrical resistivity .... See Entry 102385

Impact ionization in rare earth doped CdF_2 crystals .... See Entry 102407

72.80J Other crystalline inorganic semiconductors

Studies on electronic processes in graphite during the last decade in Japan .... See Entry 102248

Investigation of impurity levels in n-type indium selenide by means of Hall effect and deep level transient spectroscopy .... See Entry 102300

Electronic conduction in lead oxides and at metal/oxide interfaces .... See Entry 102374

Determination of the equilibrium $US_{2\alpha}\rightleftarrows US_{2\beta}$ and variations of the electrical properties of these two sulfides as function of sulfur pressure between 600 and 1000°C .... See Entry 102375

***n*-type $CdCr_2Se_4$: a Mott extrinsic semiconductor** .... See Entry 102387

Electrical conductivity and optical transmission of phases of the Li_2S-Sb_2S system. Correlation between structure and physical properties .... See Entry 102389

The Frenkel thermal-field emission in $EuGa_2S_4$ single crystals .... See Entry 102406

The electrical conduction process in antimony trisulfide semiconducting thin films .... See Entry 102410

The transition metal influence on some physical properties of $Sn_{1-x}Mn_xTe$ (where Me=Mn, Cr, Fe, Ni, Co) alloys .... See Entry 102443

About negative residual photoconductivity of indium-selenide single crystals .... See Entry 102449

Characterization of fluorine-doped In_2O_3 films synthesized by spray pyrolysis .... See Entry 102542

Effect of CuO addition on the electrical and dielectrical properties of semiconducting barium titanate ceramics .... See Entry 102826

Optical and electrical properties of RF-sputtered indium-tin oxide films .... See Entry 102976

72.80L Organic semiconductors

The DC conductivity of polyphenylacetylene below room temperature .... See Entry 102378

Effect of molecular rotation upon charge transport between disordered carbazole units .... See Entry 102379

Charge transport at mid-gap in trans-$(CH)_x$: An electrochemical study .... See Entry 102392

Remnant conductivity in polymer semiconductors of polynaphthol and polyhydroquinone .... See Entry 102397

Poole-Frenkel centres in dielectrics. Kind and space density in plasma-polymerized organosilicon films .... See Entry 102405

Photovoltaic effect in sensitized crystal violet dyes .... See Entry 102448

Intramolecular charge transfer complexes. XXI. Photoconductivity in N(2-hydroxyethyl) carbazolyl methacrylate-methacryloyl-β-hydroxyethyl-3,5-dinitrobenzoate copolymers .... See Entry 102454

Dark relaxation of surface charge of an organic photosemiconducting layer .... See Entry 102488

Electrical properties of polystyrene doped with leucomalachite green for correlation with its electrothermographic behaviour .... See Entry 102802

72.80N Amorphous and glassy semiconductors

Theory of doping in chalcogenide glasses .... See Entry 101577

Electronic phenomena in mechanical relaxation of semiconducting oxide glasses .... See Entry 101855

IR laser-induced deposition of silicon thin films .... See Entry 102213

Optical instabilities and localized electronic states in hydrogenated amorphous silicon .... See Entry 102299

Basic issues in electronic conduction in amorphous semiconductors. II. Electronic transport properties .... See Entry 102369

The DC conductivity of polyphenylacetylene below room temperature .... See Entry 102378

Effect of molecular rotation upon charge transport between disordered carbazole units .... See Entry 102379

Highly doped sputtered amorphous silicon without hydrogen .... See Entry 102380

The interpretation of the electric and optical properties of a-Si:H films produced by RF glow discharge through dark conductivity, photoconductivity and pulse controlled capacitance-voltage measurements .... See Entry 102381

Electrical and optical properties of RF-SP a-Ge:O:(H) deposited from GeO_2 .... See Entry 102382

Transport studies of S-Se amorphous semiconductors .... See Entry 102384

The relation between contact potential and planar conduction as a-Si:H films undergo gas adsorption or temperature changes .... See Entry 102400

Theory of electron-hole kinetics in amorphous semiconductors under illumination: application to solar cells .... See Entry 102412

Temperature dependent light induced conductivity changes in hydrogenated amorphous silicon .... See Entry 102451

Photoconductivity and dark conductivity of hydrogenated amorphous silicon .... See Entry 102455

Models of photogeneration in amorphous selenium .... See Entry 102457

Staebler-Wronski effects in hydrogenated amorphous $Si_{1-x}Ge_x$ .... See Entry 102459

The effect of light soaking on the low temperature photoconductivity of hydrogenated amorphous silicon .... See Entry 102460

The interpretation of photoconductivity measurements in hydrogenated amorphous silicon .... See Entry 102461

Origin of the photo-induced changes in hydrogenated amorphous silicon .... See Entry 102462

Optoelectronic characterization of undoped amorphous silicon thermistor .... See Entry 102463

On the spectral response of undoped amorphous silicon photoconductor .... See Entry 102464

Noise spectroscopy in amorphous silicon films .... See Entry 102474

Electrical conduction in sputtered Si:Al films .... See Entry 102521

Effects of controlled hydrogenation by ion implantation on the localized states in vacuum evaporated amorphous silicon .... See Entry 102530

Mechanism of dispersive transport in hydrogenated amorphous silicon .... See Entry 102531

Electrical conductivity, structure and Hall effect measurements of InSe films .... See Entry 102543

Electrical properties of polystyrene doped with leucomalachite green for correlation with its electrothermographic behaviour .... See Entry 102802

Microwave absorption in amorphous chalcogenide semiconductors .... See Entry 103004

Stability of p-i-n hydrogenated amorphous silicon solar cells to light exposure .... See Entry 103690

Light-induced effects in indium tin oxide/n-i-p hydrogenated amorphous silicon solar cells .... See Entry 103691

Light-induced instability of amorphous silicon photovoltaic cells .... See Entry 103692

Effects of optical stress on the properties of sputtered amorphous silicon solar cells and thin films ....See Entry 103693

Analysis of photoinduced changes in the performance of amorphous silicon solar cells ....See Entry 103694

Stability of Pd/Nb_2O_5/amorphous hydrogenated silicon solar cells ....See Entry 103699

72.90 OTHER TOPICS IN ELECTRONIC TRANSPORT IN CONDENSED MATTER

102475 Tensor of effective electrical conductivity for medium with two-layer particles of dispersed phase. V.I.Popov.
Magnetohydrodynamics (USA), vol.18, no.4, p.395-8 (Oct.-Dec. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.4, p.76-8 (Oct.-Dec. 1982).
In real heterogeneous media the particles of the dispersed phase are usually covered with sheaths of either surface-active substances (in emulsions and in suspensions) or oxides (in alloys and in mixtures of liquid metals), or simply constitute two-layer particles. Since the characteristics of these sheaths (electrical conductivity, dielectric permittivity, magnetic permeability, thermal conductivity) differ from the characteristics of the carrier phase and of the dispersed phase, they can appreciably affect the effective generalized electrical conductivity of the entire heterogeneous medium. The author determines the tensor of effective electrical conductivity for uniform steady heterogeneous medium. (3 refs.)

Size effects in thin films ....See Entry 98674

73.00 ELECTRONIC STRUCTURE AND ELECTRICAL PROPERTIES OF SURFACES, INTERFACES, AND THIN FILMS

73.20 ELECTRONIC SURFACE STATES

(for emission and impact phenomena, see 79.)

102476 Theory of surface core-level shifts in metals. B.Johansson (Inst. of Phys., Univ. of Aarhus, Aarhus, Denmark), N.Martensson.
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.405-26 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
From the complete screening picture for the core electron ionization process in a metal, a theoretical expression for the surface core-level binding energy shift is derived. By means of the equivalent core approximation this expression is evaluated for the 5d transition metal series and comparisons with experiment are made. Surface core-level shifts are shown to be related to the surface heat of segregation of a substitutional (Z+1) impurity, and are calculated to depend on the surface crystal plane. Also the possibility of valence changes at the surface of rare-earth metals is briefly treated. (61 refs.)

102477 Electronic properties of interfaces. J.Pollman (Inst. fur Phys., Univ. Dortmund, Dortmund, Germany).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.493-504 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Some fundamental microscopic electronic properties of vacuum-semiconductor, metal-semiconductor and semiconductor-semiconductor interfaces are discussed in connection with the question of their meaning for macroscopic transport properties of junction devices. (35 refs.)

102478 Surface state density determination based on conductance approximation methods. R.J.Singh (Dept. of Phys., Banaras Hindu Univ., Varanasi, India).
Indian J. Pure & Appl. Phys., vol.21, no.6, p.354-6 (June 1983).
Amongst different approximate methods for the determination of interface state density at the Si-SiO_2 interface, the Hill and Coleman (1980) method is found to be the most suitable one. Results obtained from various samples having surface state density of varying magnitudes computed by three different methods are compared to support this conclusion. (9 refs.)

102479 Valley splitting on tilted Si(100) surfaces. S.M.Goodnick, J.R.Sites, K.S.Yi, D.K.Ferry, C.W.Wilmsen (Colorado State Univ., Fort Collins, CO, USA).
Phys. Lett. A (Netherlands), vol.97A, no.3, p.111-13 (15 Aug. 1983).
Investigates Shubnikov-de Haas (SdH) oscillations and Hall measurements in the inversion layer of surfaces tilted 1.2° from the Si(100) towards the Si(111). SdH measurements reveal two distinct bands, populated approximately in a 4:1 ratio, each with a valley degeneracy of one, which is consistent with valley splitting in a projection model. (15 refs.)

102480 Dynamical image potential of a slowly moving electron: effects of spatial dispersion and boundary conditions at the image plane. W.Ekardt (Fritz-Haber-Inst., Max-Planck-Gesellschaft, Berlin, Germany).
Phys. Rev. B (USA), vol.28, no.2, p.1099-102 (15 July 1983).
The effect of spatial dispersion on the dynamical nonlocal image potential of a slowly moving electron is studied within a hydrodynamiclike model. It is shown that, for energies below the surface-plasmon-emission threshold spatial dispersion effects and dynamical effects are of equal importance. Compared with this, the use of the surface Green's function instead of the free-particle Green's function in calculating the nonlocal self-energy is only of minor importance. (12 refs.)

102481 Absorption of ballistic phonons by the (001) inversion layer of Si: electron-phonon interaction in two dimensions. J.C.Hensel, R.C.Dynes, D.C.Tsui (Bell Labs., Murray Hill, NJ, USA).
Phys. Rev. B (USA), vol.28, no.2, p.1124-6 (15 July 1983).
The authors report the observation of absorption as a function of electron density of ballistic phonons in the two-dimensional electron gas in the (001) inversion layer of Si. Remarkably, the strength of the absorption is found to be an order of magnitude greater than can be explained by a conventional absorption model based on electron scattering in two dimensions and a deformation-potential electron-phonon interaction characteristic of bulk Si. (6 refs.)

102482 Many-body effects on the subband structure of *n*-type surface space-charge layers in InP. K.S.Yi, D.K.Ferry (Dept. of Electrical Engng., Colorado State Univ., Fort Collins, CO, USA).
Phys. Rev. B (USA), vol.28, no.2, p.1127-9 (15 July 1983).
The effects of both the direct and the polar LO-phonon mediated electron-electron interactions are included in a calculation of the many-body effects on the subband structure of InP. The results show that the effects of exchange and correlation among surface electrons are not negligible. The dominant contribution to electronic self-energy correction comes from the direct electron-electron interaction. The threshold densities of higher-subband occupancy are determined and compared with existing models and experiments. (14 refs.)

102483 Core- and valence-band energy-level shifts in small two-dimensional islands of gold deposited on Pt(100): the effect of step-edge, surface, and bulk atoms. M.Salmeron, S.Ferrer, M.Jazzar, G.A.Somorjai (Molecular & Materials Res. Div., Lawrence Berkeley Lab., Berkeley, CA, USA).
Phys. Rev. B (USA), vol.28, no.2, p.1158-60 (15 July 1983).
Photoemission techniques were used to study the electronic properties of two-dimensional islands of Au deposited on Pt(100) in the submonolayer range. Shifts of approximately 0.6 eV were observed in both valence-band and core-level binding energies for $\Theta=1$ to 0.1. These shifts are interpreted in terms of the increasing proportion of island edges as the gold coverage approaches zero. Above $\Theta=1$ the surface-bulk energy shift was found to agree with previously published data. (10 refs.)

102484 Comparison of image-potential theories. A.Puri, W.L.Schaich (Dept. of Phys., Indiana Univ., Bloomington, IN, USA).
Phys. Rev. B (USA), vol.28, no.4, p.1781-4 (15 Aug. 1983).
The authors study a simple model which contains the basic physics of the image-potential problem but which allows a nearly exact solution. The predictions of this numerical solution are compared to those of various approximate theories that have been recently proposed. The authors find no support for the suggested anomalies; conventional image-potential theory appears to be adequate. (14 refs.)

102485 Angle-resolved photoelectron spectroscopy of II-VI compound semiconductors. III. Study of surface states of CdTe (110). S.Takano, H.Koinuma, S.Asami, A.Ebina, T.Takahashi.
Rec. Electr. & Commun. Eng. Conversazione Tohoku Univ. (Japan), vol.52, no.1, p.1-5 (June 1983). In Japanese.
For pt.II see ibid., vol.51, no.1, p.26-31 (1982). Electronic surface states of a cleaved CdTe (110) surface were studied with angle-resolved photoemission spectroscopy (ARUPS) using a HeI resonance line. Surface electronic states were distinguished from bulk electronic states by a so-called contamination test: the state which changes in intensity with adsorption of oxygen is identified as a surface state. Thus the dispersion of the surface state was determined along the Γ-X, and the Γ-*X* symmetry lines. It was found that the uppermost occupied surface state locates below the valence band maximum. (9 refs.)

Beyond the local-density approximation in calculations of ground-state electronic properties ....See Entry 100274

Surface reconstruction and adsorbate geometry by surface core level spectroscopy ....See Entry 102129

Analysis of laser-enhanced adsorption/desorption processes on semiconductor surfaces via electronic surface state excitation ....See Entry 102182

Electronic structures of the $LaBO_3$ (B=Co, Fe, Al) perovskite oxides related to their catalysis ....See Entry 102256

Long range surface plasmons in birefringent media ....See Entry 102274

Effects of keV electron irradiation on the avalanche-electron generation rates of three donors on oxidized silicon ....See Entry 102399

Exciton-induced photoemission from extrinsic surface states: NaI ....See Entry 102456

Classical magnetoresistance of a two-dimensional electron gas in a one-dimensional superlattice ....See Entry 102487

Time-dependent response of interface states in indium phosphide metal-insulator-semiconductor capacitors investigated with constant-capacitance deep-level transient spectroscopy ....See Entry 102513

Positrons and solid state physics ....See Entry 102989

73.25 SURFACE CONDUCTIVITY

102486 Electrical conductivity of a low-temperature two dimensional medium. B.M.Vul, E.I.Zavaritskaya, V.N.Zavaritskii (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
JETP Lett. (USA), vol.37, no.2, p.105-8 (20 Jan. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.2, p.87-9 (20 Jan. 1983).
The surface conductivity $\sigma_\square$ of the (111) face of a germanium crystal has been studied over the temperature (T) interval from 1.2 to 4.2K. At $\sigma_\square \lesssim (e^2/h)$ the surface conductivity $\sigma_\square$ varies in proportion to $\exp(-\varepsilon/kT)$, where e is the electron charge, h is the Planck constant, and ε is the activation energy. At $\sigma_\square \gtrsim (e^2/h)$ the behavior of the conductivity is described by $\Delta\sigma=\sigma_\square(T_1)-\sigma_\square(T)\simeq(e^2/4h)\ln(T_1/T)$ as the temperature is lowered from $T_1=4.2K$ to 1.2K. In the transition region the $\sigma_\square(T)$ dependence agrees quite well with both descriptions. (4 refs.)

102487 Classical magnetoresistance of a two-dimensional electron gas in a one-dimensional superlattice. G.M.Gusev, Z.D.Kvon, V.N.Ovsyuk (Inst. of Phys. of Semiconductors, Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.4, p.210-12 (20 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.4, p.177-9 (20 Feb. 1983).
The magnetoresistance due to restructuring of the Fermi surface of electrons under the action of a one-dimensional superlattice has been predicted and observed in a degenerate two-dimensional electron gas on a high-index surface of silicon. The effect is sharply anisotropic and can be used as a new method for investigating the indicated system. (6 refs.)

102488 Dark relaxation of surface charge of an organic photosemiconducting layer. G.N.Ganco, E.B.Mockus, N.A.Fedorova (Vilnius Sci. Res. Inst. of Electrography, Vilnius, Lithuanian SSR).
Sov. Phys.-Collect. (USA), vol.22, no.2, p.67-76 (1982). Translation of: *Litov. Fiz. Sb. (USSR)*, vol.22, no.2, p.89-101 (1982).
Investigates dark relaxation of nonuniform surface charge using the example of an organic photosemiconducting layer (OPL) of polyepoxypropylcarbazole. Surface drift of carriers is determined on the basis of spreading of the nonuniform surface charge of the OPL created by photodischarge of the OPL under nonuniform illumination. This procedure makes it possible to estimate small values of the surface mobility, less than 10^{-10} $m^2/(V.sec)$, that are characteristic of organic photosemiconductors. A substantial change in OPL properties after holding in darkness in a charge state is established. On the

basis of an analysis of various mechanisms of surface phenomena, a physical model is proposed that accounts for the experimental findings. In accordance with the model, in a surface region 20-40 Å deep of the OPL a surface polarization barrier arises, due to dipole-segment relaxation, and orientation of carbazole rings and other polar groups in a strong electric field. For the surface mobility of holes the estimate $(10^{-9}\text{-}10^{-12})$ $m^2/(V.sec)$ is obtained, while for the mobility of adsorbed ions it is less than 10^{-16} $m^2/(V.sec)$. (20 refs.)

Structure and properties of evaporated amorphous films consisting of transition metal-metalloid alloys .... See Entry 102193

Transverse acousto-EMF as a function of acoustically stimulated adsorption on the surface of a semiconductor .... See Entry 102467

Peculiarities of induced potential in silicon layers .... See Entry 102537

Physicomechanical properties of polytetrafluoroethylene treated in a high-frequency gas-discharge plasma .... See Entry 103360

The potential of zero charge of oriented single-crystal RuO_2 in aqueous electrolytes .... See Entry 103534

73.30 SURFACE DOUBLE LAYERS, SCHOTTKY BARRIERS, AND WORK FUNCTIONS

102489 The temperature dependencies of parameters of metal-*p*-GaAs Schottky diodes. A.B.Medzhidov, F.N.Sultanov, B.G.Tagiev.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.5, p.83-5 (1982). In Russian.
An investigation of the temperature dependence of volt-ampere characteristics and $C^{-2}=f(U)$ for metal-*p*-GaSe Schottky diodes has been made. The temperature coefficients for the barrier height and cut-off voltage have been determined. The changes in the direct and reverse currents of diodes versus temperature are likely to be connected with thermal generation of current carriers. (5 refs.)

102490 Pile up of implanted phosphorus during palladium silicide formation and the characteristics of Schottky barrier diodes. A.Kikuchi (Central Res. Lab., Hitachi, Ltd., Tokyo, Japan).
J. Appl. Phys. (USA), vol.54, no.7, p.3998-4000 (July 1983).
Schottky barrier diodes are fabricated on silicon surfaces whose impurity concentrations are controlled by ion implantation of phosphorus. The barriers are produced from Pd_2Si or Al-Si. The forward voltages fo Schottky barrier diodes made from Pd_2Si show a much greater lowering than those made from Al-Si for implanted doses of 5×10^{13} cm^{-2} and higher. Spreading resistance measurements show that the implanted phosphorus atoms are piled up at the Pd_2Si-Si interface during Pd_2Si formation. This causes reduction in the effective barrier height. (6 refs.)

102491 Al-GaAs(001) Schottky barrier formation. S.P.Svensson, G.Landgren, T.G.Andersson (Dept. of Phys., Chalmers Univ. of Technol., Goteborg, Sweden).
J. Appl. Phys. (USA), vol.54, no.8, p.4474-81 (Aug. 1983).
Schottky diodes have been fabricated by in situ deposition of Al on GaAs (001) grown by molecular beam epitaxy. A detailed study of the Schottky barrier height (ϕ_b) dependence on surface geometry and composition has been undertaken. Reconstructed, as well as very As- and very Ga-rich surfaces have been prepared. For comparison also samples with a thin interfacial AlAs layer were produced. The barrier height was determined by the capacitance-voltage (*C-V*) and current-voltage (*I-V*) techniques. The quality of the material was controlled by deep level transient spectroscopy revealing a total concentration of levels in the upper part of the band gap in the mid 10^{12} cm^{-3} range. Measuring the barrier heights of different diodes across a wafer showed lateral variations which were preserved also after annealing. A number of possible explanations for these variations were investigated but none proved satisfactory. Averaging over a large number of diodes revealed no apparent reconstruction dependence of the barrier height. The two measurement techniques gave the same barrier height $\phi_b\approx0.75$ eV. By defining the Auger As (MVV)/Ga(MMM) signal ratio as a measure on the surface composition it was found that reconstructed surfaces appeared in the interval $2<As/Ga<5$. Going outside this interval the barrier increased for $As/Ga<2$ and decreased for $5<As/Ga<10$. For $As/Ga>10$ an increase was again found. Annealing at 573K led to a rapid initial increase of the barrier height for the samples with reconstructed GaAs surfaces followed by a slower interdiffusion related increase during prolonged annealing. (28 refs.)

102492 Degradation mechanism of $Mo/GaAs_{0.6}P_{0.4}$ Schottky barriers. J.C.Lou, M.S.Lin, W.H.Su (Dept. of Electrical Engng., Nat. Tsing Hua Univ., Hsinchu, Taiwan).
J. Appl. Phys. (USA), vol.54, no.8, p.4482-9 (Aug. 1983).
The electrical characteristics and interdiffusion in electron-beam evaporated $Mo/GaAs_{0.6}P_{0.4}$ Schottky barriers have been studied. The barrier height, ideality factor and deep trapping levels of these annealed or unannealed $Mo/GaAs_{0.6}P_{0.4}$ Schottky barriers are obtained by using the *I-V*, *C-V*, Rutherford backscattering spectroscopy (RBS), Auger electron spectroscopy (AES), and deep level transient spectroscopy (DLTS) analyses. A significant interdiffusion at the $Mo/GaAs_{0.6}P_{0.4}$ interface is demonstrated for 500°C, 600°C, annealed Schottky barriers. DLTS results show that there are two electron traps [$E_c-(0.19\pm0.01)$ eV and E_c-(0.65 ± 0.01) eV] and five hole traps [$E_v+0.15$ eV, $E_v+(0.27\pm0.01)$ eV, $E_v+(0.36\pm0.02)$ eV, $E_v+(0.56\pm0.01)$ eV and $E_v+0.84$ eV] in existence at the metal-semiconductor interface or in the bulk of the degraded Schottky barriers. These traps enhance the generation-recombination effect and degrade the barrier height. RBS, AES, and DLTS results also indicate that the newly discovered hole trap $E_v+0.84$ eV, induced by Mo indiffusion, is believed to play a major role for $Mo/GaAs_{0.6}P_{0.4}$ Schottky barriers degradation. (30 refs.)

102493 Work-function calculations for a symmetrical total-charge-density profile at the metallic surface. K.F.Wojciechowski, M.Sobanska-Nowotnik (Inst. of Experimental Phys., Univ. of Wroclaw, Wroclaw, Poland).
Phys. Rev. B (USA), vol.28, no.2, p.1105-8 (15 July 1983).
It is shown that, if the total-charge-density profile $n_T(x)$ at the surface of jellium satisfies the Budd-Vannimenus constraint and also is a symmetrical function of x, relative to the ordinate axis, then the work-function variation versus the Wigner-Seitz radius r_s does not depend on the form of $n_T(x)$. Also the simple linear-density profile is used to calculate the work function by application of the variational principle for the energy, including the first and second density-gradient corrections to the kinetic energy and the first gradient correction to the exchange and correlation energy. The results for the work function are in good agreement with the polycrystalline values for low-density metals. (22 refs.)

The potential of zero charge of jellium .... See Entry 98937

Integrated-optics photodetector utilizing the external photoelectric effect in a Schottky barrier .... See Entry 99189

Surface reconstruction of Cu(111) upon oxygen adsorption .... See Entry 102139

Investigation of surface self-diffusion of Ni atoms on the Ni(100) plane by means of work function measurements and Monte Carlo calculations .... See Entry 102177

Capacitance temperature analysis of midgap states in hydrogenated amorphous silicon .... See Entry 102243

Effect of photoelectrochemical etching on charge collection efficiency in CdS: An electron beam induced current study .... See Entry 102415

Interpretation of DC characteristics of phosphorus-doped polycrystalline silicon films: conduction across low-barrier grain boundaries .... See Entry 102534

73.40 INTERFACES

Reduction of contact resistivity by As redistribution during Pd_2Si formation .... See Entry 102076

Electronic conduction in lead oxides and at metal/oxide interfaces .... See Entry 102374

The relation between contact potential and planar conduction as a-Si:H films undergo gas adsorption or temperature changes .... See Entry 102400

Transverse acousto-EMF as a function of acoustically stimulated adsorption on the surface of a semiconductor .... See Entry 102467

A study of the frictional, wear and contact resistance performance of tin alloy coatings .... See Entry 103338

73.40J Metal-to-metal contacts

102494 Point-contact spectroscopy. A.G.M.Jansesn, A.P.van Gelder, A.M.Duif, P.Wyder, N.d'Ambrumenil (Res. Inst. for Materials, Univ. of Nijmegen, Nijmegen, Netherlands).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.209-22 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Point contacts between metals show deviations from Ohm's law, which are used for a spectroscopic analysis of the scattering of electrons in a metal. A theoretical model is presented for the electrical transport problem of a metallic constriction, based on the solution of the Boltzmann equation. Experiments demonstrate that the electron-phonon interaction function α^2F can be measured directly in normal metals. Other scattering mechanisms than the electron-phonon interaction can also be detected with point contacts. Examples are given for dilute alloys of metals with paramagnetic impurities. (21 refs.)

Point-contact electron-phonon interaction spectra of pure metals .... See Entry 101885

73.40L Semiconductor-to-semiconductor contacts, p-n junctions, and heterojunctions

102495 New perspective in semiconductor physics based on advanced technology. T.Porjesz (Dept. for Low Temperature Phys., Roland Eotvos Univ., Budapest, Hungary).
Acta Phys. Acad. Sci. Hung. (Hungary), vol.53, no.3-4, p.411-17 (1982). [received: Aug. 1983] (CRYOSEM '81. Second International Seminar on Low Temperature Physics, Visegrad, Hungary, 8-10 Oct. 1981).
Up-to-date technology provides the possibility of producing submicron semiconductor devices and higly dense device structures. The classification of the devices is based on the characteristic durations of the processes taking place in them. The dominant or the perturbative nature of the effects depends on the sizes of the system in question. The Boltzmann transport theory can fail with the decrease of dimensions. After some criticism of the fundamental assumptions the limits of the validity of the theory are marked out. The main lines of the quantum transport theory are pointed out and with the help of the superlattices very dense device arrays are described, with indications of the further development of theory and practice. (5 refs.)

102496 Compositional and doping superlattices in III-V semiconductors. K.Ploog, G.H.Dohler (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
Adv. Phys. (GB), vol.32, no.3, p.285-359 (May-June 1983).
The unusual electrical and optical properties of three important types of semiconductor superlattices are reviewed. The artificial structures which were grown by molecular beam epitaxy (MBE) consist of a periodic sequence of ultrathin crystalline layers of alternating composition ($Al_xGa_{1-x}As/GaAs$ or $Ga_xIn_{1-x}As/GaAs_ySb_{1-y}$) or of alternating doping (*n*-GaAs/*p*-GaAs). The electronic energy bands in these superlattices are split into quasitwo-dimensional subbands whose spacing and width can be tailored by appropriate choice of the design parameters of the structure. After a brief outline of the electronic properties of compositional superlattices, the authors discuss the unique properties of GaAs doping superlattices in detail. The space charge induced band edge modulation in doping superlattices leads to an indirect energy gap in real space. As a consequence, the electrons and holes are spatially separated and their recombination lifetimes are strongly enhanced, i.e. non-equilibrium free-carrier distributions can be metastable. This implies the unique possibility of tuning the carrier concentration in a given superlattice sample over a wide range. (99 refs.)

102497 Field ionised impurity scattering in an AlGaAs/GaAs two-dimensional electron gas. A.Livingstone, K.Tsubaki, M.Kawashima, H.Okamoto, K.Kumabe (Nippon Telegraph & Telephone Public Corp., Tokyo, Japan).
Electron. Lett. (GB), vol.19, no.16, p.619-20 (4 Aug. 1983).
Low field-mobility saturation has been observed in AlGaAs/GaAs heterostructures. Under illumination, the mobility decreases and the carrier concentration increases at high fields. Both effects are thought to be due to ionisation of a centre in the GaAs, probably oxygen. The experimental results are explained in terms of a simple trap model. (7 refs.)

102498 Applications of superlattices. N.T.Linh (Thomson-CSF Central Res. Lab., Orsay, France).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.361-74 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Since the first work on periodic superlattice, many studies have been devoted to heterojunction multilayers. Combinations of different material properties have led to a new class of semiconductors exhibiting interesting electronic properties. Applications in the field of quantum well lasers, two-dimensional

electron gas field effect transistors, superlattice avalanche photo-diodes are described. Conclusion is given on the tight cooperation between physicists and engineers to build up new ideas. (25 refs.)

102499 Space-charge waves in multilayered heterostructures. S.Datta, R.L.Gunshor (School of Electrical Engng., Purdue Univ., West Lafayette, IN, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4453-6 (Aug. 1983).
Space-charge waves in multilayered heterostructures are discussed using coupled Boltzmann equations. Acoustic plasma modes are investigated with practical examples. The formulation includes both degenerate and nondegenerate electron systems; exchange and correlation effects are incorporated using a local density approximation and are shown to affect the acoustic plasma mode significantly; lattice collisions are included using the relaxation time approximation. (8 refs.)

102500 Peripheral photoresponse of a *p-n* junction. H.Holloway, A.D.Brailsford (Ford Motor Corp., Dearborn, MI, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4641-56 (Aug. 1983).
A quantitative theory is presented for the enhanced photoresponse of *p-n* junctions that arises from the lateral diffusion of photogenerated carriers. This mechanism leads to a photoactive area for a photodiode that may be much larger than its *p-n* junction area. The main theory pertains to the geometry that arises with mesa diodes, the results for which are also applicable to planar junctions that are shallow when compared with the minority-carrier diffusion length. The solution for infinitely deep planar junctions is obtained by separate analysis. The magnitude of the peripheral photoresponse is sensitive to geometric and physical factors such as semiconductor thickness, surface recombination, optical absorption length, and competition for photogenerated carriers by adjacent photodiodes. The dependence of the response upon all of these features is presented. (6 refs.)

102501 Transient capacitance spectroscopy on large quantum well heterostructures. P.A.Martin, K.Meehan, P.Gavrilovic, K.Hess, N.Holonyak,Jr., J.J.Coleman (Electrical Engng. Res. Lab., Univ. of Illinois, Urbana, IL, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4689-91 (Aug. 1983).
The authors report transient capacitance measurements on $Al_xGa_{1-x}As$-GaAs-$Al_xGa_{1-x}As$ ($x \sim 0.35$) double heterojunctions with a large quantum well active region ($L_z \sim 800$ Å). It is suggested that the thin GaAs layer acts as a 'giant' artificial deep level. It follows then that the band edge discontinuity ΔE_c determines the electron emission rates (from the thin layer), thus making it possible for ΔE_c to be determined by transient capacitance measurements. (11 refs.)

102502 Growth peculiarities of graded band gap GaAsSb/GaAs heterostructures and effective light modulation in the 1.06 μm wavelength region. Yu.B.Bolkhovityanov (Inst. of Semiconductor Phys., Acad. of Sci., Novosibirsk, USSR), B.A.Bobylev, V.I.Korzhov, V.I.Yudaev, E.H.Hairi.
Phys. Status Solidi a (Germany), vol.78, no.1, p.343-7 (16 July 1983).
Growth features of LPE n-$GaAs_{1-x}Sb_x$/n^+-GaAs ($n \approx 10^{15}$ cm^{-3}) continuously graded composition heterostructures are investigated and the electroabsorption spectra in these heterocompositions are analysed. Franz-Keldysh light modulators are used with a modulation coefficient up to 30% in the wavelength region up to 1.06 μm. (6 refs.)

102503 Quantum oscillations in strained-layer superlattices. J.E.Schirber, I.J.Fritz, L.R.Dawson, G.C.Osbourn (Sandia Nat. Labs., Albuquerque, NM, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2229-31 (15 Aug. 1983).
Large-amplitude quantum oscillations are observed in the magnetotransport in GaAs-$Ga_{0.8}In_{0.2}As$ strained-layer superlattices. These measurements demonstrate that single-crystal perfection and high mobilities at low temperatures can be achieved in a new class of semiconductor structures. The properties of these structures can be tailored easily over a wide range inaccessible to naturally occurring lattice-matched heterostructures. (13 refs.)

Quick and easy measurement of the band gap in semiconductors .... See Entry 98700

Minority carrier lifetime and luminescence efficiency of 1.3 μm InGaAsP-InP double heterostructure layers .... See Entry 100759

Quasi-two-dimensional excitons in GaAs/$Al_xGa_{1-x}As$ semiconductor multiple quantum well structures .... See Entry 102264

Electronic states associated with extended defects in quantum well structures .... See Entry 102316

Influence of carbon and hydrogen segregation on the electrical properties of grain boundaries in polycrystalline silicon sheets .... See Entry 102423

The quantized Hall effect .... See Entry 102440

Capacitance oscillations in quantized Hall effect .... See Entry 102441

Light-induced effects in amorphous silicon material and devices .... See Entry 102458

Electronic properties of interfaces .... See Entry 102477

Electrical characteristics of contact of polycrystalline and monocrystalline silicon films with the same type of conductance .... See Entry 102529

The electrooptical properties of ZnSe-ZnTe heterojunctions . See Entry 102957

Stability of p-i-n hydrogenated amorphous silicon solar cells to light exposure .... See Entry 103690

Light-induced effects in indium tin oxide/n-i-p hydrogenated amorphous silicon solar cells .... See Entry 103691

Light-induced instability of amorphous silicon photovoltaic cells .... See Entry 103692

Analysis of photoinduced changes in the performance of amorphous silicon solar cells .... See Entry 103694

Optimization of substrate thickness for interdigitated back contact silicon solar cells .... See Entry 103703

73.40M Semiconductor-electrolyte contacts

102504 Photoelectrochemical study of (Ti,V)O$_2$ and (Ti,Nb)O$_2$ alloys. J.Gautron, P.Lemasson (Lab. d'Electrochimie Interfaciale, CNRS, Meudon, France), B.Poumellec, J.-F.Marucco.
Sol. Energy Mater. (Netherlands), vol.9, no.1, p.101-11 (May-June 1983).
The ceramic alloys (Ti,Nb)O$_2$ and (Ti,V)O$_2$ are studied photoelectrochemically in an aqueous electrolyte. A n-type electrical conductivity is noted for the whole composition range. The energy gaps E_g for the (Ti,V)O$_2$ alloys are 0.8 eV (VO$_2$)$<E_g<$3 eV (TiO$_2$) whereas for the (Ti,Nb)O$_2$ alloys E_g remains nearly constant and $\approx$3 eV. With an energy gap of $\approx$2 eV, the alloy $Ti_{0.4}V_{0.6}O_2$, which is electrochemically stable, seems especially attractive for solar energy conversion. However, its characteristics are counterbalanced by a too much anodic flat-band potential and by a low quantum efficiency. A correlation between the photocurrent and the associated optical transitions leads to precise band diagrams for both alloys. The study of their photoelectrochemical stability enables one to determine the nature of the optical transitions, giving rise to the photocurrent. (20 refs.)

73.40N Metal-nonmetal contacts

102505 Laser annealed ohmic contact to n^+-GaAs. P.Sircar (Dept. de Phys.-Math., Univ. de Moncton, Moncton, NB, Canada).
Can. J. Phys. (Canada), vol.61, no.8, p.1218-21 (Aug. 1983).
Ohmic contacts were made on n^+-GaAs substrates by evaporating a gold-germanium eutectic film with or without a thin nickel overlayer and then alloying these samples either in a furnace or by means of an excimer laser. It is found that laser annealing gives a better surface morphology and a lower contact resistance than furnace annealing. (10 refs.)

102506 Comparison of photoelectrochemical properties of n-TiO$_2$ films obtained by different production methods. K.J.Hartig (Inst. fur Theoretische Chem. und Strahlenchem., Univ. Wien, Wien, Austria), N.Getoff, G.Nauer.
Int. J. Hydrogen Energy (GB), vol.8, no.8, p.589-96 (1983).
Semiconducting n-TiO$_2$ films on titanium metal foils were produced by controlled thermal oxidation anodic oxidation with facultative subsequent reduction with hydrogen and by vapor deposition. These samples were compared with respect to their photochemical and photophysical behavior, their electrochemical and photoelectrochemical properties and their surface structure and chemical composition. n-TiO$_2$ layers produced by controlled thermal oxidation turned out to be optimal photoanodes. (4 refs.)

102507 Al/Poly Si specific contact resistivity. J.M.Ford (Motorola Semiconductor Res. & Dev. Lab., Phoenix, AZ, USA).
IEEE Electron Device Lett. (USA), vol.EDL-4, no.7, p.255-7 (July 1983).
Experimental results on the specific contact resistivity of Al/polysilicon are given for Al/1.5-percent Si contacting poly Si implanted with boron or phosphorus, annealed to surface concentrations from 3E18 to 4E20 cm^{-3}. Specific contact resistivities of the interfaces involved were determined using an extrapolation method. Measurements were taken at room temperature, and were conducted both before and after an anneal cycle of 20 min at 450°C in forming gas. Results provide a useful parameter which enables modeling of Al/poly Si contacts. (17 refs.)

102508 Physical model and mechanism of charge-carrier transfer in tungsten silicide-silicon contacts. I.V.Belousov, V.V.Il'chenko, V.I.Strikha (T.G. Shevchenko Kiev State Univ., Kiev, Ukrainian SSR).
Sov. Phys. J. (USA), vol.25, no.11, p.998-1002 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR),* vol.25, no.11, p.27-31 (Nov. 1982).
A great number of works have been devoted to the investigation of tungsten silicides at the metal-semiconductor interface. However, in these works, the physical model of the interface has not been considered, nor the reasons for the change in electrophysical properties of the structures in the formation of tungsten silicides at the contact. In the present work, a physical model of tungsten silicide-silicon contacts is proposed, and the electronic properties of the interface and the charge-transfer mechanisms leading to change in electrophysical properties of the contact are analyzed. (6 refs.)

102509 The properties of laser-alloyed zinc layers on GaAs. B.Heulin, B.J.Sealy (Dept. of Electrical & Engng., Univ. of Surrey, Guildford, England).
Thin Solid Films (Switzerland), vol.105, no.3, p.227-35 (22 July 1983).
Optical microscopy, Rutherford backscattering and electrical measurements were performed on laser-irradiated zinc layers on GaAs. Hole concentrations of about 2×10^{21} cm^{-3} were recorded corresponding to a sheet carrier concentration of (1-2)$\times 10^{16}$ cm^{-2}. The p^+-n junctions formed are non-ideal and have high leakage currents which are associated with decomposition and surface roughness caused by the laser anneal. (11 refs.)

Reduction of contact resistivity by As redistribution during Pd$_2$Si formation .... See Entry 102076

Metal-semiconductor interface formation .... See Entry 102183

Characterization of tantalum-silicon films on GaAs at elevated temperatures .... See Entry 102195

Electronic conduction in lead oxides and at metal/oxide interfaces .... See Entry 102374

Effect of photoelectrochemical etching on charge collection efficiency in CdS: An electron beam induced current study .... See Entry 102415

Electronic properties of interfaces .... See Entry 102477

The temperature dependencies of parameters of metal-*p*-GaAs Schottky diodes .... See Entry 102489

Al-GaAs(001) Schottky barrier formation .... See Entry 102491

Degradation mechanism of Mo/$GaAs_{0.6}P_{0.4}$ Schottky barriers .... See Entry 102492

73.40Q Metal-insulator-semiconductor structures

(inc. semiconductor-to-insulator)

102510 Long-term effects of injected electrons in tunnel oxide on the electrical characteristics of Al gate/thin oxide/Si structures—relatively low oxide field case. K.Nagai, Y.Hayashi (Electrotech. Lab., Ibaraki, Japan).
IEEE Trans. Electron Devices (USA), vol.ED-30, no.6, p.715-17 (June 1983).
Long-term effects of injected electrons in the tunnel oxide of a MOS structure is investigted. Forward tunneling current characteristics of the structure are not much affected and rather stable. The increase or decrease of reverse current due to long-term injected electrons in the tunnel oxide is found to be caused by the generation or annihilation of interface states by injected electrons. (11 refs.)

102511 Influence of a resistive sublayer at the polysilicon/silicon dioxide interface on MOS properties. N.Lifshitz, S.Luryi (Bell Labs., Murray Hill, NJ, USA).
IEEE Trans. Electron Devices (USA), vol.ED-30, no.7, p.833-6 (July 1983).
The authors suggest that a thin ($\lesssim$100 Å) resistive sublayer of polysilicon near the oxide interface can have a pronounced effect on the MOS capacitance-voltage characteristics. On the depletion side of the *C-V* curve, the lower effective work-function difference leads to a higher threshold for strong inversion. On the accumulation side, the MOS capacitance is lowered due to the added thickness of the depletion sublayer. With the help of the sublayer model, the authors attempt to explain the anomalous behavior often observed in MOS capacitors with silicide/polysilicon gates. The sublayer depletion activates traps due to the heavy impurities (Cu, Fe, and Ta) at the interface, a considerable amount of which were observed in these samples by Auger spectroscopy. (4 refs.)

102512 Deep traps in metal-insulator-chemically vapor-deposited amorphous SiN_x diodes. G.Sasaki, S.Fujita, A.Sasaki (Dept. of Electrical Engng., Kyoto Univ., Kyoto, Japan).
J. Appl. Phys. (USA), vol.54, no.7, p.4008-13 (July 1983).
The dependence of capacitance of chemically vapor-deposited (CVD) amorphous $SiN_{0.2}$ metal-insulator-semiconductor (MIS) diodes on frequency and temperature is measured and discussed. The results show that the MIS diode includes slow states and fast states. The response time of slow states is 2.4×10^{-9} $\exp(-0.6\ eV/k_BT)$s above 130°C. The fast states fully respond to 95 Hz at 130°C. It cannot be distinguished whether these states originate from the interface states or the a-$SiN_{0.2}$ gap states. The densities are evaluated to be 6×10^{17} cm^{-3} eV^{-1} (fast states) and 6×10^{18} to 2×10^{19} cm^{-3} eV^{-1} (slow states) as the CVD a-$SiN_{0.2}$ gap states, or 6.9×10^{11} cm^{-2} eV^{-1} (fast states) and 6.2×10^{12} to 1.2×10^{13} cm^{-3} eV^{-1} (slow states) as the interface states. (13 refs.)

102513 Time-dependent response of interface states in indium phosphide metal-insulator-semiconductor capacitors investigated with constant-capacitance deep-level transient spectroscopy. P.van Staa, H.Rombach, R.Kassing (Inst. fur Angewandte Phys., Univ. Munster, Munster, Germany).
J. Appl. Phys. (USA), vol.54, no.7, p.4014-21 (July 1983).
Constant-capacitance deep-level transient spectroscopy measurements performed on InP-SiO_2 metal-insulator-semiconductor capacitors are reported for the first time. Two types of samples have been used, one of epitaxial InP with a free-electron concentration $n=1.4\times10^{15}$ cm^{-3} and covered with an 'undoped' SiO_2 insulating layer, the other of bulk material with $n=10^{16}$ cm^{-3} and covered with an HCl-'doped' SiO_2 dielectric. Extensive experiments have been performed and a model has been proposed which successfully explains the corresponding results. This model is based on the assumption of a spatial and energetical distribution of interface states within the dielectric. The interaction of these traps with the conduction band takes place via a tunneling process during the capture of electrons and by a tunneling followed by a thermally activated transition during the emission process. The interface state density has been found to be about 10^{12} cm^{-2} eV^{-1} in the energy range between about 0.2 and 0.5 eV below the conduction band and to decrease considerably to the conduction band about 0.2 eV. Thus accumulation can be reached. The interface state density strongly increases below about 0.6 eV for the undoped sample and about 0.7 eV for the HCl doped one. Thus strong inversion has not been observed. It is shown that the models presented previously are inconsistent with the experimental results while the model proposed in the present paper explains the authors' and most of the experimental results given in the literature. (20 refs.)

102514 Conductivity of inversion layers in InSb MIS structure below the 'mobility threshold'. S.V.Belotelov, V.A.Gergel', A.N.Solyakov, R.A.Suris.
JETP Lett. (USA), vol.37, no.2, p.1198-23 (20 Jan. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.2, p.97-100 (20 Jan. 1983).
The temperature and field dependences of the conductivity of inversion layers in InSb MIS structures are studied. The experimental results are interpreted using the fluctuation theory of surface states and the conductivity of MIS structures [Zh. Eksp. Teor. Fiz. 84, 719 (1983)]. (3 refs.)

102515 Nonstoichiometric germanium nitride. A new insulating material for MIS microelectronics. I. The choice of the insulator and deposition. G.D.Bagratishvili, R.B.Dzhanelidze, D.A.Jishiashvili (Inst. of Cybernetics, Acad. of Sci., Tbilissi, Georgian SSR).
Phys. Status Solidi a (Germany), vol.78, no.1, p.115-23 (16 July 1983).
A qualitative model of the electronic interaction at the insulator-semiconductor interface is proposed. On the basis of this model a sequence of electron-donor ability of the oxygen and nitrogen atoms in oxides and nitrides of the silicon subgroup is established which makes it possible to choose an insulator for a high-quality IS interface. A low-temperature method of obtaining thin films of nonstoichiometric germanium oxynitrides is described based on reactive sputtering of germanium in hydrazine plasma preceded by a low-temperature in situ etching of a semiconductor surface. (27 refs.)

102516 Subband energies in accumulation layers on InP. G.Abstreiter, R.Huber, G.Trankle, B.Vinter (Phys.-Dept., Tech. Univ. Munchen, Garching, Germany).
Solid State Commun. (USA), vol.47, no.8, p.651-4 (Aug. 1983).
Resonant inelastic light scattering with incident photon energies close to the $E_0+\Delta_0$ optical gap in InP is used to study spin-flip single-particle and collective intersubband excitations in surface accumulation layers. The determined subband splittings and the depolarization shifts are compared with self-consistent calculations. From the obtained results it is concluded that the non-parabolicity of the conduction band cannot be neglected in the evaluation of the subband energies especially at high carrier concentrations. (16 refs.)

102517 Contact resistivity of TiN on p^+-Si and n^+-Si. M.Finetti, I.Suni, M.-A.Nicolet (California Inst. of Technol., Pasadena, CA, USA).
Sol. Cells (Switzerland), vol.9, no.3, p.179-83 (Aug. 1983).
The contact resistivity ρ_c of reactively sputtered TiN films deposited on silicon was measured with patterns conforming to the transmission line model. Values of $\rho_c=(2.8\pm0.5)\times10^{-4}$ Ω cm^2 and $\rho_c=(1.5\pm0.8)\times10^{-5}$ Ω cm^2 were determined on solar-cell-type p^+-Si (about 10^{20} B atoms cm^{-3}) and n^+-Si (about 2×10^{20} P atoms cm^{-3}) respectively. (9 refs.)

Field-assisted thermally stimulated current of mobile ions in a dielectric layer of a metal-oxide-semiconductor structure .... See Entry 102046

Observation of spin-dependent thermal emission from deep levels of semiconductors .... See Entry 102309

The quantized Hall effect .... See Entry 102440

Surface state density determination based on conductance approximation methods .... See Entry 102478

Absorption of ballistic phonons by the (001) inversion layer of Si: electron-phonon interaction in two dimensions .... See Entry 102481

Electrical and structural properties of pulse laser-annealed polycrystalline silicon films .... See Entry 102528

Distribution of elements according to the thickness of anodic oxide films on gallium arsenide .... See Entry 103362

A two-stage solution to the anisotropic polysilicon etching problem .... See Entry 103364

Stability of Pd/Nb_2O_5/amorphous hydrogenated silicon solar cells .... See Entry 103699

Simple method for the determination of the minority carrier diffusion length in metal/insulator/semiconductor solar cells .... See Entry 103704

73.40R Metal-insulator-metal structures

102518 Experiment and theory for switching in $Al/V_2O_5/Al$ devices. G.S.Nadkarni, V.S.Shirodkar (Dept. of Phys., Inst. of Sci., Bombay, India).
Thin Solid Films (Switzerland), vol.105, no.2, p.115-29 (15 July 1983).
The experimentally observed DC and AC electrical properties of $Al/V_2O_5/Al$ devices and a model to interpret these results are presented. It was observed that these devices switch from a high impedance (OFF) state to a low impedance (ON) state (memory switching) when the voltage across them is increased to a critical value V_t. Further, V_t was found to be a function to the oxide thickness as well as of the ambient device temperature, and the extrapolation of the V_t-T characteristics gives the insulator-to-metal transition temperature T_c of V_2O_5. If the current through the device is controlled with an external resistor, it is possible to switch the device to a partially OFF state (i.e. the device resistance is lower than that of the original). The current-voltage characteristics were observed to be described by a relation of the type $I=A\exp(BV)$, irrespective of whether the device was in its completely OFF state or partially OFF state, in a limited voltage range. A device in the ON state can be switched back to its original OFF state by applying a voltage pulse of short duration. (14 refs.)

102519 Electroformed states in an Au-NaF-Au thin film structure. S.M.Babulanam, M.Ibrahim (Dept. of Phys., Dacca Univ., Dacca, Bangladesh).
Vacuum (GB), vol.33, no.5, p.307-9 (May 1983).
An Au-NaF-Au thin film structure exhibited electroformed states at the application of a step voltage $V_F=3\pm1$ V and then the structure showed a current maxima at a voltage $V_P=3\pm0.5$ V. The device became low conducting at an unforming voltage $V_U\geq4.5$ V. The voltage controlled negative resistance region occurred for $V_P<V_{VCNR}<V_U$. An Au-NaF-Au thin film structure generally showed a few tens of ohms resistance just after its preparation. The samples could be preformed through the application of a step voltage. Typical DC IU-V characteristics of a preformed sample (V42, NaF530 nm thick) at room temperature (302K) and under a voltage ramp of about 1 V min^{-1} are shown. The I-V characteristic was non-ohmic and a plot of I-V^2 showed a straight relation for $V<2$ V. (6 refs.)

73.40S Metal-semiconductor-metal structures

On the exact calculation of the specific electrical conductivity of semiconducting slabs .... See Entry 102373

73.60 ELECTRONIC PROPERTIES OF THIN FILMS

102520 Electrical conductivity and film morphology of TCNQ salt dispersion in polymer matrix. O.K.Kim (Naval Res. Lab., Washington, DC, USA).
J. Polym. Sci. Polym. Lett. Ed. (USA), vol.21, no.7, p.575-81 (July 1983).
A study of electrical conductivity and stability of N-methylphenazinium TCNQ (NMP^+TCNQ^-)*/polymer composite is reported with an emphasis on film morphology. Since this system can eliminate the influence of the CT interaction due to TCNQ°, the effect of the particular cation of this simple salt on the film morphology can be better evaluated. However, the role of TCNQ° doping was important for the composite stability and the conductive film morphology. Conductivity and stability of the films are discussed, with the morphological change which was studied spectroscopically in various matrices such as poly(vinyl acetal)s, polycarbonate, and poly(methyl methacrylate). (4 refs.)

102521 Electrical conduction in sputtered Si:Al films. A.D.Inglis, J.R.Dutcher, N.Savvides, S.P.McAlister, C.M.Hurd (Solid State Chem., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
Solid State Commun. (USA), vol.47, no.7, p.555-8 (Aug. 1983).
The d.c. electrical resistivity $\rho(x, T)$ has been measured for a series of granular Si_xAl_{1-x} sputtered films for $0.25<x<0.62$ and $4K<T<300K$. Three separate behaviours are identified in $\rho(x, T)$ corresponding to extrinsic activated semiconduction, metallic conduction and electron localisation. (13 refs.)

73.60D Metallic thin films

102522 Thermoelectric power of aluminum films. D.De, S.K.Bandyopadhyay, S.Chaudhuri, A.K.Pal (Dept. of General Phys. & X-rays, Indian Assoc. for the Cultivation of Sci., Calcutta, India).
J. Appl. Phys. (USA), vol.54, no.7, p.4022-7 (July 1983).
The thermoelectric power (TEP) of aluminum film was measured in the thickness range of 300-1600 Å. From the size effect of electron diffusion term, the energy dependence of the mean free path of conduction electrons (U) and the Fermi surface area (V) were calculated to be $U=0.957$ and $V=1.322$. The phonon-drag part of TEP also exhibited a size effect from which the mean free path of the dominant phonon mode was estimated to be 400 Å. The effect of grain boundary scattering on thermoelectric power was also studied. (29 refs.)

102523 Conduction parameters in chemically deposited thin silver films. C.R.Pichard, J.-P.Drexler, A.J.Tosser, J.Flechon (Lab. d'Electronique, Univ. de Nancy 1, Vandoeuvre-les-Nancy, France).
J. Mater. Sci. (GB), vol.18, no.8, p.2414-18 (Aug. 1983).
Experimental data related to the resistivity of chemically deposited silver films, and the TCR are interpreted from linearized equations in the framework of the three-dimensional conduction model. The electronic transmission coefficient at the grain boundary, t, and the electronic specular reflection coefficient at the film surface, p, are calculated from both resistivity and TCR measurements; no marked departure is observed. The high value of t agrees with crystallographic data. (37 refs.)

102524 Electron localization and interaction in bismuth thin films. Yu.F.Komnik, E.I.Bukhshtab, V.V.Andrievskii, A.V.Butenko (Phys.-Tech. Inst. of Low Temperatures, Acad. of Sci., Kharkov, Ukrainian SSR).
J. Low Temp. Phys. (USA), vol.52, no.3-4, p.315-33 (Aug. 1983).
The authors have studied the conductivity of thin bismuth films (thickness $L\approx100$-200 Å) for temperatures from 1.4 to 4.2K and magnetic fields up to ~50 kOe. The low-temperature behaviour includes an increase in electrical resistance as temperature is lowered and an anomalous positive magnetoresistance. These features can be quantitatively described in terms of a theory accounting for electron localization and interaction in two-dimensional systems. The experimental data for conductivity in a perpendicular magnetic field are analyzed as suggested by the theory of Altshuler, Aronov, Larkin, and Khmel'nitskii (1981) and those for a parallel field by the theory of

Altshuler and Araonov (1978). The inelastic electron relaxation time at 1.4-4.2K was found to vary as T^{-p}, where $p=1.3\text{-}1.5$. (22 refs.)

102525 Studies on Co-Sn-Te thin films. J.G.Bamane, H.V.Keer (Industrial Hygiene Div., Central Labour Inst., Government of India, Bombay, India).
Pramana (India), vol.20, no.4, p.305-12 (April 1983).
Electrical and galvanomagnetic properties of $Co_xSn_{1-x}Te$ thin films have been studied. On the basis of small positive temperature coefficient of resistance, small and constant resistivity, low Hall coefficient and negligible magnetoresistance, it was concluded that CoTe-SnTe system is metallic. Discussion employing the Sondheimer's (1952) model further corroborated the metallic nature of the thin films. (13 refs.)

102526 Electrical resistivity and reduced temperature coefficient of polycrystalline metallic thin films. C.R.Pichard (Lab. d'Electronique, Univ. de Nancy, Vandoeuvre-les-Nancy, France), C.R.Tellier, A.J.Tosser.
Vide les Couches Minces (France), vol.38, no.215, p.3-11 (Jan.-Feb. 1983). In French. [received: July 1983]
Extended tabulated values of the resistivity of thin polycrystalline metal films and of the temperature coefficient are given. A linearized equation for the resistivity and its temperature coefficient is then proposed. Equations are proposed for calculating the Hall coefficient, the thermopower, the thermal conductivity and the strain coefficients in terms of film resistivity and its temperature coefficient. (47 refs.)

Size effects in thin films ....See Entry 98674

Structure and properties of evaporated amorphous films consisting of transition metal-metalloid alloys ....See Entry 102193

Long range surface plasmons in birefringent media ....See Entry 102274

Time of flight experiments with conduction electrons—an application of weak localization ....See Entry 102357

Electron localization and superconductivity in 2D in metals ..See Entry 102574

73.60F Semiconductor films

102527 Hall mobility in undoped microcrystalline Si:H,Cl films. V.Augelli, R.Murri, T.Ligonzo (Dipartimento di Fisica, Univ. di Bari, Bari, Italy).
Appl. Phys. Lett. (USA), vol.43, no.3, p.266-7 (1 Aug. 1983).
The Hall mobility in undoped microcrystalline Si:H,Cl films has been measured in the temperature range $130<T<300$K. The dependence of μ_H on the temperature clearly evidences two different transport mechanisms. Above $T_0 \simeq 200$K, the Hall mobility has an activation energy of about 0.3 eV, while below T_0 it is practically temperature independent. (12 refs.)

102528 Electrical and structural properties of pulse laser-annealed polycrystalline silicon films. T.I.Cox, V.G.I.Deshmukh, J.R.Hill, H.C.Webber, N.G.Chew, A.G.Cullis (Royal Signals & Radar Establ., Great Malvern, England).
IEEE Trans. Electron Devices (USA), vol.ED-30, no.7, p.737-44 (July 1983).
Doped epitaxial films of Si on single-crystal high-resistivity Si substrates have been prepared using ion implantation and Q-switched ruby laser annealing of LPCVD polycrystalline Si layers. Films doped with B or As in the range 10^{17} to 5×10^{20} cm^{-3} were studied by the measurement of their resistivities, Hall mobilities, and doping density profiles. The good film quality achieved permitted the fabrication of p-channel MOS transistors which, through measurements of threshold voltage and transconductance, yielded additional data on the surface mobility and the integrity of the Si-SiO_2 interface. The electrical properties of the films compared favorably with those of similarly doped single-crystal material, and transmission electron microscopy was used to confirm the good structural quality of the epitaxial growth. (15 refs.)

102529 Electrical characteristics of contact of polycrystalline and monocrystalline silicon films with the same type of conductance. F.D.Kasimov, Z.A.Iskender-Zade, A.G.Abdulla, V.M.Mamikonova.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.4, p.76-9 (1982). In Russian.
V-A characteristics of contacts of polycrystalline and monocrystalline Si films with the same type of conductance were investigated. It was shown that under the certain conditions of growth and thermal treatment leakage currents of interfaces of poly- and monocrystalline films were small. At the voltage above 120 V the effect of S-type switching was observed. The cutoff voltage depended on the length of the films. (8 refs.)

102530 Effects of controlled hydrogenation by ion implantation on the localized states in vacuum evaporated amorphous silicon. T.C.Lee, G.W.Neudeck (School of Electrical Engng., Purdue Univ., West Lafayette, IN, USA).
J. Appl. Phys. (USA), vol.54, no.7, p.3977-82 (July 1983).
Hydrogen incorporation into electron beam vacuum-evaporated amorphous silicon films has been performed by ion implantation followed by a low temperature thermal activation at 230°C. After hydrogenation, a field effect conductance change of 4 orders of magnitude was observed. A comparison of the samples before hydrogenation and after hydrogenation demonstrates that almost 3 orders of magnitude reduction (from about 10^{22} /cm^3 eV to about 10^{19} /cm^3 eV) in the density of localized states near the Fermi level in the energy gap has been achieved. Varying the hydrogen implantation dosage between samples from 1×10^{16} to 1.5×10^{17} /cm^2, with all other sample preparation procedures fixed, causes a decrease in the density of localized states near the Fermi level of the amorphous silicon from 8.6×10^{20} to 1×10^{19} /cm^3 eV. (41 refs.)

102531 Mechanism of dispersive transport in hydrogenated amorphous silicon. J.Shirafuji, H.Matsui, Y.Inuishi (Dept. of Electrical Engng., Osaka Univ., Osaka, Japan).
J. Appl. Phys. (USA), vol.54, no.7, p.3983-6 (July 1983).
Temperature dependence of the electron mobility and the dispersion parameter in hydrogenated amorphous silicon films, deposited by glow-discharge decomposition and RF reactive sputtering methods, has been measured by means of time-of-flight technique. The results of the dispersion parameter are not consistent with the theoretical prediction which has been derived on the assumption of an exponential band tail. The temperature dependence of the electron mobility seems to be more likely to invoke the presence of traps located predominantly at about 0.2 eV below the conduction band. Several possibilities suitable to this situation are discussed. (21 refs.)

102532 Impedance of thin semiconductor films in low electric field. Kwyro Lee, M.S.Shur (Dept. of Electrical Engng., Univ. of Minnesota, Minneapolis, MN, USA).
J. Appl. Phys. (USA), vol.54, no.7, p.4028-34 (July 1983).
Impedance and admittance of a thin semiconductor film in the direction perpendicular to the film is calculated as a function of the sample length, doping, and temperature for voltages smaller than the thermal voltage. The calculation is based on the approximate solution of the Boltzmann equation in the relaxation time approximation. When the sample length is smaller than the mean free path, the conductance becomes independent of the sample length. In this limit the inductive susceptance is proportional to the sample length. When the sample length becomes comparable to the mean free path, the inductive susceptance reaches the maximum value, and then decreases. The calculation shows that for high mobility GaAs samples at 77K, the size effect may be important for films thinner than 5 μm. The results of the calculation are interpreted in the frame of a simple equivalent circuit which includes the bulk resistance, in series with the resistance due to the finiteness of the sample length, in series with the inductance L due to the inertia effect of the carrier transport, and all in parallel with the geometric capacitance C. The sample inductance L is approximately equal to $(\omega_p{}^2C)^{-1}$ where ω_p is the plasma frequency. This simple model agrees fairly well with the results of the numerical calculation. The calculation, based on the model demonstrates that the predicted effects can be observed for realistic values of the contact resistance. (14 refs.)

102533 Grain boundary phenomena in n-type CdTe films grown by hot wall vacuum evaporation. W.Huber, A.L.Fahrenbruch, C.Fortmann, R.H.Bube (Dept. of Materials Sci. & Engng., Stanford Univ., Stanford, CA, USA).
J. Appl. Phys. (USA), vol.54, no.7, p.4038-43 (July 1983).
Films of *n*-type CdTe doped by coevaporation of indium have been deposited by hot wall vacuum evaporation on 7059 Corning glass and BaF_2 single crystal substrates. Layers deposited on glass show a dark resistivity of the order of 10^5 Ω cm and a light resistivity of 500 Ω cm under AM1.5; photoexcitation increases the electron density but does not affect the electron mobility. Layers deposited on BaF_2 show a dark resistivity of about 3 Ω cm and a light resistivity of about 2 Ω cm, corresponding to an electron density of 3.9×10^{16} cm^{-3} and an electron mobility of 48 cm^2/V s; illumination of these layers on BaF_2 increases the electron mobility but not the electron density. A quantitative model for grain boundary transport in polycrystalline materials is shown to give good agreement with the experimental data. (10 refs.)

102534 Interpretation of DC characteristics of phosphorus-doped polycrystalline silicon films: conduction across low-barrier grain boundaries. E.Loh (Electro-Optical & Data Systems Group, Hughes Aircraft Co., El Segundo, CA, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4463-6 (Aug. 1983).
Current-voltage curves of phosphorus-doped polycrystalline silicon films of Lee and Cheng (1982) are reanalyzed with the same trapping model of thermionic and thermionic-field emission across symmetrical Schottky barriers between grains. The analysis yields unexpectedly low values of the effective number of grains N_{eff} in the conducting path. Values of N_{eff}/N_{geo} decreases from 0.5 at 20K to 0.1 at 300K, where N_{geo}=(film length)/(typical grain size). A DC conduction model is proposed. Carriers in phosphorus-doped polysilicon films travel extensively across low-barrier grain boundaries, where electrons from segregated phosphorus are abundant enough to fill most of the electron traps. The model can also explain an observed current-temperature relation $i \propto T^3$ at low bias voltages and yield values of barrier resistance comparable to reported data on polycrystalline silicon neutron-transmutation doped with phosphorus measured by a small-area traveling potential probe. (16 refs.)

102535 Laser-recrystallized polycrystalline silicon resistors for integrated circuit applications. H.Schaber, D.Cutter (Zentralbereich Tech., Siemens AG, Munchen, Germany), J.Binder, E.Obermeier.
J. Appl. Phys. (USA), vol.54, no.8, p.4633-40 (Aug. 1983).
The influence of grain boundaries on the electrical properties of laser-recrystallized polycrystalline silicon films, which a typical grain size 1×20 μm^2 and doping concentration between 10^{16} and 10^{20} cm^{-3}, has been investigated. Over a wide range of doping concentration, sheet resistance and its temperature dependence are found to be very close to the values expected for single crystal material. Deviations occur at low doping levels and are related to the average grain size perpendicular to the current flow. The standard deviation and laser power dependence of sheet resistance $R_\square$ are strongly correlated to the influence of grain boundaries, as measured by the deviation of $R_\square$ from the single crystal value. The main sources of resistor nonlinearity are substrate field effects and the dependence of grain boundary potential barriers on applied bias. At doping concentrations $\gtrsim 10^{18}$ cm^{-3} very linear resistors are obtained reproducibly. Resistance ratios can be controlled to better than 1% and temperature coefficients $\lesssim 10^{-4}$/K can be achieved by proper choice of doping concentration. (18 refs.)

102536 Influence of carbon addition on the electrical and structural properties of phosphorus and boron doped silicon layers. W.A.P.Claassen, J.Bloem, F.H.P.M.Habraken (Philips Res. Labs., Eindhoven, Netherlands).
J. Electrochem. Soc. (USA), vol.130, no.7, p.1586-92 (July 1983).
Phosphorus and boron polycrystalline silicon layers grown by chemical vapor deposition were additionally doped with carbon via the introduction of C_2H_2 in the gas phase. Addition of carbon to n-type and p-type polycrystalline silicon gives rise to characteristic differences in resistivity *vs.* $P(C_2H_2)$ input pressures, at least at small input pressures of C_2H_2. The difference in resistivity can be explained by a donor activity of carbon or silicon-carbon complexes or by an asymmetrical energy distribution of grain boundary traps, both at the grain boundaries. It is also shown that the addition of carbon has a strong influence on the morphology of the growing silicon layer. With increasing values of $P(C_2H_2)$, the size of the grains in the layer decreases, under certain circumstances even amoprhous silicon is formed, and this effect is stronger at the lowest temperatures. The decomposition kinetics of C_2H_2 has also been discussed. It is concluded that at high input pressures of C_2H_2 the deposition rate of carbon is gas phase diffusion controlled. At lower $P(C_2H_2)$ values and temperatures above 850°C, the formation of Si-C nuclei is rate-limiting as far as the introduction of carbon is concerned. (19 refs.)

102537 Peculiarities of induced potential in silicon layers. E.E.Aboltin'sh, Kh.I.Kugel'.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.3, p.21-3 (1983). In Russian.
The induced potential dependence on the conductivity in silicon layers has been investigated. (4 refs.)

102538 Thermoelectric power in InAs films obtained by flash evaporation. A.K.Sharma, P.Jayarama Reddy (Dept. of Phys., S.V. Univ. Coll., Tirupati, India).
Phys. Status Solidi a (Germany), vol.78, no.1, p.K27-9 (16 July 1983).
Presents results on the thermoelectric power behaviour as a function of different deposition parameters viz., temperature of the film and substrate, film thickness, post deposition heat treatment, etc. (4 refs.)

102539 The influence of heating on the characteristics of the electron-excited conduction in gallium phosphide films. S.A.Azimov, D.A.Aronov, V.M.Rubinov, M.Tuichiev (S.V. Starodubtsev Physico-Tech. Inst., Acad. of Sci., Tashkent, Uzbek SSR).
Phys. Status Solidi a (Germany), vol.78, no.1, p.K53-8 (16 July 1983).
The authors present some experimental results and an analysis of the temperature dependence of current in sandwich structures based on GaP films of thickness d=0.1 to 0.5 μm and excited by an electron beam. They have studied the current-voltage characteristics (CVC) plotted at beam currents varying within $I_b=2\times10^{-9}$ to 6×10^{-8} A and T=295 to 385K, the dependence of current J in the sample on the beam current at a given voltage U and various temperatures T, as well as its dependence on 1/T at various values of I_b and voltages corresponding to the ohmic and superlinear regions of CVC and to that of almost vertical current rise. (5 refs.)

102540 Magnetoresistance thickness dependence of n-InSb. E.W.Kreutz (Inst. fur Angwandte Phys., Tech. Hochschule Darmstadt, Darmstadt, Germany).
Phys. Status Solidi a (Germany), vol.78, no.1, p.K71-5 (16 July 1983).
Geometry effects via specimen thickness and inhomogeneities via internal barriers have been discriminated by investigation of the thickness, field, and temperature dependence of the magnetoresistance. The author presents new data on n-type InSb with real surfaces, which give greater insight into the contributing effects. (13 refs.)

102541 Electrical conductivity of β-$Na_{0.33}V_2O_5$ thin films. O.B.Ajayi, O.F.Taiwo, E.J.Ibanga (Dept. of Phys., Univ. of Ife, Ile-Ife, Nigeria).
Thin Solid Films (Switzerland), vol.105, no.2, p.97-101 (15 July 1983).
β-$Na_{0.33}V_2O_5$ was deposited by the pyrolysis of a mixture of V^{III}-acetylacetonate and sodium carbonate. The composition was determined using a combination of X-ray diffraction, Rutherford backscattering and Auger electron spectroscopy. The electrical conductivity of the deposited films as a function of temperature is of the form $\sigma=(\sigma_0/T)\exp(-E_A/kT)$ with $E_A=0.21\pm0.013$ eV. The electrical conductivity is in agreement with the predictions of the small polaron model. (19 refs.)

102542 Characterization of fluorine-doped In_2O_3 films synthesized by spray pyrolysis. S.P.Singh, A.Raza, A.K.Sharma, O.P.Agnihotri, L.M.Tewari (Dept. of Phys., Indian Inst. of Technol., New Delhi, India).
Thin Solid Films (Switzerland), vol.105, no.2, p.131-8 (15 July 1983).
Thin films of fluorine-doped In_2O_3 were prepared by spray pyrolysis. For a doping concentration of 2.4 wt.% NH_4F and a substrate temperature of 310°C, the films had a maximum figure of merit, i.e. a high transmission of about 90% and a low sheet resistance of about 10 Ω/□. The effects of the doping concentration and substrate temperature were exploited in order to obtain low sheet resistances and high transmissions in the visible range of the solar spectrum. Mobilities as high as 48 $cm^2\ V^{-1}\ s^{-1}$ and carrier concentrations of about $3.6\times10^{20}\ cm^{-3}$ were achieved in as-deposited films. X-ray diffraction and transmission electron diffraction patterns and micrographs indicated good crystallinity. The (400) reflection was of maximum intensity in all cases. These films have potential for application as a top conducting layer in solar cells because of their high transmissions in the visible range of electromagnetic radiation and their low sheet resistances. (13 refs.)

102543 Electrical conductivity, structure and Hall effect measurements of InSe films. D.V.Krishna Sastry, P.Jayarama Reddy (Dept. of Phys., Sri Venkateswara Univ., Tirupati, India).
Thin Solid Films (Switzerland), vol.105, no.2, p.139-47 (15 July 1983).
Stoichiometric InSe films were prepared by discrete evaporation using spectrally pure (99.999%) InSe powder in a residual pressure of about 4×10^{-6} Torr. The thickness of the films was varied from 500 to 3000 Å. The electrical conductivity, of the films was measured by Van der Pauw's method. The as-deposited films had an amorphous structure as observed with an electron microscope. Thermal annealing was carried out through a number of annealing cycles and a transformation to a crystalline state during the process was evidenced by the electron micrographs. Conductivity measurements were made on the amorphous films from the transition temperature to liquid air temperature and the activation energies were calculated from the variation in conductivity with temperature. The density of states at the Fermi level was also calculated at low temperatures. Hall effect measurements were made on the annealed films and the Hall mobility μ_H, the Hall coefficient R_H and the carrier concentration n were evaluated. (30 refs.)

Zn incorporation in $Ga_{1-x}Al_x$ As grown by liquid phase epitaxy and its electrical properties .... See Entry 101728

Epitaxial growth of $Hg_{0.7}Cd_{0.3}Te$ by laser-assisted deposition .... See Entry 102190

Effects of growth temperature and substrate orientation on the entry of tellurium into epitaxial gallium arsenide films .... See Entry 102209

IR laser-induced deposition of silicon thin films .... See Entry 102213

Evidence for shallow bound states in PbTe .... See Entry 102313

Evidence for shallow bound states in PbTe: A reply .... See Entry 102314

Highly doped sputtered amorphous silicon without hydrogen .... See Entry 102380

The interpretation of the electric and optical properties of a-Si:H films produced by RF glow discharge through dark conductivity, photoconductivity and pulse controlled capacitance-voltage measurements .... See Entry 102381

Electrical and optical properties of RF-SP a-Ge:O:(H) deposited from GeO_2 .... See Entry 102382

On the phase-breaking time of electrons in a disordered two-dimensional system .... See Entry 102416

Hall effect studies in germanium doped $Al_xGa_{1-x}As$ .... See Entry 102432

Temperature dependent light induced conductivity changes in hydrogenated amorphous silicon .... See Entry 102451

Photoconductivity and dark conductivity of hydrogenated amorphous silicon .... See Entry 102455

Noise spectroscopy in amorphous silicon films .... See Entry 102474

Contact resistivity of TiN on p^+-Si and n^+-Si .... See Entry 102517

Electrical properties of polystyrene doped with leucomalachite green for correlation with its electrothermographic behaviour .... See Entry 102802

A study of the electrical and luminescence characteristics of a novel Si-based thin film electroluminescent device .... See Entry 102960

Optical and electrical properties of RF-sputtered indium-tin oxide films .... See Entry 102976

A new self-limiting process for the production of thin submicron semiconductor films .... See Entry 103346

Mass spectrometric studies of impurities in silane and their effects on the electronic properties of hydrogenated amorphous silicon .... See Entry 103618

73.60H Insulating thin films

102544 Electric properties of antimony oxide films formed by heating antimony films in air. P.S.Nikam, D.L.Mankar (MSG Coll., Malegaon, India).
Indian J. Pure & Appl. Phys., vol.21, no.6, p.361-2 (June 1983).
A study has been made of resistivity (ρ), activation energy (ΔE), temperature coefficient of resistance (TCR) and mean free-path (l_0) of charge carriers in air-oxidized antimony films in the temperature range 50-240°C. The electric parameters of these films differ considerably from those of vacuum-evaporated films of antimony oxide. (18 refs.)

Reactively RF magnetron sputtered AlN films as gate dielectric .... See Entry 102197

High field conduction in solution-grown polyvinylidene fluoride (PVF_2) films .... See Entry 102395

Conduction and dielectric polarization in neodymium fluoride thin films .... See Entry 102818

Mechanisms of reactive sputtering of titanium nitride and titanium carbide. II. Morphology and structure .... See Entry 103052

73.60K Superconducting films

Electron diffraction studies of metastable phase decay in amorphous bismuth with high hydrogen content .... See Entry 102194

On the relation between T_c measurements and structure inhomogeneity of Nb_3Ge superconductor .... See Entry 102545

Superconducting transition temperature versus thickness of Nb film on various substrates .... See Entry 102551

Size effect on the lattice thermal conductivity of lead single crystals .... See Entry 102572

Electron localization and superconductivity in 2D in metals .... See Entry 102574

Superconducting tunnel junctions on oxidized Zr_2Rh films .... See Entry 102578

Excitation of resistive domains in a superconducting film .... See Entry 102591

Flux pinning in interdiffusing thin films .... See Entry 102596

Magnetic coupling in granular aluminum superconducting films .... See Entry 102600

RF superconducting properties of thin films on niobium .... See Entry 102601

CVD of niobium germanides from partially reacted input gases .... See Entry 103059

74.00 SUPERCONDUCTIVITY

CRYOSEM '81. Second International Seminar on Low Temperature Physics .... See Entry 98614

74.10 OCCURRENCE, CRITICAL TEMPERATURE

102545 On the relation between T_c measurements and structure inhomogeneity of Nb_3Ge superconductor. K.Frohlich, D.Machajdik, S.Benacja, V.Cernusko (Electrotech. Inst. Slovak Acad. of Sci., Bratislava, Czechoslovakia).
Acta Phys. Acad. Sci. Hung. (Hungary), vol.53, no.3-4, p.419-23 (1982). [received: Aug. 1983] (CRYOSEM '81. Second International Seminar on Low Temperature Physics, Visegrad, Hungary, 8-10 Oct. 1981).
Transition curves of Nb_3Ge samples prepared by chemical vapour deposition were obtained by resistive and inductive methods. The differences between the values of T_c midpoints of both methods as well as the width of superconducting transition measured inductively are found to be dependent on the degree of inhomogeneity. As a measure of inhomogeneity the half-width of diffraction peak was chosen. Using the resistive method T_c onset of 23.2K was obtained for one of the samples. (6 refs.)

102546 Some physical properties of multifilamentary Nb_3Sn superconductors prepared by bronze technology. J.Kruzliak, P.Hutka, P.Kovac, P.Setina (Inst. of Electrical Engng., Slovak Acad. of Sci., Bratislava, Czechoslovakia).
Acta Phys. Acad. Sci. Hung. (Hungary), vol.53, no.3-4, p.425-31 (1982). [received: Aug. 1983] (CRYOSEM '81. Second International Seminar on Low Temperature Physics, Visegrad, Hungary, 8-10 Oct. 1981).
The critical current densities and critical temperatures of multifilamentary Nb_3Sn superconductors prepared by the bronze technology were studied. It is shown that the growth rate of Nb_3Sn layer under given conditions of heat treatment depends also on the number of filaments in the wire. The critical current densities obeying $10^9\ A/m^2$ at 5T were obtained. The J_c values in the cross section of the Nb_3Sn layer are not constant, because the grain diameter of Nb_3Sn is not homogeneous. The influence of growth rate on T_c was also observed. The lower T_c values are obtained for higher growth rates of the Nb_3Sn layer. (11 refs.)

102547 The effect of precipitation heat treatments on the critical temperature in Ti-rich Nb-Ti alloys. L.Miu, D.Niculescu, E.Cruceanu (Inst. of Phys. & Technol. of Materials, Bucharest-Magurele, Rumania).
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.425-7 (Aug. 1983).
Precipitation heat treatments are found to produce an increase in critical temperature (T_c). Explanations of this effect are discussed. One is based on the Nb enrichment of the superconducting Nb-Ti (β) matrix during Ti-rich secondary phase precipitation (α-ti, thermal ω). The other is based on the varying extent of the superconducting proximity effect. (4 refs.)

102548 Microstructure and superconducting properties of helium-saturated niobium-titanium alloy. P.G.Vasilev, I.N.Goncharov, G.T.Zhdan, Sh.Sh.Ibragimov, L.V.Petrova, V.F.Reutov, E.P.Romanov (Joint Inst. for Nuclear Res., Dubna, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1092-100 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
Foils 58-μm thick were made from $Nb_{0.8}Ti_{0.2}$ after recrystallization and saturation with helium (by irradiation with α-particles of 29 MeV energy in air). These foils were subjected to annealing at various temperatures. At each stage the microstructure was determined under an electron microscope and measurements were made of the superconducting transition temperature T_c, resistivity in the normal state ρ_n, the second critical field H_{c2}, and the pinning force F_p. The results were compared with the data obtained for helium-saturated samples of both pure niobium and of $Nb_{0.97}Ti_{0.03}$. (6 refs.) *A.T*

102549 Superconductivity of FCC tantalum nitride at high pressures up to 12 GP*a*. M.A.Il'yina, W.S.Maynashev, T.A.Pashkina.
Fiz. Nizk. Temp. (USSR), vol.9, no.7, p.757-9 (July 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The T_c (P) dependences of nonstoichiometric f.c.c. TaN of different composition has been studied. The said dependences are found to suffer disontinuities at different pressures P depending on the initial values of T_c. X-ray analysis of the samples under pressures up to 12 GP*a* did not reveal the appearance of any new crystal modification of TaN. Such a kind of T_c (P) dependence in TaN is supposed to be connected with the changes in the energy spectrum of carriers due to the pressure. (10 refs.)

102550 Superconductivity in $CeCu_2Si_2$: dependence of T_c on alloying and stoichiometry. H.Spille, U.Rauchschwalbe, F.Steglich (Inst. fur Festkorperphys., Tech. Hochschule Darmstadt, Darmstadt, Germany).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.165-77 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The authors have determined the transition temperatures of the alloy systems $(Ce,M)Cu_2Si_2$ with $M=La,Y,Sc$, $Ce(Cu,T)_2Si_2$ with $T=AG,Au,Mn,Ru,Rh,Pd$ and $CeCu_2(Si,Ge)_2$ as well as of $CeCu_2Si_2$ samples with varying stoichiometry. In each case, alloying is found to depress T_c, the critical concentrations necessary to destroy superconductivity ranging between <1 at.% and 10 at.%. Off-stoichiometry samples with a Cu- or Ce-deficiency of a few at.% are not superconducting, while samples prepared with a comparable excess of Cu or Ce show sharp transitions at $T_c \gtrsim 600$ mK. The authors infer that stoichiometric $CeCu_2Si_2$ contains substantial concentrations of Cu- and Ce-vacancies, which hinder superconductivity. First results on $CeCu_2Si_2$ single crystals, which exhibit bulk superconductivity, are also reported. (21 refs.)

102551 Superconducting transition temperature versus thickness of Nb film on various substrates. J.Kodama, M.Itoh, H.Hirai (Dept. of Electronic Engng., Kinki Univ., Osaka, Japan).
J. Appl. Phys. (USA), vol.54, no.7, p.4050-3 (July 1983).
Dependence of superconducting transition temperature on the thickness of Nb films deposited upon several kinds of substrates by means of RF sputtering was studied in search of rudimental data necessary in fabricating variable thickness microbridge type Josephson junctions. The transition temperature was found to lower with the decrease of Nb film thickness. The lowering characteristics of the transition temperature were found to vary in accordance with whether the substrate surface was amorphous or crystalline. The cause of the variance was studied on thin films with the aid of X-ray diffraction pattern analysis and measurement of film resistance. (2 refs.)

102552 On the relationship between the electronic density of states and the superconducting critical temperature of disordered V_3Si. D.O.Welch, C.S.Pande, R.Caton (Brookhaven Nat. Lab., Upton, NY, USA), R.Viswanathan.
J. Low Temp. Phys. (USA), vol.52, no.3-4, p.289-300 (Aug. 1983).
The available data on the effect of neutron and α-particle irradiation on the superconducting properties and the low-temperature specific heat capacity of single- and polycrystalline V_3Si were analyzed in a unified manner. It was found that the electron-phonon renormalization parameter λ does not vary simply proportionally to the bare density of electron states at the Fermi level as had been earlier conjectured by Dynes and Varma (1976), nor does it vary in exactly the same manner as found by Fradin and Williamson (1974) to hold for a variety of vanadium-based A15 structure compounds and pseudobinary alloys. When the behaviour of V_3Si is compared with that of Nb_3Sn, Nb_3Al, and Nb_3Ge, it is seen that the response to disorder of parameters of importance in the superconductivity of these compounds does not follow any simple, universal behaviour. (28 refs.)

102553 Superconductivity and structural transformation in HfRuAs. G.P.Meisner (Inst. for Pure & Appl. Phys. Sci., Univ. of California, San Diego, La Jolla, CA, USA).
Phys. Lett. A (Netherlands), vol.96A, no.9, p.483-6 (1 Aug. 1983).
HfRuAs exists in two structural modifications. The high-temperature phase (ZrRuSi-type structure) exhibits superconductivity at 4.93-4.37K, whereas the low-temperature phase (TiFeSi-type superstructure) remains normal at 1K. The lattice distortion giving rise to the superstructure indicates zig-zag chains of metal atoms are crucial to superconductivity in this class of compounds. (23 refs.)

102554 Effects of oxygen content on pressure-induced superconductivity in $EuMo_6S_8$. D.W.Capone, R.P.Guertin (Tufts Univ., Medford, MA, USA), S.Foner, D.G.Hinks, Hung-Chen Li.
Phys. Rev. Lett. (USA), vol.51, no.7, p.601-4 (15 Aug. 1983).
Pressure-induced superconductivity in $EuMo_6S_8$ is sensitive to the systematic addition of oxygen. As oxygen content increases, the critical pressure above which the sample is superconducting ($P \simeq 11$ kbar) decreases, the onset is less abrupt, the maximum T_c (11.8K) decreases, and dT_c/dP at high pressures (−0.29 K/kbar) is less negative. The c/a ratio and the unit cell volume vary linearly with the extrapolated zero pressure T_c. The results are discussed in terms of an oxygen-induced defect at the Eu site. (21 refs.)

102555 The Pd-Pt-H system: phase transformations at high pressure and superconductivity. V.E.Antonov, T.E.Antonova, I.T.Belash, E.G.Ponyatovskii, V.I.Rashupkin (Inst. of Solid State Phys., Acad. of Sci., Chernogolovka, USSR).
Phys. Status Solidi a (Germany), vol.78, no.1, p.137-46 (16 July 1983).
Studies on crystal structure and superconducting properties of hydrogen solid solutions in the Pd-Pt alloys with 2.8, 10, 15, 25, 40, and 60 at% Pt are presented. Palladium alloying with platinum is shown to decrease the maximum values of superconducting transition temperature attainable at hydrogenation. The phenomenon of dissolution to phases rich and poor in platinum is revealed for the solutions based on the alloys containing 15 to 60 at% Pt. Hydrogenation of the samples is performed at hydrogen pressures to 6.5 GLa and temperatures to 350°C. (14 refs.)

102556 Effect of thermal phonons on the superconducting transition temperature. C.R.Leavens (Div. of Phys., Nat. Res. Council of Canada, Ottawa, Ontario, Canada), E.Talbot.
Phys. Rev. B (USA), vol.28, no.3, p.1304-13 (1 Aug. 1983).
There is no consensus in the literature on whether or not thermal phonons depress the superconducting transition temperature T_c. In this paper it is shown by accurate numerical solution of the real-frequency Eliashberg equations for the pairing self-energy ϕ and renormalization function Z that thermal phonons in the kernel for ϕ raise T_c but those in Z lower it by a larger amount so that the net effect is to depress T_c. (A previous calculation which ignored the effect of thermal phonons the ϕ overestimated the suppression of T_c by at least a factor of 3.) It is shown how to switch off the thermal phonons in the imaginary-frequency Eliashberg equations, exactly for Z and approximately for ϕ. The real-frequency and approximate imaginary-frequency results for the depression of T_c by thermal phonons are in very satisfactory agreement. Thermal phonons are found to depress the transition temperature of Nb_3Sn by only 2%. It is estimated that the suppression of T_c by thermal phonons saturates at about 50% in the limit of very strong electron-phonon coupling. (18 refs.)

102557 Upper critical fields and superconducting transition temperatures of some zirconium-base amorphous transition-metal alloys. M.G.Karkut, R.R.Hake (Dept. of Phys., Indiana Univ., Bloomington, IN, USA).
Phys. Rev. B (USA), vol.28, no.3, p.1396-418 (1 Aug. 1983).
Superconducting upper critical fields $H_{c2}(T)$, transition temperatures T_c, and normal-state electrical resistivities ρ_n have been measured in the amorphous transition-metal alloy series $Zr_{1-x}Co_x$, $Zr_{1-x}Ni_x$, $(Zr_{1-x}Ti_x)_{0.78}Ni_{0.22}$, and $(Zr_{1-x}Nb_x)_{0.78}Ni_{0.22}$. Structural integrity of these melt-spun alloys is indicated by X-ray, density, bend-ductility, normal-state electrical resistivity, superconducting transition width, and mixed-state flux-pinning measurements. The specimens display $T_c=2.1\text{-}3.8$K, $\rho_n=159\text{-}190$ $\mu\Omega$cm, and $|(dH_{c2}/dT)_{Tc}|=28\text{-}36$ kG/K. These imply electron mean free paths $l \approx 2\text{-}6$ Å, zero-temperature Ginzburg-Landau coherence distances $\xi_{G0} \approx 50\text{-}70$ Å, penetration depths $\lambda_{G0} \approx (7\text{-}10) \times 10^3$ Å, and extremely high dirtiness parameters $\xi_0/l \approx 300\text{-}1300$. All alloys display $H_{c2}(T)$ curves with negative curvature and (with two exceptions) fair agreement with the standard dirty-limit theory of Werthamer, Helfand, Hohenberg, and Maki (WHHM) for physically reasonable values of spin-orbit-coupling induced, electron-spin-flip scattering time τ_{so}. (136 refs.)

102558 Superconductivity and magnetic order: low temperature phase diagrams. M.B.Maple (Dept. of Phys., Univ. of California, San Diego, La Jolla, CA, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.337-52
Recent experiments on magnetically-ordered ternary and pseudoternary rare earth superconductors are briefly reviewed. Superconductivity has been found to coexist with antiferromagnetic order, but to be destroyed by the onset of ferromagnetic order at a second transition temperature $T_{c2} \sim T_M$, where T_M is the Curie temperature. In antiferromagnetic superconductors, the antiferromagnetic order modifies superconducting properties such as the curve of the upper critical magnetic field versus temperature. In ferromagnetic superconductors, a long wavelength ($\sim 10^2$ Å) sinusoidally modulated magnetic state develops in the superconducting state as a result of the superconducting-ferromagnetic interactions. The interplay of superconductivity and competing magnetic interactions in pseudoternary rare earth systems produces complex and interesting low temperature phase diagrams. (47 refs.)

Anisotropic superconductors containing paramagnetic impurities .... See Entry 102566

Electron-phonon interaction and superconductivity of lanthanum .... See Entry 102567

Proximity effect and branching conditions in superconducting networks .... See Entry 102579

Determination of microscopic parameters by macroscopic measurements in superconductors .... See Entry 102590

V_3Ga superconductors with a high critical current density ..... See Entry 102597

Transport and magnetic properties of layered rare earth disilicides .... See Entry 102619

74.20 THEORY

102559 Application of the 'boson method' to the study of superconducting order parameter. A.Pevala (Inst. of Electrical Engng., Slovak Acad. of Sci., Bratislava, Czechoslovakia).
Acta Phys. Acad. Sci. Hung. (Hungary), vol.53, no.3-4, p.321-30 (1982). [received: Aug. 1983] (CRYOSEM '81. Second International Seminar on Low Temperature Physics, Visegrad, Hungary, 8-10 Oct. 1981).
A brief outline of the so called 'boson method' in the theory of superconductivity is presented. The computation of the space dependence of the superconducting order parameter by means of this method has some advantages compared to standard techniques based on Gor'kov equations. The possibility of obtaining the space dependence of this quantity in the general form is shown. (15 refs.)

102560 Theory of magnetic superconductors. M.Tachiki (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.189-206 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
An epoch-making discovery of new ternary compounds which are simultaneously superconductors and magnetic materials was made in 1977. Since then, many materials of this type have been found and are called 'magnetic superconductors'. These materials have unusual properties owing to the interplay between superconductivity and magnetism. The explanation of these properties and the predictions of new phenomena are presented. (59 refs.)

102561 Magnetic properties of superconducting or normal networks and random walks on percolating clusters. G.Toulouse, R.Rammal (Lab. de Phys., ENS, Paris, France).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.733-40 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
A scaling theory for the diamagnetic susceptibility and the upper critical field of random mixtures of superconducting and insulating elements is presented. The resulting predictions for the critical field are compared with experiments on InGe films and numerical simulation data. One important critical exponent in the theory is related to the spectral dimensionality of a fractal structure, which also governs the diffusion properties. The authors suggest that the number S_N of distinct sites visited during an n-step random walk on an infinite cluster at percolation threshold varies asymptotically as: $S_N \sim N^{2/3}$, in any dimension $d \leq 6$. For more regular networks, such as periodic lattices (with a strip geometry) and fractal structures, the spectrum of Landau levels has been determined. The contribution of the edge states to the quantized Hall conductance is explained in a way which clarifies the role of the geometry in the derivations of this effect. (21 refs.)

102562 Coexistence of superconductivity and ferromagnetism in surface layers of rare-earth ternary compounds. U.Klein (Inst. fur Theoretische Phys., Univ. Linz, Linz, Austria).
Phys. Lett. A (Netherlands), vol.96A, no.8, p.409-12 (25 July 1983).
The bulk and surface stability limits of the homogeneous superconducting and ferromagnetic phases of a ferromagnetic superconductor are investigated using a generalized Ginzburg-Landau functional. It is found that both on cooling and on warming the bulk phase transitions are preceded by transitions to coexistence phases localized at the surface. (11 refs.)

102563 Correlation of superconductivity with material properties. P.K.Lam, M.L.Cohen (Dept. of Phys., Univ. of California, Berkeley, CA, USA).
Phys. Lett. A (Netherlands), vol.97A, no.3, p.114-16 (15 Aug. 1983).
A simple model is used to study the trends of the electron-phonon interaction parameter λ. (8 refs.)

102564 Electrical conductivity of a quasi-one-dimensional superconductor. K.Okamoto (Dept. of Phys., Tokyo Inst. of Technol., Tokyo, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1666-8 (May 1983).
Electrical conductivity of a quasi-one-dimensional superconductor is discussed by the use of the phase Hamiltonian with which the impurity scattering and the interchain interaction are taken into account. The behaviour of the calculated conductivity as a function of temperature is similar to that of the observed conductivity of TMTSF salts. (12 refs.)

102565 Role of potential scattering in the Shiba-Rusinov theory of the magnetic impurities in superconductors. Y.Okabe, A.D.S.Nagi (Dept. of Phys., Univ. of Waterloo, Waterloo, Ontario, Canada).
Phys. Rev. B (USA), vol.28, no.3, p.1320-2 (1 Aug. 1983).
The Shiba-Rusinov theory of magnetic impurities in a superconductor is investigated, with special attention paid to the role of the potential scattering term in the electron-impurity interaction. The meaning of Anderson's theorem in the Shiba-Rusinov theory is discussed. (10 refs.)

102566 Anisotropic superconductors containing paramagnetic impurities. Y.Okabe, A.D.S.Nagi (Dept. of Phys., Univ. of Waterloo, Waterloo, Ontario, Canada).
Phys. Rev. B (USA), vol.28, no.3, p.1323-8 (1 Aug. 1983).
The effect of paramagnetic impurities on superconductors with energy-gap anisotropy is studied using the Shiba-Rusinov theory and treating the ordinary and exchange interactions equally. The Abrikosov-Gor'kov-theory results are a special case of the calculations. The transition temperature T_c and the jump in specific heat at T_c are calculated. The emphasis is to clarify the roles of the ordinary and the exchange interactions in the electron-impurity scattering. The difference between the results of the Shiba-Rusinov and Abrikosov-Gor'kov theories is brought out. (14 refs.)

AC loss and macroscopic theory of superconductors ....See Entry 98671

Spin susceptibility in superconductors ....See Entry 102569

Behavior of a hollow superconducting cylinder in a magnetic field ....See Entry 102571

Determination of microscopic parameters by macroscopic measurements in superconductors ....See Entry 102590

Theory of magnetic structure in reentrant magnetic superconductors $HoMo_6S_8$ and $ErRh_4B_4$ ....See Entry 102628

74.20F BCS theory and its applications

102567 Electron-phonon interaction and superconductivity of lanthanum. Zhang Li-yuan, Han Ru-san, Zhang Yu-lin (Dept. of Phys., Beijing Univ., Peking, China).
Chin. Phys. (USA), vol.3, no.2, p.484-8 (April-June 1983).
Based on a band theory analysis, the BCS mechanism of superconductivity is valid for lanthanum. The principal factor resulting in the comparatively high superconductive transition temperature in lanthanum is the large $\langle I^2 \rangle$ value, caused by *d-p* and *d-f* scattering. The abundance of an *f* partial-wave component in the band structure of lanthanum and the unfavourable factor of its large atomic volume should attract further attention in the preparation of superconductive materials containing lanthanum. It appears that lanthanum is one of the typical '*f* band' superconductors. (23 refs.)

102568 Dispersion of superconducting gap excitations in layered charge density wave systems. G.C.Mahanty, S.N.Behera (Inst. of Phys., Bhubaneswar, India).
Can. J. Phys. (Canada), vol.61, no.8, p.1160-8 (Aug. 1983).
The phonon spectral function for charge density wave (CDW) systems in the superconducting (SC) phase is calculated for finite wave vectors (q). An exact expression for the q dependent phonon self-energy is obtained. The analysis is carried out with a small q limit. The spectral function shows a two peak structure for frequencies ω less than the SC energy gap (2Δ) in contrast to the single peak obtained by Balseiro and Falicov (1980) for $q=0$. The peaks approach each other with increasing q and finally merge into one. Both modes have linear dispersions for small q and the frequency of the low-lying one goes to zero as $q \to 0$. For $\omega > 2\Delta$ the phonon spectrum does not change significantly. The results are discussed in context with the Raman scattering observation of SC gap excitations in $2H\text{-}NbSe_2$ (a layered compound exhibiting both CDW and SC transitions) by Sooryakumar and Klein (1981). The present calculation demands that the strength of coupling between the CDW phonon and SC electrons be an order of magnitude smaller than that used for $q=0$ in order to get an agreement with the experimental result. (15 refs.)

Determination of microscopic parameters by macroscopic measurements in superconductors ....See Entry 102590

74.30 GENERAL PROPERTIES

102569 Spin susceptibility in superconductors. W.A.Roshen, J.Ruvalds (Phys. Dept., Univ. of Virginia, Charlottesville, VA, USA).
Phys. Rev. B (USA), vol.28, no.3, p.1329-31 (1 Aug. 1983).
The wave-vector-dependent spin susceptibility $\chi(q)$ of a superconductor in one, two, and three dimensions is calculated numerically. These calculations show that for large $q \sim k_F$, where k_F is the Fermi momentum, $\chi(q)$ is essentially the same as that in the normal state, indicating that for distances $r \ll \xi_0$(ξ_0 the coherence length), Ruderman-Kittel-Kasuya-Yosida coupling between magnetic atoms is essentially unchanged by superconductivity of the system. In one and two dimensions the authors find a reduction in $\chi(q)$ at very small q, whose structure affects any possible cryptomagnetic order of the type suggested by Anderson and Suhl (1959) for the case of three dimensions. In three dimensions the calculation verifies the validity of the approximate $\chi(q)$ of Anderson and Suhl in the appropriate q region. For small q, $\chi(q)$ shows a much stronger dependence on q for lower dimensions than in the three-dimensional case, which has a bearing on the range of magnetic ordering, and may be relevant to rare-earth materials with Fermi-surface 'nesting'. (18 refs.)

Correlation of superconductivity with material properties ....See Entry 102563

Electron-phonon interaction and superconductivity of lanthanum ....See Entry 102567

74.30C Magnetization curves, Meissner effect, penetration depth

Upper critical fields and superconducting transition temperatures of some zirconium-base amorphous transition-metal alloys ....See Entry 102557

74.30E Thermodynamic properties; thermal conductivity

102570 Search for two-dimensional melting in a lattice of superconducting vortices. P.Martinoli, M.Nsabimana, G.A.Racine, H.Beck (Inst. de Phys., Univ. de Neuchatel, Neuchatel, Switzerland), J.R.Clem.
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.765-85 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The dynamic shear response Z of the vortex lattice in superconducting granular Al films shows interesting features near T_M, the Kosterlitz-Thouless temperature for dislocation-mediated melting. The T-dependence of Z is interpreted in terms of the coupled motion of the displacement field and dislocations in an elastic continuum. Pinning of the vortices by inhomogeneities seems to play an important role. (18 refs.)

102571 Behavior of a hollow superconducting cylinder in a magnetic field. R.M.Arutunian, G.F.Zharkov (Lebedev Phys. Inst., Moscow, USSR).
J. Low Temp. Phys. (USA), vol.52, no.5-6, p.409-31 (Sept. 1983).
The behavior of a hollow superconducting cylinder of arbitrary dimensions in an external magnetic field is investigated in detail within the Ginzburg-Landau macroscopic theory. The thermodynamic potential of the system is presented in a compact form, which enables the authors to give a simpler description of the transitions of the system between the quantized levels in a magnetic field than in previous work on this subject. The general theory is illustrated by a number of cases, which show the dependence of the order parameter, the total flux in a cavity, and the magnetic moment of the cylinder on the magnitude of the external field and on temperature. The phase transition curves and the hysteresis boundaries are found. The tricritical points, where the difference between first- and second-order phase transitions vanishes, are established. The oscillations in a magnetic field of the specific heat of the cylinder are investigated. The formulas are presented for the case of a thin-walled cylinder and are valid for arbitrary values of the order parameter ψ, inner and outer radii of the cylinder, external field, and temperature. The results are discussed in connection with experiment and other papers on this subject. (40 refs.)

102572 Size effect on the lattice thermal conductivity of lead single crystals. W.Odoni, P.Fuchs, H.R.Ott (Lab. fur Festkorperphys., ETH, Zurich, Switzerland).
Phys. Rev. B (USA), vol.28, no.3, p.1314-19 (1 Aug. 1983).
The authors have measured the temperature dependence of the thermal conductivity λ of lead single crystals with different sample dimensions in the superconducting state between 0.05 and 1.2K. Experimental data reveal that apart from boundary scattering of phonons, an additional scattering mechanism, interpreted as scattering of phonons at dislocations, becomes increasingly important with decreasing temperature. By considering both scattering mechanisms, they demonstrate that the boundary scattering length is indeed limited by sample dimension. Additional λ measurements in the intermediate state indicate that an as-yet-unidentified heat transport across the boundaries between normal and superconducting regions may be the reason for the considerable discrepancy between experiment and theoretical calculations. (34 refs.)

Low temperature properties of metallic glasses ....See Entry 101563

Thermal conductivity of niobium and molybdenum single crystals at low temperatures ....See Entry 102345

On the relationship between the electronic density of states and the superconducting critical temperature of disordered V_3Si ....See Entry 102552

Anisotropic superconductors containing paramagnetic impurities ....See Entry 102566

74.30G Response to electromagnetic fields, nuclear magnetic resonance, ultrasonic attenuation

Low temperature properties of metallic glasses ....See Entry 101563

Raman scattering of light off magnetically doped superconductors ....See Entry 102858

74.40 FLUCTUATIONS AND CRITICAL EFFECTS

102573 Normal zone initiation in composite superconductors. A.L.Rakhmanov (Inst. of High Temperatures, Acad. of Sci., Moscow, USSR).
Cryogenics (GB), vol.23, no.9, p.487-91 (Sept. 1983).
The initiation of superconducting state instability in composite superconductors due to heat disturbances is investigated. The instability development results as a rule in the transition of the superconductor into the resistive state and normal zone propagation along the conductor. It is shown that in the case of high current density, thick conductors and poor cooling the heat power necessary to initiate the instability may be small compared to the heat power necessary to warm the superconductor to the temperature of the resistive transition. (12 refs.)

102574 Electron localization and superconductivity in 2D in metals. Y.Bruynseraede, M.Gijs, C.van Haesendonck (Lab. voor Vaste Stof-Fysika en Magnetisme, Katholieke Univ. Leuven, Leuven, Belgium).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.37-45 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The magnetic field and temperature dependence of the resistance of thin Al films and Cu/Pb proximity layers has been investigated at temperatures higher than the superconducting transition temperature. The results are explained in the framework of weak localization and electron-electron interaction in the presence of superconducting fluctuations in two-dimensional disordered systems. (19 refs.)

74.50 PROXIMITY EFFECTS, TUNNELLING PHENOMENA, AND JOSEPHSON EFFECT

102575 **Effect of energy relaxation in a superconductor on HF SQUID response.** I.M.Dmitrenko, V.A.Khlus, G.M.Tsoi, V.I.Shnyrkov.
Fiz. Nizk. Temp. (USSR), vol.9, no.7, p.766-9 (July 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The authors considered the influence of energy relaxation in a superconductor on macroscopic quantum interference effects taking place in a ring closed by a Josephson junction. It was experimentally evidenced that the behaviour of such a ring when external parameters are altered radically differs from the properties suggested by the resistive model. The effects revealed may well be explained by the microscopic theory allowing for the excitation energy relaxation time of the superconductor. (8 refs.)

102576 **First direct observation of the quantum mechanical behaviour of a truly macroscopic object.** R.J.Prance, J.E.Mutton, H.Prance, T.D.Clark (Dept. of Phys., Univ. of Sussex, Brighton, England), A.Widom, G.Megaloudis.
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.789-95 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
The authors begin by quoting the equation describing the magnetic field energy storage in a superconducting ring subjected to an external applied flux. The well known experimental technique adopted to facilitate transitions between winding-number current-carrying states is to include a 'Josephson' weak link in the ring. Quantum-mechanically, the effect of this weak link is to connect states of different winding number (referred to as the principal quantum number) by the coherent transfer of magnetic flux bundles (Φ_0) across the weak link. Quantum-electrodynamically, this transfer can be considered to constitute the second or 'conjugate' Josephson effect, by analogy with the coherent transfer of superconducting pairs through a weak link. The authors construct a Schrodinger equation to describe the infinite set of nearest-neighbour transitions. The equation makes it possible to calculate the lowest-lying energy level of the weak-link ring accurately. (6 refs.)

102577 **A superconducting flip-flop using two interacting weak links.** Lide Zhang, Yuan-Dong Dai, Y.H.Kao (Dept. of Phys., State Univ. of New York, Stony Brook, NY, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4494-501 (Aug. 1983).
Experimental results are presented showing that two superconducting indium microbridges coupled via a resistor and a capacitor can exhibit bistable states under a constant current bias, with one bridge at a finite voltage while the other is at zero voltage. The voltage states of the two microbridges can be interchanged by applying an external trigger current to the circuit. Current-voltage characteristics are compared with analog simulation as well as numerical calculation and found in good agreement. The effect of bias current, coupling resistor, capacitor, bridge resistance, and critical current values on the circuit properties are investigated. The authors' estimate for the flip-flop switching time is in the neighborhood of 0.1 nsec. (8 refs.)

102578 **Superconducting tunnel junctions on oxidized Zr_2Rh films.** M.Levinson, M.Gurvitch (Bell Lab., Murray Hill, NJ, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4683-5 (Aug. 1983).
High quality superconducting Zr_2Rh films have been produced by DC diode sputtering in Ar. Superconducting films were obtained for substrate temperatures of ~350-650°C, with the maximum values of T_c (11.2K) and resistance ratio (~26) falling in a narrower range ~550-600°C. Oxidations were performed without breaking vacuum. The best tunneling characteristics were obtained with 180 Torr sec oxygen exposure and pre- and postoxidation anneals. A ~10 Å sputtered Zr overlayer yielded additional improvement. (7 refs.)

102579 **Proximity effect and branching conditions in superconducting networks.** J.Riess (Centre de Recherches sur les Tres Basses Temperatures, CNRS, Grenoble, France).
J. Low Temp. Phys. (USA), vol.52, no.3-4, p.259-69 (Aug. 1983).
The onset of superconductivity on proximity networks made of very thin wires of different materials is investigated by adapting de Gennes' one-frequency approximation for dirty superconductors to networks. Branching conditions for the order parameter in the presence of a magnetic field H are derived, and an equation for the global critical temperature $T_c(H)$ of arbitrary networks is obtained that generalizes Alexander's equation for networks made of a single material. Numerical applications to simple proximity networks are given showing phase boundaries $T_c(H)$ and the order parameter on adjacent branches as a function of geometry and mean free path. (11 refs.)

102580 **Transient response of a nonequilibrium superconductor to pulsed injection of quasiparticles through a tunnel barrier.** I.Iguchi, A.Nishiura (Inst. of Materials Sci., Univ. of Tsukuba, Ibaraki, Japan).
J. Low Temp. Phys. (USA), vol.52, no.3-4, p.271-87 (Aug. 1983).
The authors report the first direct measurements on the transient response of a nonequilibrium superconductor to high tunnel-current pulses. The sample is a Sn-I-Sn-I-Sn double-tunnel junction and the observed transient time is 20-30 nsec, depending on the samples. The calculated results based on the nonlinear Rothwarf-Taylor equation give a good fit to the experimental data for a reasonable set of parameter values. For injection strong enough to drive a film into the inhomogeneous gap state, the contribution of the negative diffusive term becomes important, suggesting the occurrence of an effective abnormal diffusion of quasiparticles. Measurements are also performed for the transient detector I-V characteristics at a certain sampling-gate delay time. It is shown that the inhomogeneous gap state is formed within a few tens of nanoseconds for bath temperatures both below and above T_λ. (30 refs.)

102581 **Two-dimensional imaging of hotspots in superconducting bridges by low-temperature scanning electron microscopy.** R.Eichele, L.Freytag, H.Seifert, R.P.Huebener (Phys. Inst. II, Univ. Tubingen, Tubingen, Germany), J.R.Clem.
J. Low Temp. Phys. (USA), vol.52, no.5-6, p.449-79 (Sept. 1983).
Hotspots generated in a thin-film superconductor through dissipation of Joule energy are imaged by scanning the sample with the electron beam of a scanning electron microscope equipped with a liquid He stage. The signal utilized for imaging is the change of the sample voltage caused by the beam irradiation. A theoretical analysis of the heat balance equation indicates that the voltage signal reaches a maximum at the hotspot boundaries where the temperature profile passes through the critical temperature value of the superconductor. The predictions of the authors' theoretical model agree well with experiments performed using films of pure Sn, O_2-doped Sn, and O_2-doped Al. The width of the signal peaks marking the hotspot boundaries is twice the thermal healing length of the film/substrate configuration. (15 refs.)

102582 **Tunnelling-conductivity anomalies at low bias voltages in a magnetic field.** B.L.Al'tshuler, A.G.Aronov (B.P. Konstantinov Inst. of Nuclear Phys., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.3, p.175-8 (5 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.3, p.145-7 (5 Feb. 1983).
The imposition of a magnetic field gives rise to a structure at a value of eV equal in modulus to the Zeeman splitting for a conduction electron in addition to the anomalous behaviour of the tunnelling conductivity at a zero bias voltage *V*. The shape and height of these new structural features depend on the temperature, the spin scattering, and the details of the electron-electron interaction. The position of the structure is determined exclusively by the electron g-factor. (10 refs.)

102583 **Josephson behaviour in small normal one-dimensional rings.** M.Buttiker, Y.Imry, R.Landauer (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Phys. Lett. A (Netherlands), vol.96A, no.7, p.365-7 (18 July 1983).
Small and strictly one-dimensional rings of normal metal, driven by an external magnetic flux, act like superconducting rings with a Josephson junction except that $2e$ is replaced by e. (11 refs.)

102584 **Thermal activation in extremely underdamped Josephson-junction circuits.** M.Buttiker, E.P.Harris, R.Landauer (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Phys. Rev. B (USA), vol.28, no.3, p.1268-75 (1 Aug. 1983).
Noise-activated escape of a particle out of a metastable well was treated by Kramers (1940), who derived results covering the three cases of heavy damping, moderate damping, and extreme underdamping. In the case of extreme underdamping, the escape occurs through diffusive motion along the energy coordinate. The authors extend Kramers's treatment of this extremely underdamped case to cover a wider range of damping constants, taking into account that at energies just above the barrier peak and within the initial well, the distribution is controlled both by uphill diffusion in energy, and by the flow out of the well. This new result is compared with computer simulations of escape events for the case of Josephson junctions under constant current bias. In addition to a conventional simulation which initially puts the particles at the bottom of the well, a method is developed which requires simulation only in an energy range close to the peak of the barrier. (26 refs.)

102585 **Fiske steps in Josephson junctions.** Jhy-Jiun Chang (Dept. of Phys., Wayne State Univ., Detroit, MI, USA).
Phys. Rev. B (USA), vol.28, no.3, p.1276-80 (1 Aug. 1983).
A theoretical study of the Fiske steps in superconductor-insulator-superconductor tunnel junctions has been carried out. When the amplitude of the excited cavity mode is small, the result reduces to that obtained by Eck et al. (1964) and Kulik (1965). However, when the excitation amplitude is large, the author has found current-voltage characteristics qualitatively different from those previously obtained by Kulik. Furthermore, the maximum current-step height calculated was $0.38 I_0(T)$, slightly larger than $0.34 I_0(T)$ previously obtained by Kulik. He has also obtained the details of the dependences of the current-voltage characteristics on the applied magnetic field and the damping factor of the cavity mode in the junction. (14 refs.)

102586 **Josephson tunneling and the proximity effect.** V.Z.Kresin (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Phys. Rev. B (USA), vol.28, no.3, p.1294-303 (1 Aug. 1983).
Josephson junctions containing one or two proximity systems (e.g., S_α-M_β-I-S_γ, S_α-M_β-I-M_γ-S_δ; $M_{\beta(\gamma)}$ is a normal metal or superconductor) are studied. An analysis of thickness and temperature dependences of the maximum DC Josephson current I_M is carried out. The curvature of the function $I_M(L_\beta)$ is found to depend strongly on the ratio of energy gaps $\varepsilon_\gamma/\varepsilon_\alpha$ and on the temperature. The analysis is based on the thermodynamic Green's-function method, and the effect of strong coupling is also taken into account. If the proximity system contains two superconductors S_α and S_β, then it appears that the electron-phonon interaction described by the constant λ_β contributes noticeably even if $T > T_{c\beta}$. (40 refs.)

102587 **Report on the driven Josephson equation.** J.A.Sanders (Subfaculteit Wiskunde en Informatica, Vrije Univ., Amsterdam, Netherlands).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.297-8 (2 refs.)

A Josephson effect apparatus for the undergraduate laboratory ....See Entry 98687

Stability and relative stability in nonlinear driven systems ....See Entry 98953

The effect of precipitation heat treatments on the critical temperature in Ti-rich Nb-Ti alloys ....See Entry 102547

Superconducting transition temperature versus thickness of Nb film on various substrates ....See Entry 102551

Electron localization and superconductivity in 2D in metals ..See Entry 102574

74.55 TYPE-I SUPERCONDUCTIVITY

102588 **The peculiarities of electrical resistance behaviour in the superconductor intermediate state with paramagnetic effect.** V.A.Frolov.
Fiz. Nizk. Temp. (USSR), vol.9, no.7, p.710-13 (July 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
It is shown that paramagnetic effect in the superconductor intermediate state causes the decrease of its electrical resistance. (9 refs.)

102589 **Surface resistance due to trapped magnetic flux of superconducting lead at *X*-band.** T.Momose, T.Yamashita, Y.Onodera (Res. Inst. of Electrical Communication, Tohoku Univ., Sendai, Japan).
J. Appl. Phys. (USA), vol.54, no.7, p.4044-9 (July 1983).
The surface resistance due to trapped magnetic flux of superconducting lead at *X*-band is described. A TM_{010} mode cavity was prepared by deep drawing copper substrates and electroplating lead on the substrates. Measurements were made on the cavity at RF input power less than 3 mW. Residual surface resistance values of 0.06 and 7.4 $\mu\Omega$ were obtained. The apparent surface resistance $[R(H,T)]$ of lead due to the trapped magnetic flux has a temperature dependence of $(1-t^2)^{-1}(1-t^4)^{-1/2}$ at $t=T/T_c<0.6$ and a relationship is established for trapped flux field dependence, $R(H,T) \propto 2S_c R_H$, where R_H is the surface resistance of lead due to trapped flux and S_c is the cross section area of the cavity to the field direction. A new equation for $R_H(T=0)$ is given as $R\ (H,T=0) \times (S_{tot}/2S_c)$. The results prepared using the new equation show good agreement with the published results shown to date for superconducting lead cavities having differences in mode, structure, and frequency. To obtain $R_{res} \leq 0.001\ \mu\Omega$, an ambient magnetic field should be set less than 1 mG. The field dependence of $R\ (H,T)+R_{res}$ in the case of $R_{res}=7.4\ \mu\Omega$ approaches gradually to that of $R_{res}=0.06\ \mu\Omega$ as the field increases. A model to explain the relationship between the two cases is also described. (10 refs.)

Electron-phonon interaction and superconductivity of lanthanum .... See Entry 102567

74.60 TYPE-II SUPERCONDUCTIVITY

Fatigue life of brittle superconducting alloys in normal and superconducting states .... See Entry 103301

74.60E Mixed state, H_{c2}, surface sheath

102590 Determination of microscopic parameters by macroscopic measurements in superconductors. I.Kirschner, K.Sajo (Dept. for Low Temperature Phys., Roland Eotvos Univ., Budapest, Hungary).
Acta Phys. Acad. Sci. Hung. (Hungary), vol.53, no.3-4, p.313-19 (1982). [received: Aug. 1983] (CRYOSEM '81. Second International Seminar on Low Temperature Physics, Visegrad, Hungary, 8-10 Oct. 1981).
Macroscopic magnetic measurements were performed on superconducting alloys. From the results of these experiments microscopic parameters namely the energy gap and the vortex creation energy could be calculated. Their dependence on the additive material content (or on the GL-parameter) was determined. It was shown that the BCS and the GLAG theory are applicable for small-κ superconductors in wide temperature interval. (15 refs.)

102591 Excitation of resistive domains in a superconducting film. Yu.M.Ivanchenko, P.N.Mikheenko (Physicotech. Inst., Acad. of Sci., Donetsk, Ukrainian SSR).
JETP Lett. (USA), vol.37, no.4, p.217-19 (20 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.4, p.182-4 (20 Feb. 1983).
Penetration of vortices into a current-carrying superconducting film is observed for the first time. The distribution of the transport current over the width of the specimen and temperature distribution in the vicinity of the resistive domains are reconstructed experimentally. (6 refs.)

Microstructure and superconducting properties of helium-saturated niobium-titanium alloy .... See Entry 102548

Upper critical fields and superconducting transition temperatures of some zirconium-base amorphous transition-metal alloys .... See Entry 102557

Magnetic properties of superconducting or normal networks and random walks on percolating clusters .... See Entry 102561

Flux pinning in interdiffusing thin films .... See Entry 102596

74.60G Flux pinning; fluxon-defect interactions

102592 Investigation of the influence of the heat treatment and forming regimes on the critical current and pinning force of NbTi superconductors. J.Hoellrich, G.Kath (Veb Halbzeugwerk Auerhammer, Aue, Germany).
Acta Phys. Acad. Sci. Hung. (Hungary), vol.53, no.3-4, p.331-6 (1982). [received: Aug. 1983] (CRYOSEM '81. Second International Seminar on Low Temperature Physics, Visegrad, Hungary, 8-10 Oct. 1981).
The results obtained in the optimization of NbTi superconductors are set forth. The intermediate annealing temperature is discussed and the influence of final forming on the critical current density and the reduced pinning forces is studied. For the types of conductors investigated (1, 19, 55-core conductors), the j_c-maximum occurs at different degrees of final forming; it drops as the filament diameter decreases. As to the reduced pinning force, an increasing in the number of cores or a reduction of the filament diameters results in a displacement of the maximum and, for optimized conductors, an extension of the maximum towards higher fields is obtained. A final heat treatment makes the j_c-values drop. (9 refs.)

102593 Statistical theory of pinning in superconductors including correlations in the defect distribution. S.Takacs (Inst. of Electrical Engng., Slovak Acad. of Sci., Bratislava, Czechoslovakia).
Acta Phys. Acad. Sci. Hung. (Hungary), vol.53, no.3-4, p.337-45 (1982). [received: Aug. 1983] (CRYOSEM '81. Second International Seminar on Low Temperature Physics, Visegrad, Hungary, 8-10 Oct. 1981).
The statistical theory of pinning on randomly distributed weak pinning centres with small densities is developed. In addition to the randomness in the spatial distribution of the defects, some correlation effects in the defect distribution are included. The results are in good agreement with experiments not only qualitatively (the volume pinning force proportional to the defect density), but also quantitatively. (32 refs.)

102594 The pinning of vortex lines in very dilute superconductors. I.Kirschner, K.Martinas (Dept. for Low Temperature Phys., Roland Eotvos Univ., Budapest, Hungary).
Acta Phys. Acad. Sci. Hung. (Hungary), vol.53, no.3-4, p.347-51 (1982). [received: Aug. 1983] (CRYOSEM '81. Second International Seminar on Low Temperature Physics, Visegrad, Hungary, 8-10 Oct. 1981).
In a one dimensional model the possibility of synchronization of the flux line system to the randomly distributed pinning centres is shown. The result yields direct summation without threshold in the very dilute case. (11 refs.)

102595 Experimental determination of pinning forces. J.Bankuti, E.Farkas (Dept. for Low Temperature Phys., Roland Eotvos Univ., Budapest, Hungary).
Acta Phys. Acad. Sci. Hung. (Hungary), vol.53, no.3-4, p.353-60 (1982). [received: Aug. 1983] (CRYOSEM '81. Second International Seminar on Low Temperature Physics, Visegrad, Hungary, 8-10 Oct. 1981).
Four different methods are given for the determination of the pinning forces: critical current measurements, magnetization measurements and two AC methods. The measured data of the critical current density obtained by these methods are published here for the samples Nb-10 at.% Ti. (10 refs.)

102596 Flux pinning in interdiffusing thin films. W.E.Yetter, E.J.Kramer (Dept. of Materials Sci. & Engng., Cornell Univ., Ithaca, NY, USA).
Philos. Mag. B (GB), vol.48, no.1, p.1-12 (July 1983).
Large changes in the flux pinning force and critical fields have been observed during room-temperature interdiffusion of a polycrystalline Pb-18% Bi film with a coating of either Pb or Tl. The flux pinning evolution is highly dependent on the reduced field $h \equiv H/H_{c2}$. In Tl-coated films the transverse flux pinning force $F_{p\perp}$ (i.e. measured with the applied magnetic field H normal to the film surface) increases rapidly with ageing, then slowly declines. In Pb-coated films $F_{p\perp}$ also rises and falls, although in a different manner; for $h \geq 0.5$, in fact, there is a brief initial period during which $F_{p\perp}$ declines. These phenomena are attributed to the growth of localized variations modify the intrinsic local perturbation in the electron mean free path (and the Ginzburg-Landau parameter κ) which is produced by the grain boundary itself (Zerweck 1981), and thus alter $F_{p\perp}$. Calculations based on an electron-scattering-flux-pinning model are compared qualitatively with the observed $F_{p\perp}$ evolution. The model and the experimental evidence both indicate that impurity segregation at grain boundaries should not, by itself, enhance flux pinning. The authors conclude that controlled interdiffusion via grain boundaries should offer a novel means of enhancing flux pinning in technologically important materials. (14 refs.)

Microstructure and superconducting properties of helium-saturated niobium-titanium alloy .... See Entry 102548

Upper critical fields and superconducting transition temperatures of some zirconium-base amorphous transition-metal alloys .... See Entry 102557

74.60J Critical currents

102597 V_3Ga superconductors with a high critical current density. K.Fischer, S.Rohr, J.Monch, W.Holzhauser, C.Frenzel (Central Inst. of Solid State Phys. & Materials Res., Acad. of Sci., Dresden, Germany).
Acta Phys. Acad. Sci. Hung. (Hungary), vol.53, no.3-4, p.305-12 (1982). [received: Aug. 1983] (CRYOSEM '81. Second International Seminar on Low Temperature Physics, Visegrad, Hungary, 8-10 Oct. 1981).
The effect of In, Zn and Mn additions to the bronze matrix on formation rate, critical current density, and critical temperature of V_3Ga layers in bronze-processed V_3Ga wires has been investigated. The V_3Ga layers were produced by heat treatment at 600...650°C within a period of 20...200 h. For a given heat treatment condition the critical current density (j_c) of the V_3Ga phase and the critical current (I_c) of In-containing conductors with a suitable composition of bronze (e.g. 16 at.% Ga, 1.2 at.% In) are considerably higher (by the factor ≥ 1.7) than those of conductors with a usually applied, binary Cu-Ga alloy containing 19 at.% Ga. The critical temperature of In-containing samples is relatively high and approaches values up to 15.4K (for which the specimens showed half its normal-state resistance). Too high Ga and In contents of the matrix are unfavourable for obtaining high critical parameters. An addition of Mn (0.6 at.%) to the bronze leads to considerably thicker V_3Ga layers, however, j_c and T_c down to 13K are decreased and thus, depending on heat treatment conditions and Ga content of bronze, unchanged or reduced I_c values were obtained. Substitution of Zn for 2 at.% Ga in the matrix causes a reduction of V_3Ga layer thickness and a increase of j_c. (10 refs.)

102598 Continuous determination of the cross section area of the components of a niobium-titanium superconducting conductor. P.Dubots, P.Genevey, J.Goyer, J.C.Renard, A.Sagniez.
Cryogenics (GB), vol.23, no.9, p.495-7 (Sept. 1983).
Multifilamentary superconducting conductors, which are usually manufactured by hot extrusion and cold drawing, consist of bundles of small diameter superconducting filaments embedded in a normal conducting matrix. It is most desirable for the magnet designer as well as for the conductor manufacturer to control the uniformity of properties along the length of conductors which will be used in large magnets. In this paper the authors present a continuous monitoring of the superconducting and normal matrix areas through a non-destructive sampling procedure over the whole length of a superconducting conductor. (no refs.)

102599 Phase-slip centers in long superconducting filaments. W.J.Yeh, Y.D.Dai, Y.H.Kao (Dept.of Phys., State Univ. of New York, Stony Brook, NY, USA).
J. Low Temp. Phys. (USA), vol.52, no.3-4, p.249-57 (Aug. 1983).
The behaviour of phase slip centers and their interactions via exchange of AC and DC quasiparticles in long superconducting filaments are studied with samples fabricated by using an electron beam lithography technique. The data show that the AC decay length of quasiparticles is shorter than the DC decay length in indium at temperatures near T_c. The interactions among phase slip centers in the long filament are interpreted on the basis of critical current variations due to quasiparticle exchange, from which a DC decay length $\Lambda \approx 5.0$ μm for indium at $T/T_c = 0.992$ has been obtained. The results indicate that a phase slip center can be used as a quasiparticle detector to obtain information about other phase slip centers and their mutual interactions. (13 refs.)

102600 Magnetic coupling in granular aluminum superconducting films. K.E.Gray (Materials Sci. & Technol. Div., Argonne Nat. Lab., Argonne, IL, USA).
Phys. Rev. B (USA), vol.28, no.3, p.1281-5 (1 Aug. 1983).
The maximum coupling force F_{cm} in a Giaever superconducting transformer is measured in granular aluminum films at significantly higher fields and lower temperatures than in previous work. A new method to determine F_{cm} by measuring the critical current in one film only is presented. The results are in excellent quantitative agreement with the one-reciprocal-lattice-vector approximation to the theoretical analysis in its region of validity, i.e. at high fields. For low fields, F_{cm} is consistent with the temperature dependence of the low-field approximation over the entire reduced temperature ($t = T/T_c$) range ($0.36 < t < 0.96$). (14 refs.)

Some physical properties of multifilamentary Nb_3Sn superconductors prepared by bronze technology .... See Entry 102546

Investigation of the influence of the heat treatment and forming regimes on the critical current and pinning force of NbTi superconductors ...See Entry 102592

Experimental determination of pinning forces .... See Entry 102595

74.70 SUPERCONDUCTING MATERIALS

Electron diffraction studies of metastable phase decay in amorphous bismuth with high hydrogen content .... See Entry 102194

Superconductivity of FCC tantalum nitride at high pressures up to 12 GP*a* .... See Entry 102549

Superconductivity and structural transformation in HfRuAs ..See Entry 102553

Normal zone initiation in composite superconductors .... See Entry 102573

Continuous determination of the cross section area of the components of a niobium-titanium superconducting conductor .... See Entry 102598

74.70D Material effects on T_c, K, critical currents

(see also 81.40R Electrical properties related to materials treatment)

Superconductivity in $CeCu_2Si_2$: dependence of T_c on alloying and stoichiometry .... See Entry 102550

Superconducting transition temperature versus thickness of Nb film on various substrates .... See Entry 102551

The Pd-Pt-H system: phase transformations at high pressure and superconductivity .... See Entry 102555

Correlation of superconductivity with material properties ....See Entry 102563

V_3Ga superconductors with a high critical current density .....See Entry 102597

74.70G Type-I superconductors (non transition metals)

Electron-phonon interaction and superconductivity of lanthanum ....See Entry 102567

Search for two-dimensional melting in a lattice of superconducting vortices ....See Entry 102570

Size effect on the lattice thermal conductivity of lead single crystals ....See Entry 102572

A superconducting flip-flop using two interacting weak links ....See Entry 102577

Surface resistance due to trapped magnetic flux of superconducting lead at X-band ....See Entry 102589

Phase-slip centers in long superconducting filaments ....See Entry 102599

74.70L Type-II superconductors (transition metals, alloys and compounds)

Superconducting materials for particle accelerator magnets .....See Entry 99907

Low temperature properties of metallic glasses ....See Entry 101563

Polymorphism and superconductivity of $LaIr_2Si_2$ ....See Entry 101616

On the relation between T_c measurements and structure inhomogeneity of Nb_3Ge superconductor ....See Entry 102545

Some physical properties of multifilamentary Nb_3Sn superconductors prepared by bronze technology ....See Entry 102546

The effect of precipitation heat treatments on the critical temperature in Ti-rich Nb-Ti alloys ....See Entry 102547

Microstructure and superconducting properties of helium-saturated niobium-titanium alloy ....See Entry 102548

Superconductivity in $CeCu_2Si_2$: dependence of T_c on alloying and stoichiometry ....See Entry 102550

Superconducting transition temperature versus thickness of Nb film on various substrates ....See Entry 102551

On the relationship between the electronic density of states and the superconducting critical temperature of disordered V_3Si ....See Entry 102552

Effects of oxygen content on pressure-induced superconductivity in $EuMo_6S_8$ ....See Entry 102554

The Pd-Pt-H system: phase transformations at high pressure and superconductivity ....See Entry 102555

Upper critical fields and superconducting transition temperatures of some zirconium-base amorphous transition-metal alloys ....See Entry 102557

Superconductivity and magnetic order: low temperature phase diagrams ....See Entry 102558

Superconducting tunnel junctions on oxidized Zr_2Rh films ....See Entry 102578

Determination of microscopic parameters by macroscopic measurements in superconductors ....See Entry 102590

Investigation of the influence of the heat treatment and forming regimes on the critical current and pinning force of NbTi superconductors ...See Entry 102592

Experimental determination of pinning forces ....See Entry 102595

Flux pinning in interdiffusing thin films ....See Entry 102596

V_3Ga superconductors with a high critical current density .....See Entry 102597

Magnetic coupling in granular aluminum superconducting films ....See Entry 102600

RF superconducting properties of thin films on niobium ....See Entry 102601

Magnetic ordering in superconductors ....See Entry 102623

Theory of magnetic structure in reentrant magnetic superconductors $HoMo_6S_8$ and $ErRh_4B_4$ ....See Entry 102628

CVD of niobium germanides from partially reacted input gases ....See Entry 103059

Fatigue life of brittle superconducting alloys in normal and superconducting states ....See Entry 103301

74.70N Dirty superconductors

Upper critical fields and superconducting transition temperatures of some zirconium-base amorphous transition-metal alloys ....See Entry 102557

74.90 OTHER TOPICS IN SUPERCONDUCTIVITY

102601 RF superconducting properties of thin films on niobium. I.E.Campisi, H.Deruyter, Z.D.Farkas, E.L.Garwin, H.A.Hogg, F.King, R.E.Kirby (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3363-5 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
The authors are investigating the RF properties of thin films of materials which are known to have low secondary emission coefficients, such as NbC, NbN and TiN. Preliminary measurements on the latter material have been performed by depositing a 15 nm film on parts of a doubly reentrant Nb cavity designed to favor electron multipacting which, in the uncoated cavity, occurs copiously between the posts' tips. The measurements performed with TiN films sputtered onto Nb indicate that the RF current losses are increased by the presence of the films while the dielectric losses are negligible, within the measurement sensitivity of the system. The electron multipacting cannot be excited between the posts coated with the material tested. (no refs.)

102602 Calculating damping factor of oscillations of superconducting sphere in electromagnetic suspension. A.F.Efremov.
Izv. VUZ Priborostr. (USSR), vol.26, no.6, p.72-6 (June 1983). In Russian.
A procedure is proposed for calculating the damping factor for the oscillations of a superconducting sphere suspended in a magnetic field, which can be used to establish directly the dependence of the damping factor on the structural parameters of the device under investigation. The characteristics of the oscillations are evaluated and it is established that aperiodic damping of the linear oscillations of the superconducting sphere suspended in a magnetic field can be achieved by means of passive electromagnetic damping. (5 refs.)
L.M.H.

102603 Thermoelectric effect in a superconducting torus. R.M.Arutunian, G.F.Zharkov (Theoretical Dept., Lebedev Inst. of Phys., Moscow, USSR).
Phys. Lett. A (Netherlands), vol.96A, no.9, p.480-2 (1 Aug. 1983).
It is shown that a temperature gradient in a superconducting torus should lead to spontaneous generation of magnetic-flux quanta inside the ring. This effect is much weaker in a torus than in a hollow superconducting cylinder of comparable dimensions. The flux jumps and related hysteresis effects are predicted and the connection with experiment is discussed. (11 refs.)

75.00 MAGNETIC PROPERTIES AND MATERIALS

(see also 81.40R Magnetic properties related to materials treatment; for galvanomagnetic effects, see 72.15G and 72.20M; for magneto-optical effects, see 78.20L)

75.10 GENERAL THEORY AND MODELS OF MAGNETIC ORDERING

(see also 05.50 Ising problems, 71.25 Nonlocalized single-particle electronic states, 71.70 Level splitting and interactions)

102604 Magnetic order and magnetogyration in $\pi(2p)$ electron systems. M.E.Lines, M.A.Bosch (Bell Labs., Murray Hill, NJ, USA).
Comments Solid State Phys. (GB), vol.11, no.2, p.73-87 (1983).
The simplest class of magnetic substances based on molecular orbitals rather than atomic wavefunctions is the $\pi(2p)$ electron system, represented by interacting oxygen molecules or O_2^- radicals. Molecular units introduce an important new degree of freedom, the orientation of the molecular axis (dumbbell). A multitude of phase transitions of crystallographic or magnetoelastic nature is thus expected even in simple systems like solid oxygen and the alkali-hyperoxides. Fascinating cooperative phenomena arise through coupled elastic, electric and magnetic interactions. The phenomenon of magnetogyration is the magnetic driving of a crystalline phase transition involving the rotation of molecular groups. The first confirmed example of this effect has recently been recognized in the alkali-hyperoxide KO_2 at ~11K. Other probable but as yet unconfirmed examples are the pyrite to marcasite phase transition in NaO_2 and the gamma to beta phase transition in solid oxygen. (28 refs.)

102605 Spin alternation in one-dimensional exchange-coupled systems: magnetic behaviour of the $(^1/_2\text{-}1)_N$ chain. M.Drillon, J.C.Gianduzzo, R.Georges (Dept. Sci. des Materiaux, CNRS, Strasbourg, France).
Phys. Lett. A (Netherlands), vol.96A, no.8, p.413-16 (25 July 1983).
The authors report on the magnetic behaviour of exchange-coupled closed chains (rings) of increasing length made of two alternating spin sublattices $S_a={}^1/_2$, $S_b=1$. Taking into account the geometrical and spin space symmetries of such systems, the problem is shown to be tractable up to 10 spins for distinct values of the g_a/g_bn ratio between Lande factors; the results are discussed for an antiferromagnetic coupling. The limiting behaviour for the infinite chain is determined by extrapolation of the data obtained for finite rings. At very low temperatures, the analogy with the regular $S={}^1/_2$ ferromagnetic chain is underlined. (12 refs.)

Theory of magnetic superconductors ....See Entry 102560

75.10D Crystal-field theory and spin Hamiltonians

102606 The use of neutron polarisation analysis in determining Hamiltonians for simple ferromagnetic systems. M.Hood (Inst. Laue-Langevin, Grenoble, France).
J. Phys. C (GB), vol.16, no.23, p.4655-62 (20 Aug. 1983).
The neutron scattering cross section and neutron polarisation for scattering by single magnons are calculated for a ferromagnetic Heisenberg Hamiltonian with various kinds of anisotropy. Although in a one-magnon theory if it is not possible to distinguish between exchange and single-site anisotropies for an easy-axis system using this technique, it is found that is possible to distinguish between an exchange anisotropy and a single-site anisotropy for an easy-plane system by measuring the neutron polarisation at different scattering wavevectors. It is also possible to distinguish between easy-plane systems and easy-axis systems by measuring the neutron scattering cross section for scattering of a completely polarised beam of neutrons for one particular scattering wavevector. (11 refs.)

Effects of screening on crystal-field magnetoelastic coupling in rare-earth intermetallic compounds ....See Entry 102328

Excitation spectrum of ferromagnetic XXZ-chains ....See Entry 102613

Magnetic anisotropy and exchange interactions in Li-Al ferrites ....See Entry 102652

75.10H Ising and other classical spin models

102607 Extended high-temperature series expansions for the spin-s Ising model. S.McKenzie (Dept. of Phys., King's Coll. London, London, England).
J. Phys. A (GB), vol.16, no.12, p.2875-80 (21 Aug. 1983).
Extended high-temperature series expansions are presented for the spin-s Ising model on the face-centred cubic lattice. Series coefficients for the zero-field internal energy (U_0) and the second moment (μ_2) of the correlation function are derived, for ${}^1/_2\leq s\leq{}^9/_2$, to order 14 in the high-temperature expansion variable $K(=J/kT)$. For $s={}^1/_2$, the fourth field derivative of the free energy is calculated to order K^{14} and the magnetisation series is given to order 13 and 27 in the temperature and magnetic field variables respectively. For $s=1$ to ${}^9/_2$, the zero-field susceptibility series are derived to order K^{14}. (27 refs.)

102608 Geometry of equilibrium configurations in the Ising model. J.Cohen, L.Haskins, J.-P.Marchand (Dept. of Math., Univ. of Denver, Denver, CO, USA).
J. Stat. Phys. (USA), vol.31, no.3, p.671-8 (June 1983).
The authors derive microscopically precise identities for the geometry of small clusters in the equilibrium states of the two-dimensional Ising model with emphasis on near-critical phenomena. (4 refs.)

102609 Computer simulations of a discontinuous phase transition and percolation clusters in the two-dimensional one-spin-flip Ising model. E.Stoll, T.Schneider (IBM Zurich Res. Lab., Ruschlikon, Switzerland).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.213-15
The films 'Computer Simulation of a Discontinuous Phase Transition in the Two-Dimensional One-Spin-Flip Ising Model' and 'Percolation Clusters' show the temporal evolution of Ising spin configurations. The system is brought to nonequilibrium by an abrupt change of the applied field or temperature, and the approach to the stable equilibrium is shown. (6 refs.)

Phenomenological renormalisation group through the moments of the pair correlation function .... See Entry 99019

Non-linear modes and statistical mechanics of a classical Heisenberg chain with two anisotropies .... See Entry 102690

75.10J Heisenberg and other quantized localized spin models

102610 Exact excitation spectrum of the $Z_{n+1}\times Z_{n+1}$ generalized Heisenberg model. O.Babelon, H.J.De Vega, C.M.Viallet (Lab. de Phys. Theorique et Hautes Energies, Paris, France).
Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B220(FS8), no.3, p.283-301 (25 July 1983).
The authors describe the excitations of the generalized Heisenberg anisotropic hamiltonian to Z_{n+1} spins. They analyse the Bethe ansatz equations without assuming the existence of strings. Excited states above an antiferromagnetic ground state are described by a finite number of parameters, which verify a finite system of equations. They give the energy and momentum of the excitations. In a suitable limit they recover the spectrum of a relativistically invariant theory. (9 refs.)

102611 Relaxation in linear ferromagnetic chain. I. Phonon relaxation. V.N.Kashcheev.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.3, p.6-13 (1983). In Russian.
In the classical linear Heisenberg chain the polarization operator is calculated for the long-wave low-frequency phonon due to the spin-phonon interaction of exchange origin. The corrections traced back to the latter are found for the spin diffusion constant. (21 refs.)

102612 Formation and coupling of magnetic moments in Heusler alloys. J.Kubler (Inst. fur Festkorperphys., Tech. Hochschule Darmstadt, Darmstadt, Germany), A.R.Williams, C.B.Sommers.
Phys. Rev. B (USA), vol.28, no.4, p.1745-55 (15 Aug. 1983).
The microscopic mechanisms responsible for both the formation and coupling of magnetic moments in Heusler alloys (X_2MnY) are identified. The authors find that the X atoms (e.g. Cu, Pd) serve primarily to determine the lattice constant, while the Y atoms (e.g. Al, In, Sb) mediate the interaction between the Mn d states. There is no significant direct interaction between the Mn atoms, but the occupied d states of Mn are delocalized by their strong interaction with the X-atom d states. The localized character of the magnetization results from the exclusion of minority-spin (defined locally) electrons from the Mn 3d shell. The coupling between the localized magnetic Mn moments can be described with the Heisenberg Hamiltonian and the sign of the exchange constants results from a competition between the intra-atomic magnetic energy and interatomic Y-atom mediated covalent interactions between the Mn d states. These effects compete because the covalent mechanism is possible only for antiferromagnetic alignments, but necessarily reduces the magnitude of the local moments. The sensitive dependence of magnetic order on the occupation of the mediating p-d hybrid states accounts well for experiments by Webster in which this occupation is varied by alloying. The authors' analysis is based on self-consistent, spin-polarized energy-band calculations for Co_2MnAl, Co_2MnSn, Ni_2MnSn, Cu_2MnAl, Cu_2MnSn, Pd_2MnIn, Pd_2MnSn, and Pd_2MnSb, for both ferromagnetic and antiferromagnetic spin alignments. (30 refs.)

102613 Excitation spectrum of ferromagnetic XXZ-chains. T.Schneider, E.Stoll (IBM Zurich Res. Lab., Ruschlikon, Switzerland).
Structural Elements in Particle Physics and Statistical Mechanics. Proceedings of the NATO Advanced Summer Institute on Theoretical Physics 1981, Freiburg, Germany, 31 Aug.-11 Sept. 1981 (New York, USA: Plenum 1983), p.201-12
The authors review the theoretical understanding of dynamic form factors of ferromagnetic XXZ chains as tools to probe and interpret the excitation spectrum and briefly review the history and state of the art of these spin chains. (24 refs.)

Quantum theory of magnetism. Second corrected and updated edition .... See Entry 98676

The use of neutron polarisation analysis in determining Hamiltonians for simple ferromagnetic systems .... See Entry 102606

Quantum critical behaviour of X-Y spin model with magnetic field .... See Entry 102688

Non-linear modes and statistical mechanics of a classical Heisenberg chain with two anisotropies .... See Entry 102690

75.10L Band and itinerant models

102614 Itinerant magnetism in actinide systems. J.J.M.Franse (Natuurkundig Lab., Univ. van Amsterdam, Amsterdam, Netherlands).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.131-45 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
A survey is presented on the occurrence of itinerant-electron magnetism in actinide metals with emphasis on the uranium Laves phase- and the uranium-platinum compounds. The Laves phase compounds can be understood with concepts of magnetism that have been developed for the transition metals, including that of spin fluctuations. The absence of magnetic order in most of the uranium-platinum compounds in combination with large values for the coefficient of the electronic term in the specific heat points to a strong hybridisation of f and d electron states. The magnetic order of UPt is complex and can not simply be represented by an itinerant-electron model. (38 refs.)

102615 The high temperature series for the single-band Hubbard model in the strong correlation limit. I.. K.Kubo, M.Tada (Inst. of Phys., Univ. of Tsukuba, Ibaraki, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.5, p.1345-57 (May 1983).
The high temperature series of the thermodynamic potential and the uniform susceptibility have been investigated for the single-band Hubbard model in the strong correlation limit. It is rigorously shown that the series absolutely converge both in the low density and the half-filled limit. Correct first terms have been obtained up to the ninth order in terms of the inverse temperature. Coefficients of the series are oscillating rapidly as functions of the occupation probability of electrons. (14 refs.)

102616 Itinerant-5*f*-electron antiferromagnetism in uranium nitride: A temperature-dependent angle-resolved photoemission study. B.Reihl (IBM Zurich Res. Lab., Ruschlikon, Switzerland), G.Hollinger, F.J.Himpsel.
Phys. Rev. B (USA), vol.28, no.3, p.1490-4 (1 Aug. 1983).
A 5f-like photoemission peak emerges at E_F-0.78 eV in normal emission from UN(100) upon cooling below $T_{Neel}=53$K. This is the first observation of its kind for f electrons. The authors believe that this peak arise from band states which are folded back into the new antiferromagnetic Brillouin zone owing to the doubling of the unit cell along ⟨100⟩. Isoelectronic USb, which has localized 5f electrons, does not exhibit such a temperature effect. The results suggest that UN can be described within the theory of itinerant-5f-electron antiferromagnetism. (27 refs.)

Magnetic behaviour of RRh_3B_2 ternary borides .... See Entry 102629

Magnetic correlations in metallic magnetics at finite temperatures .... See Entry 102664

75.20 DIAMAGNETISM AND PARAMAGNETISM

Magnetic susceptibility of Wigner's crystal .... See Entry 102278

Magnetic properties of superconducting or normal networks and random walks on percolating clusters .... See Entry 102561

Quantum-mechanical ground state of crystals with dipole-dipole and exchange interactions .... See Entry 102676

75.20C Nonmetals

102617 Magnetic susceptibility and kinetics of 'graphitization' of glass-like carbons. D.B.Fischbach, M.E.Rorabaugh (Dept. of Mining, Metall. & Ceramic Engng., Univ. of Washington, Seattle, WA, USA).
Carbon (GB), vol.21, no.4, p.429-39 (1983).
The room temperature magnetic susceptibility (X) of glass-like carbons (GLC) from several sources has been determined as a function of heat treatment temperature (HTT) over the range 1000-3000°C. Effects of dilute ferromagnetic impurities were observed for HTT<1500°C. The impurity (probably Fe) exists in a non-magnetic form in the carbonized GLC; transforms to a ferromagnetic state with $1000\leq$HTT≤1400°C; then disappears at higher HTT. The dependence of the diamagnetism of pure GLC on HTT is characterized by a slope decrease and inflection near 1500°C and increases smoothly thereafter. $X\simeq5.2\times10^{-6}$ emu/g and is still increasing at HTT=3000°C, and the values for different GLCs with the same HTT differ by <10%. The evolution of X as a function of isothermal residence time (HTt) over the range 2400-3000°C for three GLCs was analyzed by the superposition method. Very high effective activation energies, 360-420 kcal/mole (~1500-1750 kJ/mole) were obtained and attributed to successive-activation processes of structural development required by the microstructural constraints inherent to difficult-to-graphitize carbons. Evidence was found for a small X increase due to the plastic volume dilation (density decrease) processes that occur in some GLCs at high HTT. (37 refs.)

102618 Magnetic properties and structural chemistry of ternary silicides (RE, Th, U)Ru_2Si_2 (RE=rare earth). K.Hiebl, C.Horvath, P.Rogl (Inst. fur Phys. Chem., Univ. Wien, Vienna, Austria), M.J.Sienko.
J. Magn. & Magn. Mater. (Netherlands), vol.37, no.3, p.287-96 (July 1983).
Ternary silicides (RE, Th, U)Ru_2Si_2 have been synthesized from the elements. All the compounds (RE=Y, La, Ce, Pr, Nd, Sm, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu) were found to be isotypic and to crystallize with the structure type of $ThCr_2Si_2$ (ordered derivative of the $BaAl_4$-type). The magnetic behavior of these alloys was studied in the temperature range 1.5K<T<1100K. Magnetic susceptibilities at temperatures T>300K closely follow a typical Van Vleck paramagnetism of free RE^{3+}-ions. In the case of $CeRu_2Si_2$ susceptibilities are well described for 20K<T<1100K by a Van Vleck paramagnetism of widely spaced multiplets; the observed effective paramagnetic moment $\mu_{eff}=2.12$ BM indicates a high percentage (85%) of Ce^{3+}. $SmRu_2Si_2$ yields an effective moment $\mu_{eff}=0.54$ BM, which compares reasonably well with the Hund's rule $J=5/2$ ground level for free Sm^+ and a low-lying excited level with $J=7/2$. For temperatures T>15K the magnetic susceptibility as a function of temperature follows the 'Van Vleck behavior' for free Sm^{3+}. At low temperatures ferromagnetic ordering was encountered for (Pr, Nd, Ho, Er, Tm)Ru_2Si_2, whereas antiferromagnetic ordering was observed for (Sm, Gd, Tb, Dy)Ru_2Si_2. The ordering temperatures are generally below 55K. No superconductivity was found for temperatures as low as 1.8K. (12 refs.)

102619 Transport and magnetic properties of layered rare earth disilicides. L.D.Woolf (Corporate Res. Sci. Labs., Exxon Res. & Engng. Co., Linden, NJ, USA).
Solid State Commun. (USA), vol.47, no.7, p.519-23 (Aug. 1983).
The layered rare earth (RE) disilicides RE_3Si_5 with RE=Y, Er, Tm, Yb and Lu have been studied by means of AC magnetic susceptibility and AC electrical resistance measurements. Evidence for magnetic orderings have been found at 4.4K, 3.1K and 1.7K for Er_3Si_5 and at 2.1K for Tm_3Si_5. The resistance of Lu_3Si_5 was observed to drop abruptly below 7K, possibly indicating the presence of a superconducting phase. An apparent correlation was noted between the value of the room temperature resistivity and the amount of negative curvature observed in the resistivity above ~50K in these materials. (17 refs.)

Structure and electronic properties of molten $TlAsSe_2$ .... See Entry 101525

Structures and magnetic properties of rare earth compounds in the melilite group .... See Entry 101678

Melting and wetting behavior in oxygen films .... See Entry 102167

Magnetic behavior of RRh_3B_2 (R=La to Gd) ternary borides .... See Entry 102636

Quantum-mechanical ground state of cerous magnesium nitrate .... See Entry 102677

Magnetic properties of new organic metals. Introduced by the example of the fluoranthene-radical cation salts .... See Entry 102760

Preparation, magnetic and Mossbauer resonance investigation of some perovskite-type oxides containing iridium +V .... See Entry 102784

Method of the study of diamagnetic anisotropy of polypropylene fibers .... See Entry 102849

75.20E Metals and alloys

102620 Reduced paramagnetism in γ-cerium. H.H.Bertschat, C.Broude, E.Dafni, F.D.Davidovsky, M.Hass, P.M.S.Lesser (Dept. of Nuclear Phys., Weizmann Inst. of Sci., Rehovot, Israel).
Solid State Commun. (USA), vol.47, no.7, p.525-7 (Aug. 1983).
The electronic structure of cerium ions in cerium metal has been investigated via time-differential perturbed angular distribution (TDPAD) measurements of the paramagnetic enhancement factor at several temperatures and zero pressure. A considerable reduction of the paramagnetic enhancement in γ-cerium was observed in comparison to systems where Ce is believed to be in the trivalent state, indicating the 4f electron to be partially delocalized. The results are discussed within the framework of the valence fluctuations concept. (20 refs.)

Magnetic susceptibility and solubility limits of dilute Mn in liquid Se .... See Entry 101987

Temperature dependences of the magnetic susceptibility, magnetization, and electrical resistivity of solid solutions of the $GdZn_xMg_{1-x}$ system .... See Entry 102630

Magnetic correlations in metallic magnetics at finite temperatures .... See Entry 102664

Effect of high magnetic fields on the heat capacity of strongly Pauli-paramagnetic Pd-Ni alloys .... See Entry 102672

Angle-resolved photoelectron spectroscopy of the nickel magnetism below and above T_c .... See Entry 103029

75.20H Local moment in dilute alloys; Kondo effect

(see also 72.15Q Electronic conduction)

On the ground state energy of the symmetric Anderson model .... See Entry 102222

Magnetic susceptibility and kinetics of 'graphitization' of glass-like carbons .... See Entry 102617

75.25 SPIN ARRANGEMENTS IN MAGNETICALLY ORDERED MATERIALS (NEUTRON STUDIES, ETC)

102621 Dipolar energy of a modulated structure. E.-F.Bertaut (Lab. de Cristallographie, CNRS, Grenoble, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.15, p.1123-7 (25 April 1983). In French.
A method of evaluating dipolar energies in reciprocal space is presented which is applicable to modulated magnetic structures as well as to crystallographic incommensurate structures when they are modulated antiferroelectrics. The only condition imposed is that the dipole moments can be expanded in Fourier series. The modulation can be helicoidal, sinusoidal, squared, etc. (2 refs.)

102622 Neutron diffraction effects of distortion of the structure of Ni-67.7 at.% Fe alloy in a magnetically ordered state. S.F.Dubinin, S.G.Teploukhov, S.K.Sidorov (Inst. of Metal Phys., Acad. of Sci., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1160-4 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
An analysis was made of the neutron diffraction patterns of a single crystal of Ni-67.7 at.% Fe obtained in a wide range of temperatures. The long-range ferromagnetic and antiferromagnetic ordering appeared in this alloy in a distorted lattice state. It was established that the Curie and Neel temperatures of this alloy were also the points at which structural transitions occurred. This indicated an additional distortion of the crystal on transition to a magnetically ordered state. The magnitude of such distortion clearly determined the Invar effect in this Fe-Ni alloy. (8 refs.) *A.T.*

102623 Magnetic ordering in superconductors. R.Pynn (Inst. Laue-Langevin, Grenoble, France), J.W.Lynne, J.Joffrin.
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.179-88 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Several ternary rare-earth compounds display long-range magnetic order in the superconducting state. When this order is antiferromagnetic, coexistence with superconductivity occurs over a wide temperature interval. Although simple ferromagnetic order destroys superconductivity, the competition between the magnetic and superconducting states produces a magnetic modulation of several hundred Angstroms wavelength which coexists with superconductivty. The modulated state, which has been studied by neutron scattering techniques in $ErRh_4B_4$ and $HoMo_6S_8$, exists over a narrow temperature range and is replaced by a ferromagnetic, normal conducting state at low temperature. Recent small-angle, neutron-scattering experiments with $HoMo_6S_8$ have established that the magnetic order in the modulated state is of long range. Although these experiments have proven that the modulated phase is not a vortex lattice no definitive microscopic description of the phase has yet been confirmed in either $HoMO_6S_8$ or $ErRh_4B_4$. Recent neutron scattering investigations which have attempted to elucidate the nature of the modulated phase are described. (26 refs.)

102624 Magnetic properties of Cr, Mo, and W-modified Mn_3B_4. T.Ishii, M.Shimada, M.Koizumi (Inst. of Sci. & Industrial Res., Osaka Univ., Osaka, Japan).
J. Chem. Phys. (USA), vol.79, no.3, p.1511-15 (1 Aug. 1983).
Magnetic properties of Cr, Mo, and W-modified Mn_3B_4 were examined, and it was found that the ferromagnetic moment of $(Mn_{1-x}M_x)_3B_4$ (M=Cr, Mo, W) increased with increasing x ($0 \leq x \leq 0.1$), but the value of the effective Bohr magnetron μ_{eff} was almost constnt for the present compositional range studied and μ_{eff} was independent of the kind of substituted elements. This result suggests that ferromagnetism of the present solid solutions is due to canting of the antiferromagnetic sublattice of Mn 2(c) atoms of Mn_3B_4. (10 refs.)

102625 Antiferromagnetic order in fluoride glasses $PbMnFeF_7$ and Pb_2MnFeF_9. A.Le Bail, C.Jacoboni, R.De Pape (Lab. des Fluorures et Oxyfluorures Ioniques, Faculte des Sci., Le Mans, France).
J. Solid State Chem. (USA), vol.48, no.2, p.168-75 (1 July 1983). In French.
Neutron diffraction experiments have been carried out on fluoride glasses '$PbMnFeF_7$' and 'Pb_2MnFeF_9' to provide informations on the magnetic short range order of M-M pairs ($M = Mn^{2+}$, Fe^{3+}). The magnetic correlation function in both glasses shows prevailing strong antiferromagnetic first neighbor interaction at 3.6 Å, and two ferromagnetic interactions at 5.4 and 6.7 Å. The structure of these glasses is described in terms of randomly linked corner-shared MF_6 octahedral chains, with Pb^{2+} in interstitial sites. (20 refs.)

102626 Crystalline and magnetic structures in $REAl_xGa_{2-x}$ systems (RE=Nd, Er; $0 \leq x \leq 2$). II. Magnetic structures. O.E.Martin, K.Girgis (Inst. fur Kristallographie und Petrographie, Eidgenossische Tech. Hochschule, Zurich, Switzerland), P.Fischer.
J. Magn. & Magn. Mater. (Netherlands), vol.37, no.3, p.231-6 (July 1983).
For pt.I see ibid., vol.37, no.3, p.228 (1983). Part II describes results on bulk magnetic properties, transition temperatures, magnetic structures and magnetic moments found for the $NdAl_xGa_{2-x}$ and $ErAl_xGa_{2-x}$ pseudoternary solid solution systems ($0 \leq x \leq 2$). Characterization techniques include electron microprobe analysis, induction magnetometer, X-ray and neutron diffraction. The authors found ferromagnetic as well as antiferromagnetic order with parallel and incommensurate spiral structures. These spiral structures are of cycloidal or triangular screw axis type. (10 refs.)

102627 The magnetic structures of $LaTiO_3$ and $CeTiO_3$. J.P.Goral, J.E.Greedan (Inst. for Materials Res., McMaster Univ., Hamilton, Ontario, Canada).
J. Magn. & Magn. Mater. (Netherlands), vol.37, no.3, p.315-21 (July 1983).
The basic features of the magnetic structures of $LaTiO_3$ and $CeTiO_3$ were determined by powder neutron diffraction. $LaTiO_3$ ($T_N = 125K$) is a type G antiferromagnet with a moment on Ti(III) of 0.45(5) μ_B at 10K. As bulk magnetic measurements indicate a weak ferromagnetic moment, a G_zF_x or G_xF_z configuration is implied. $CeTiO_3$ ($T_N = 116K$) shows more complex behaviour. At 81K only G and F type reflections are observed. The most consistent interpretation is to assign G-type configuration to Ti(III) and an induced F_z on Ce(III). Moments are 0.36 μ_B on Ti(III) and 0.4(1) μ_B on Ce(III). It is also possible to assign both G and F components to Ti(III). This demands a 'canting angle' of 34° to explain the F moment. Below 80K a C-type component develops. A model assuming a G_zF_x configuration for Ti(III) and a C_yF_x configuration for Ce(III) provides a good fit to the data. This assignment is consistent with Bertaut's symmetry considerations. Other models which violate Bertaut's rules also fit the data. (17 refs.)

102628 Theory of magnetic structure in reentrant magnetic superconductors $HoMo_6S_8$ and $ErRh_4B_4$. L.N.Bulaevskii, A.I.Buzdin, S.V.Panjukov (P.N. Lebedev Phys. Inst., Moscow, USSR), M.L.Kulic.
Phys. Rev. B (USA), vol.28, no.3, p.1370-88 (1 Aug. 1983).
Magnetic superconductors, in which the first- and the second-order phase transition to the ferromagnetic (FN) state would occur in the absence of superconductivity, are considered. The exchange and the electromagnetic dipolar interactions of localized moments and electrons as well as magnetic anisotropy are taken into account. It is shown that one realizes the transverse domainlike magnetic structure in a superconducting state (the DS phase). Transitions $S \rightarrow DS \rightarrow FN$ are considered. The proposed theory (with the second-order transition) explains well the experimental data for $HoMo_6S_8$. The experimental data on $ErRh_4B_4$ may be explained in the framework of the similar microscopic theory with the assumption that it is a first-order magnetic transition and that the critical-temperature (Θ) variations over the sample investigated by Moncton et al. [Phys. Rev. Lett. 45, 2060 (1981)] and by Sinha et al. [Phys. Rev. lett. 48, 950 (1982)] are due to inhomogeneous stresses. (37 refs.)

Prediction of structures and magnetic orientations in solid α-and β-O_2 .... See Entry 101881

The use of neutron polarisation analysis in determining Hamiltonians for simple ferromagnetic systems .... See Entry 102606

Influence of titanium on magnetic properties and structure of iron-chromium-cobalt alloys .... See Entry 102650

Magnetic phase transitions in ordered $(Fe_{1-x}Mn_x)Pt$ alloys .. See Entry 102655

75.30 MAGNETICALLY ORDERED MATERIALS, OTHER INTRINSIC PROPERTIES

(for critical point effects, see 75.40)

Interrelation of crystal structure with physical properties in complex perovskite-type oxides .... See Entry 101675

75.30C Saturation moments and magnetic susceptibility

102629 Magnetic behaviour of RRh_3B_2 ternary borides. R.Vijayaraghavan (Tata Inst. of Fundamental Res., Bombay, India).
Curr. Sci. (India), vol.52, no.11, p.518-27 (5 June 1983).
Magnetisation studies on RRh_3B_2(R=La to Gd) ternary borides have shown that all except La containing compound order magnetically. While the magnetic behaviour of $PrRh_3B_2$, $NdRh_3B_2$ and $GdRh_3B_2$ is mainly determined by the localised rare earth moments interacting via the indirect RKKY exchange, the experimental data suggest that the magnetic ordering in $CeRh_3B_2$ and $EuRh_3B_2$ is of itinerant nature and is presumed to arise from Rh-d band. Possibly the 4f electrons of Ce and Eu also play a significant role. Preliminary resistivity studies on $CeRh_3B_2$ show that the temperature behaviour of resistivity is similar to what one would expect for a 'strongly interacting electron gas'. ^{151}Eu Mossbauer studies in $EuRh_3B_2$ show clearly that Eu ions are nonmagnetic in this compound and, therefore, magnetic ordering in this compound cannot be ascribed to Eu sublattice. Magnetisation behaviour in $SmRh_3B_2$ is rather anomalous. (26 refs.)

102630 Temperature dependences of the magnetic susceptibility, magnetization, and electrical resistivity of solid solutions of the $GdZn_xMg_{1-x}$ system. V.E.Adamyan, G.G.Karagebakyan, M.A.Melikyan, E.S.Abovyan (State Univ., Erevan, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1083-7 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A system of $GdZn_xNg_{1-x}$ solid solutions with the CsCl-type structure was synthesized. Measurements of the magnetic properties carried out in the range 77-600K showed that at low temperatures these solutions were ferromagnetic. The ferromagnetic and paramagnetic Curie temperatures were determined. At high temperatures the susceptibility obeyed the Curie-Weiss law with an effective magnetic moment close to the theoretically predicted value. The

temperature dependences of the electrical resistivity had kinks at the Curie temperatures of the solutions. (10 refs.) *A.T.*

102631 Temperature coefficients of the magnetic induction and magnetic properties of $Sm_x(R,Gd)_{1-x}Co_5$ alloys (R=Tb, Dy, Ho, Tm). O.I.Ponomareva, Ya.S.Shur, V.G.Maikov, A.G.Popov (Inst. of Metal Phys., Acad. of Sci., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1101-6 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A systematic investigation was made of the temperature dependences of the magnetic induction and magnetic properties of alloys formed by cobalt with samarium and with heavy rare-earth metals. The purpose was to determine the main conditions for achieving a low value of the temperature coefficient of the magnetic induction, which is one of the more important characteristics of permanent magnets. (13 refs.) *A.T.*

102632 Influence of high pressures and magnetic fields on magnetic ordering in Cr-Fe alloy. V.V.Kokorin, I.A.Osipenko, S.V.Cherepov, V.A.Chernenko (Inst. of Metal Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1225-8 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
Alloys of Cr containing 20 wt.% Fe were investigated. The temperature dependences of the magnetic susceptibility were recorded and the effects of a static magnetic field and of an external pressure on these dependences were studied. A transition was observed to the superferromagnetic state and the temperature of this transition was a function of the applied field. This transition occurred in a system of ferromagnetic inclusions. (9 refs.) *A.T.*

102633 On the participation of domains in the high spin ($^5T_2$)$\rightleftarrows$low spin ($^1A_1$) transition in dithiocyanatobis (2,2′-bi-2-thiazoline) iron (II). E.W.Muller, H.Spiering, P.Gutlich (Inst. fur Anorganische und Analytische Chem., Johannes Gutenberg-Univ., Mainz, Germany).
J. Chem. Phys. (USA), vol.79, no.3, p.1439-43 (1 Aug. 1983).
The hysteresis in the high spin$\rightleftarrows$low spin transition of $[Fe(bt)_2(NCS)_2]$ (bt=2,2′-bi-2-thiazoline) has been studied by magnetic susceptibility measurements in two different preparations and in a mechanically treated (ball mill) sample. From the measurement of two inner hysteresis loops and a comparison with Everett's theorems for hysteresis effects, it could be established that independent domains (i.e. groups of complex molecules of like spin that can only change their state simultaneously) participate in the spin transition in the unperturbed sample. The domains were found to be no longer independent in the milled sample. This property may result from a different limitation in the size of the domains caused by lattice defects as compared to the unperturbed sample. (24 refs.)

102634 Anisotropic magnetic susceptibility of single crystal UCl_4. E.Gamp, N.Edelstein (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA), C.Khan Malek, S.Hubert, M.Genet.
J. Chem. Phys. (USA), vol.79, no.4, p.2023-6 (15 Aug. 1983).
The anisotropic magnetic susceptibilities $\chi_\parallel$ and $\chi_\perp$ of UCl_4 have been measured in single crystals between 1.6 and 350K. Powder measurements of the average susceptibility were also performed but were found to be unreliable due to orientation effects. The single crystal results were interpreted in terms of the parameterized crystal field model with the following parameters: $\zeta=1819$ cm^{-1}; $F^2=42\ 632$ cm^{-1}, $F^4=38\ 680$ cm^{-1}; $F^6=23\ 320$ cm^{-1}; $B_0^{\,2}=-1008$ cm^{-1}; $B_0^{\,4}=1730$ cm^{-1}; $B_4^{\,4}=-2704$ cm^{-1}; $B_0^{\,6}=-2705$ cm^{-1}; $B_4^{\,6}=346$ cm^{-1}; $\alpha=29$ cm^{-1}; $\beta=-638$ cm^{-1}; and $\gamma=1617$ cm^{-1}. These parameters yield a $\Gamma_4(^3H_4)$ ground state and a paramagnetic first excited state $\Gamma_5(^3H_4)$ at 110 cm^{-1} and are in good agreement with the optical spectrum. (13 refs.)

102635 Magnetic properties of $RE_2Mo_2O_7$ pyrochlores. R.Ranganathan, G.Rangarajan, R.Srinivasan (Dept. of Phys., Indian Inst. of Technol., Madras, India), M.A.Subramanian, G.V.Subba Rao.
J. Low Temp. Phys. (USA), vol.52, no.5-6, p.481-96 (Sept. 1983).
The magnetic properties of $RE_2Mo_2O_7$ ($RE=Gd^{3+}$, Tb^{3+}, Dy^{3+}, Ho^{3+}, Er^{3+}, Tm^{3+}, and Yb^{3+}) and of solid solutions of the type $(Nd_{1-x}A_x)_2Mo_2O_7$ (A=Yb or Er; $0.05\leq x\leq 0.4$) have been studied using an AC mutual inductance bridge. All the compounds were found to exhibit magnetic ordering in the neighborhood of or below 77K. The data have been analyzed using (i) the available susceptibility data on $Y_2Mo_2O_7$, (ii) a ferromagnetic coupling among the Mo^{4+} ions to obtain the contribution from the RE^{3+} ion, and (iii) the available susceptibility data on $RE_2Ti_2O_7$ to obtain the contribution from the Mo^{4+} ions. It was found that procedure (iii) gave the most satisfactory explanation of the magnetic ordering. The results indicated that (1) the Mo^{4+} ions become ordered magnetically, (2) the behavior of the RE^{3+} ions is almost the same as in the isostructural $RE_2Ti_2O_7$ and $RE_2V_2O_7$ compounds, and (3) the susceptibility values differ appreciably as the authors go from Nd^{3+} to Yb^{3+}, possibly due to narrowing of the π*Mo-O conduction band. (15 refs.)

102636 Magnetic behavior of RRh_3B_2 (R=La to Gd) ternary borides. S.K.Malik, R.Vijayaraghavan, W.E.Wallace (Dept. of Chem., Univ. of Pittsburgh, Pittsburgh, PA, USA), S.K.Dhar.
J. Magn. & Magn. Mater. (Netherlands), vol.37, no.3, p.303-8 (July 1983).
Magnetisation of the rare earth ternary borides RRh_3B_2 (R=La to Gd), which crystallize in the hexagonal $CeCo_3B_2$ type structure, has been measured in the temperature range 4.2 to 300K. The Curie temperatures have been determined from low field AC susceptibility measurements. All except $LaRh_3B_2$ order magnetically. The Gd and Nd compounds have Curie temperatures (T_c) of 91K and <20K, respectively; the effective paramagnetic moments are slightly larger than the corresponding free ion values for trivalent rare earths. The Ce, Sm and Eu compounds show unusual behavior. From unit cell volume considerations, Eu is trivalent (ground state $4f^6$; $^7F_0$) and cerium has a valence greater than 3. In spite of this, $CeRh_3B_2$ and $EuRh_3B_2$ exhibit magnetic ordering with T_c's of 108 and 40K and saturation moments of 0.38 and 0.55 μ_B at 4.2K, respectively. The magnetism in these two compounds is presumed to be of the itinerant type. The compound $SmRh_3B_2$ has a very small moment at 4.2K in 20 kOe field (0.046 μ_B) and exhibits a peculiar temperature dependence of magnetization. (13 refs.)

102637 AC magnetic susceptibility and hysteresis studies on $La_{1-x}Y_xMn_2Si_2$ intermetallic compounds. R.S.Chaughule, C.Radhakrishnamurty, E.V.Sampathkumaran, S.K.Malik, R.Vijayaraghavan (Tata Inst. of Fundamental Res., Bombay, India).
Mater. Res. Bull. (USA), vol.18, no.7, p.817-21 (July 1983).
AC susceptibility and hysteresis studies at various temperatures indicate that the ferromagnetic pseudoternary system $La_{1-x}Y_xMn_2Si_2$ ($x<0.2$) contains mixed multidomain, single domain or superparamagnetic states. The compound with x=0.2 shows a cluster spin-glass type of ordering. (12 refs.)

External weighing with analytical balances: determination of magnetic susceptibility of inorganic compounds .... See Entry 98704

Tetramethyldithiadiselenafulvalene (TMDTDSF): properties of its hexafluorophosphate salt and alloys with tetramethyltetraselenafulvalene .... See Entry 101681

Prediction of structures and magnetic orientations in solid α-and β-O_2 .... See Entry 101881

Transport and magnetic properties of layered rare earth disilicides .... See Entry 102619

Crystalline and magnetic structures in $REAl_xGa_{2-x}$ systems (RE=Nd, Er; $0\leq x\leq 2$). II. Magnetic structures .... See Entry 102626

Magnetic properties of the $Cr_{7-x}Fe_xTe_8$ (x=0 to 3) system . See Entry 102659

Magnetic behavior of Fe_xSn_{1-x} amorphous alloys near the critical composition .... See Entry 102673

High-field specific heat of the spin-fluctuations system UAl_2 .... See Entry 102674

The new curve for the non-linear magnet .... See Entry 102708

Effect of the conditions of synthesis and heat-treatment regime on the magnetic properties of iron sulfides with a Curie temperature of 570°C .... See Entry 104341

75.30D Spin waves

(see also 76.50 Spin wave resonance)

102638 Theory of relaxation of magnons in a two-component electron liquid in a ferromagnet. Yu.A.Milyukov, O.M.Tolkachev (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1058-65 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A system of nonlinear equations of motion for a circularly polarized nonequilibrium magnetization of a two-component electron liquid in a ferromagnet with the s-d of s-f exchange interaction is used to obtain the collision integral for magnons with collective-state s and d (f) electrons. The damping decrement is found for magnons interacting with the s and d (f) electrons, as a function of the temperature and wave vector. It is shown that the contribution of the collective-state d (f) electrons to the magnon relaxation processes is considerable and the conditions are found under which the damping decrement in magnons interacting with heavy d (f) electrons is greater than or of the order of the damping decrement of magnons interacting with the light s electrons. (11 refs.) *A.T.*

102639 Parametric spin-wave excitation in amorphous ferromagnetic wires. L.Kraus, A.N.Anisimov, A.G.Gurevich, A.V.Atlasman (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
JETP Lett. (USA), vol.37, no.2, p.123-6 (20 Jan. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.2, p.100-3 (20 Jan. 1983).
A parametric excitation of spin waves has been observed during transverse pumping in amorphous thin ferromagnetic wires. This excitation is made possible by an induction 'intensification' of the magnetic field through the placement of the sample at an antinode of the electric field of a microwave resonator. (11 refs.)

102640 Magnetic excitations in the incommensurate phases of chromium metal. S.K.Burke, W.G.Stirling, K.R.A.Ziebeck (Inst. Laue-Langevin, Grenoble, France), J.G.Booth.
Phys. Rev. Lett. (USA), vol.51, no.6, p.494-7 (8 Aug. 1983).
The excitation spectrum of the incommensurate spin-density wave in chromium metal has been investigated by neutron scattering. It is found that the high-velocity mode originating from the magnetic satellite positions is not a simple spin wave but at low frequency is a longitudinal excitation. Additional excitation branches, which cross at the (100) position at a frequency corresponding to the 'commensurate' feature seen in previous studies, were also observed. (15 refs.)

102641 Collective behavior of magnons in superlattices. M.Grimsditch, M.R.Khan, A.Kueny, I.K.Schuller (Materials Sci. & Technol. Div., Argonne Nat. Lab., Argonne, IL, USA).
Phys. Rev. Lett. (USA), vol.51, no.6, p.498-500 (8 Aug. 1983).
The magnon spectrum characteristic of collective behavior in magnetic/nonmagnetic superlattices has been observed, and is in good agreement with theoretical predictions. (9 refs.)

102642 Surface spin waves in antiferromagnets. B.Luthi, D.L.Mills (Phys. Dept., Univ. of California, Irvine, CA, USA), R.E.Camley.
Phys. Rev. B (USA), vol.28, no.3, p.1475-9 (1 Aug. 1983).
A complete theory for dipolar antiferromagnetic surface spin waves is given. Analytic forms are derived for the dispersion relation and regions of stabiliy. Applications to representative uniaxal antiferromagnets (MnF_2, $GdAlO_3$, FeF_2) are shown and possible experimental methods for verification are discussed. The case of exchange-dominated antiferromagnetic surface spin waves is briefly mentioned. (17 refs.)

102643 Kinetic description of collective oscillations in a system of parametric spin waves. II. Inhomogeneous collective modes. V.G.Morozov, A.N.Mukhai (Moscow Inst. of Civil Aviation Engrs., Moscow, USSR).
Theor. & Math. Phys. (USA), vol.53, no.2, p.1142-9 (Nov. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.53, no.2, p.305-17 (Nov. 1982).
For pt.I see ibid., vol.51, p.234 (1982). On the basis of the linearised kinetic equations obtained in Part I, spatially inhomogeneous collective oscillations in a system of parametric spin waves of a ferromagnet are considered. It is shown that the spectrum $\Omega_m(\kappa)$ of such oscillations depends on the relationship between the wave number κ of the oscillations and the spreading Δk of the packet of parametric waves in the k space. An investigation is made into the behaviour of the spectrum $\Omega_0(\kappa)$ of an inhomogeneous zero-order mode near the stability boundaries of the isotropic stationary state and the anisotropic stationary states. Criteria of stability of the stationary states with respect to excitation of the inhomogeneous zero-order mode in the long-wavelength ($\kappa\ll\Delta k$) and short-wavelength ($\kappa\gg\Delta k$) regions of the spectrum are obtained. For higher modes with $m\neq 0$, the spectrum of longitudinal ($\kappa\parallel M_0$) long-wave and short-wave collective oscillations is found. (9 refs.)

The use of neutron polarisation analysis in determining Hamiltonians for simple ferromagnetic systems .... See Entry 102606

Relaxation in linear ferromagnetic chain. I. Phonon relaxation .... See Entry 102611

Limitations of spin-wave theory in $T=0$ spin dynamics .... See Entry 102675

Interaction of a moving domain wall in a orthoferrite with Lamb waves .... See Entry 102695

Asymmetry of the lineshape in one-magnon Raman scattering from FeF_2 .... See Entry 102870

75.30E Exchange and superexchange interactions

(see also 71.70 Level splitting and interactions)

102644 Exchange anistropy of polycrystalline alloy $FePd_2Au$. M.A.Borozdina, Yu.G.Karpov, Yu.A.Vereshchagin, F.A.Sidorenko, V.M.Pavlov, P.V.Gel'd (S.M. Kirov Ural Polytech. Inst., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1112-16 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of hysteresis loops of the alloy $FePd_2Au$ ion states intermediate between ferromagnetic and antiferromagnetic, achieved by atomic ordering. Cooling in a magnetic field at low temperatures resulted in considerable broadening and the strong shift of the hysteresis loops. This was attributed to a strong exchange anisotropy due to the coexistence, in the intermediate magnetic structures, of ferromagnetic and antiferromagnetic regions. (12 refs.) *A.T.*

102645 On the interference of superexchange interactions. I.Mayer, S.A.Angelov (Central Res. Inst. for Chem., Hungarian Acad. of Sci., Budapest, Hungary).
J. Phys. C (GB), vol.16, no.23, p.L857-8 (20 Aug. 1983).
An improved treatment of the problem of non-additivity in superexchange is proposed. It is stressed that the description of the interference does not require the postulation of any new superexchange mechanisms. (3 refs.)

102646 In-plane next-nearest-neighbour exchange coupling in uniaxial metamagnets: its influence on the low-temperature self-energy. E.Rastelli, A.Tassi (Istituto di Fisica, Univ. di Parma, Parma, Italy).
J. Phys. C (GB), vol.16, no.23, p.4663-77 (20 Aug. 1983).
The ladder approximation is performed for metamagnets with uniaxial and exchange anisotropy and the following exchange couplings: in-plane nearest-neighbour ferromagnetic coupling J_1, in-plane, next-nearest-neighbour antiferromagnetic coupling J_2, and small interplane antiferromagnetic coupling J'. Taking J_2 into account encounters non-trivial difficulties but the authors have tackled this problem because a suitable lattice-dependent value of $J_2=J_2$ causes the long-wavelength magnon dispersion curve to become a quartic power of the wavevector instead of a quadratic one, so one can expect dramatic consequences. In effect this is the case: the results the authors obtain for $FeBr_2$, which has just the convenient ratio J_2/J_1 to fit the situation described above, give weak renormalisation and damping for the uniform mode, while for $FeCl_2$ dramatic variances, at least from a quantitative point of view, do not arise with respect to previous approahces, where J_2 was neglected. Such a result cannot be inferred on the basis of a finite-order perturbation theory which, on the contrary, would suggest a heavier renormalisation when the dispersion curve is more flat for small wavevectors, as in $FeBr_2$. (20 refs.)

102647 Off-diagonal s-d coupling and red shift of absorption spectra in magnetic semiconductors. V.Capek, V.Szocs, I.Barvik (Inst. of Phys., Charles Univ., Prague, Czechoslovakia).
J. Magn. & Magn. Mater. (Netherlands), vol.37, no.3, p.277-82 (July 1983).
Using the method of moments, it is argued that the strong coupling s-d model gives an appreciably enhanced red shift of the quasiparticle density of states with temperature due to even a weak off-diagonal s-d coupling contribution as compared to the case with only a diagonal coupling. The result is used to interpret the red shift in chromium chalcogenide spinels. (19 refs.)

102648 Ferromagnetic intra-sublattice exchange in multicomponent ferrites. N.L.Pakhomova (Moscow Inst. of Transport Engng., Moscow, USSR), L.M.Kasimenko, V.Christoph.
Phys. Status Solidi a (Germany), vol.78, no.1, p.111-14 (16 July 1983).
Comparing the calculated temperature dependence of the magnetization of $Ni_{1-x}Zn_xFe_2O_4$ ferrites with the experimental curves measured on monocrystals the exchange integrals and their concentration dependence are determined. For the calculation a modified statistical model with three sublattices is used. The exchange interaction between the octahedral Fe^{3+} and Ni^{2+} ions is shown to be ferromagnetic. (16 refs.)

Theory of magnetic structure in reentrant magnetic superconductors $HoMo_6S_8$ and $ErRh_4B_4$ .... See Entry 102628

Magnetic behaviour of RRh_3B_2 ternary borides .... See Entry 102629

Magnetic anisotropy and exchange interactions in Li-Al ferrites .... See Entry 102652

Quenching of the phase transitions in MnAs and related compounds .... See Entry 102657

Exchange-striction mechanism of phase transitions in magnetic crystals .... See Entry 102660

Magnetic behavior of Fe_xSn_{1-x} amorphous alloys near the critical composition .... See Entry 102673

Irreversibility and metastability in spin glasses. II Heisenberg model .... See Entry 102692

Magnetization of the rare-earth sublattice in intermetallic compounds of the type $R(Co_{1-x}Ni_x)_5$ .... See Entry 102705

EPR study of electronic and magnetic properties of bis(*DL*-α-amino-*n*-butyrato) copper (II). A layered magnetic system .... See Entry 102737

Detection of exchange modes in quasi-two dimensional antiferromagnet $(NH_3)_2(CH_2)_3MnCl_4$ .... See Entry 102755

Angle-resolved photoelectron spectroscopy of the nickel magnetism below and above T_c .... See Entry 103029

75.30G Anisotropy

102649 Magnetic anisotropy of Cr_5Te_8 single crystal. M.Akram (Dept. of Phys., Punjab Univ., Lahore, Pakistan), F.M.Nazar.
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.441-3 (Aug. 1983).
The authors have measured the magnetization as a function of magnetic field and temperature along different directions in a single crystal of Cr_5Te_8. A large anisotropy has been observed in these samples. This anisotropy may be due to a change in the symmetry of nearest neighbour surrounding of chromium cations. (8 refs.)

102650 Influence of titanium on magnetic properties and structure of iron-chromium-cobalt alloys. Yu.I.Kozlov, Z.A.Rakitina (Sci.-Res. Inst. of Permanent Magnets, Novocherkassk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1223-5 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of the influence of of Ti on alloys of the compositions 62 wt.% Fe-12% Co-26% Cr and 63% Fe-10% Co-27% Cr. The dependences of the magnetic properties on the titanium concentration indicated that the optimal amount of Ti was 2 and 2.5% for the first and second alloys, respectively. These concentrations ensured the highest value of the product $(BH)_{max}$. The addition of titanium suppressed the γ phase and increased the shape anisotropy of the strongly magnetic α_1 phase. (6 refs.) *A.T.*

102651 Spin-glass behavior as a fuction of concentration and local order by NMR in nearly random NiMn systems. J.Schaf (Phys. des Solides, Univ. Paris-Sud, Orsay, France), K.Le Dang, P.Veillet.
J. Magn. & Magn. Mater. (Netherlands), vol.37, no.3, p.297-302 (July 1983).
Unidirectional anisotropy fields (H_A) in disordered $Ni_{100-x}Mn_x$ ($25 \leq x \leq 32$) systems after field cooling are found by NMR (spin echo) to be very sensitive to the Mn concentration and to local order. The H_A increases by roughly a factor of 10 when the concentration increases 5%. The Mn NMR spectra show that all Mn have several first nearest Mn neighbours. For a given concentration, in the above range, the H_A are very sensitive to the annealing-quenching temperatures (T_{AQ}) and vanish when the sample is cooled down from 900°C in 2 h. The NiMn system can be tuned by heat treatments from a spin glass to a ferromagnet. The Mn NMR spectra with decreasing T_{AQ} show a clear metallurgical evolution tending to states where a Mn atom sees fewer first nearest Mn neighbours. Evidence is found that the anisotropy has its roots in atomic randomness. (15 refs.)

102652 Magnetic anisotropy and exchange interactions in Li-Al ferrites. N.L.Pakhomova, V.A.Kozlov (Moscow Railroad Transport Engrs. Inst., Moscow, USSR).
Sov. Phys. J. (USA), vol.25, no.11, p.1022-5 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.54-7 (Nov. 1982).
The mechanism of exchange interactions in Li-Al ferrites is examined along with the nature of the magnetic crystallographic anisotropy. Calculation from a modified statistical model and another from Wolf's model may be used with observed curves for the temperature dependence of the magnetization and the first magnetic crystalline anisotropy constant to obtain values for the exchange integrals and the spin-Hamiltonian parameter SHP for Fe^{3+}. It is shown that the SHP are substantially influenced by the exchange interactions, and the concentration relationships cannot be explained within the framework of the ionic crystalline-field theory. (11 refs.)

The use of neutron polarisation analysis in determining Hamiltonians for simple ferromagnetic systems .... See Entry 102606

Theory of magnetic structure in reentrant magnetic superconductors $HoMo_6S_8$ and $ErRh_4B_4$ .... See Entry 102628

In-plane next-nearest-neighbour exchange coupling in uniaxial metamagnets: its influence on the low-temperature self-energy .... See Entry 102646

Metamagnetism of a noncollinear antiferromagnet: the Jahn-Teller garnet $Ca_3Mn_2Ge_3O_{12}$ .... See Entry 102656

Field and anisotropy effects in spin glasses. I. The collinear case .... See Entry 102667

Magnetic behavior of Fe_xSn_{1-x} amorphous alloys near the critical composition .... See Entry 102673

Phase diagrams for anisotropic spin glasses .... See Entry 102682

Non-linear modes and statistical mechanics of a classical Heisenberg chain with two anisotropies .... See Entry 102690

Magnetization of the rare-earth sublattice in intermetallic compounds of the type $R(Co_{1-x}Ni_x)_5$ .... See Entry 102705

Method of the study of diamagnetic anisotropy of polypropylene fibers .... See Entry 102849

75.30H Magnetic impurity interactions

102653 Influence of V on the Fe site spin and charge densities in BCC-iron. S.M.Dubiel, W.Zinn (IFF, KFA, Julich, Germany).
J. Magn. & Magn. Mater. (Netherlands), vol.37, no.3, p.237-45 (July 1983).
Using the Mossbauer effect the authors studied the influence of substituting iron atoms by vanadium atoms on the Fe site HF field and isomer shift for a series of Fe-V alloys containing up to 18 at.% V. The two quantities are correlated with each other and also the average HF field $\bar{H}$ is correlated with the average number of V atoms in the vicinity of the Fe nuclei $\bar{N}$. Based on the former correlations the authors were able to determine the hyperfine coupling constants to be equal to: a) 1735 kOe/s-el for itinerant s-like electrons, b) 3240 and 3450 kOe/s-el for the s-electrons localized in the first- and second-neighbour shell, respectively, and c) 3090 kOe/s-el, the average value. Using the estimated HF coupling constants and based on the $\bar{H}$-$\bar{N}$ correlation the disturbance of the spin or charge density per one V atom per unit cell, η, was calculated to be equal to 0.048. The results are compared with those obtained previously for other substitutes and they are discussed in terms of Friedel's and Stearns' models. (11 refs.)

75.30K Magnetic phase boundaries

(inc. magnetic transitions, metamagnetism, etc)

102654 Magnetic properties of ordered $Fe_{1-x}Mn_xPd_3$ alloys. B.V.Cherkashin, Yu.A.Vereshchagin, A.A.Kuranov, P.V.Gel'd (S.M. Kirov Ural Polytech. Inst., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1133-7 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The magnetic properties of atomically ordered $Fe_{1-x}Mn_xPd_3$ alloys were investigated in the temperature range from 4.2 to 600K. The results were used to plot for the first time the magnetic phase diagram with composition regions characterized by the ferromagnetic ($0.70 \leq x < 1$) and antiferromagnetic ($0 < x \leq 0.70$) long-range order. A spin glass component was observed near the magnetic phase transition. (12 refs.) *A.T.*

102655 Magnetic phase transitions in ordered $(Fe_{1-x}Mn_x)Pt$ alloys. G.P.Gasnikova, Yu.A.Dorofeev, A.Z.Men'shikov, S.K.Sidorov (Inst. of Metal Phys., Acad. of Sci., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1138-42 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A neutron-diffraction investigation of alloys corresponding to the quasibinary FePt-MnPt line, subjected to annealing to ensure a fully ordered state, was carried out in the temperature range 4.2-800K. It was found that the composition-dependent ferromagnetic-antiferromagnetic phase transition occurred in $(Fe_{1-x}Mn_x)Pt$ alloys, characterized by the base-centred tetragonal magnetic lattice, via an intermediate collinear antiferromagnetic structure characterized by the wave vector $\mathbf{K}=(1, 0, 1/2)$. The Curie and Neel temperatures were determined for the observed magnetic structures and a complete magnetic phase diagram was plotted. It was concluded that noncoplanar magnetic structures occurred in the region of transition from one type of magnetic order to another. (14 refs.) *A.T.*

102656 Metamagnetism of a noncollinear antiferromagnet: the Jahn-Teller garnet $Ca_3Mn_2Ge_3O_{12}$. Z.A.Kazei, N.P.Kolmakova, D.I.Sirota, V.I.Sokolova (M.V. Lomonosov State Univ., Moscow, USSR).
JETP Lett. (USA), vol.37, no.5, p.285-9 (5 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.5, p.240-3 (5 March 1983).
The metamagnetic phase transition in the crystal $Ca_3Mn_2Ge_3O_{12}$, induced by an external magnetic field, is investigated with the help of magnetostriction measurements at 4.2K. The unusual phase diagrams in the (001) and (010) planes, obtained in the experiment, are described by a model of an anisotropic metamagnet with four local anisotropy axes. (7 refs.)

102657 Quenching of the phase transitions in MnAs and related compounds. J.Tebbe, K.Barner (IV Phys. Inst., Univ. Gottingen, Gottingen, Germany).
J. Magn. & Magn. Mater. (Netherlands), vol.37, no.3, p.283-6 (July 1983).
The first- and second-order phase transition in MnAs and related compounds can be suppressed by rapid roller quenching. The magnetic behaviour of the resulting new metastable phases indicates a mixed double exchange-superexchange magnetic coupling for these compounds. (14 refs.)

102658 The behaviour of an amorphous ferromagnet with dilution. A.Bobak (Dept. of Theoretical Phys. & Geophys., P.J. Safarik Univ., Kisice, Czechoslovakia).
Phys. Status Solidi b (Germany), vol.118, no.1, p.K61-3 (1 July 1983).
The present work is an extension of the author's previous treatment (1982), motivated by the suspicion that the physical problem was inadequately represented because the fluctuations of the effective field, which represent a characteristic feature of disordered systems and are a consequence of the concentration and structure fluctuations, were neglected. It is obvious that the effective field acting on given 'first shell' magnetic atom takes various values depending on the occupation of the magnetic atoms in the surrounding layer or 'second shell' of the cluster. For this reason, they assume that a 'fist shell' magnetic atom i is subject to an effective field proportional to the number of magnetic n_i that it has outside the cluster. For this reason, they assume that a 'first shell' magnetic atom is subject to an effective field proportional to the number of magnetic neighbours n_i that it has outside the cluster. Thus, the effective field acting on magnetic atom i is taken to be n_iH_1, where $n_i=0, 1, 2, ..., z_i-1$, and the local coordination number, z_i, is a stochastical variable due to the amorphous structure. (6 refs.)

102659 Magnetic properties of the $Cr_{7-x}Fe_xTe_8$ (x=0 to 3) system. G.I.Makovetskii (Inst. of Phys. of Solids & Semiconductors, Acad. of Sci., Minsk, Belorussian SSR).
Phys. Status Solidi a (Germany), vol.78, no.1, p.K39-41 (16 July 1983).
Results on X-ray and magnetic studies of the alloy properties of the $Cr_{7x}Fe_xTe_8$ (x=0 to 3) system are reported. The X-ray structural study of the powder specimens in CuK_α radiation indicates that the range of solid solutions with the NiAs-type structure in the investigated system occurs in the concentration range x=0 to 2. The determined unit cell constants of the alloys, the values of Curie temperature and those of the effective magnetic moment calculated from the temperature dependence of the saturation magnetization are listed. The magnetization measurements were performed in the temperature range from 20 to 400K at fields up to 2 T. The Curie temperatures were obtained by extrapolating the magnetization versus temperature curves to a magnetic field strength of 0.8 T. (2 refs.)

102660 Exchange-striction mechanism of phase transitions in magnetic crystals. K.A.Dyul'dina, V.A.Gordienko (A.A. Baikov Inst. of Metall., Acad. of Sci., Moscow, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.927-8 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.76-8 (Nov. 1982).
The authors propose a mechanism for magnetic phase transitions of the ferromagnetic-antiferromagnetic type which incorporates the dependence of the exchange interactions on the cation-antion-cation angles. They treat the specific case of compounds having a single type of magnetically active ions which crystallize in the NiAs structure. In the analysis of the transitions it is assumed that the main contribution to the exchange energy is from the interaction of cations located in the same basal plane, i.e. the exchange parameters I_{ij} of the competing exchange interactions between cations i and j on neighboring basal planes, at least one of which depends mainly on the cation-anion-cation angle ϕ, have almost the same magnitude. (5 refs.)

102661 Magnetic transition state in metals; the Curie temperature of nickel. A.I.Likhtenshtein, M.I.Katsnel'son, V.I.Anisimov, V.A.Gubanov (Inst. of Chem., Acad. of Sci., Sverdlovsk, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.929-30 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.79-82 (Nov. 1982).
The authors propose a method for the magnetic transition state of metals that permit non-empirical calculations of the local spin excitations in systems having a continuous spectrum of d-states and an arbitrary type of magnetic interactions. Since flipping the spin of one of the atoms breaks the translational invariance of the crystal, the magnetic transition state cannot be calculated by the usual band methods. Cluster approaches, which give a good description of the local excitations in dielectrics, require the examination of large clusters when applied to the collectivized d-states of metals. In calculating ΔE for nickel they therefore used the $X\alpha$ scattered-wave method with k-dependent boundary conditions, which makes it possible to model correctly the structure of delocalized states by considering even small groups of atoms. (10 refs.)

Ferromagnetism of alloys: a new probe in ion implantation ...See Entry 101820

Order-disorder transition and magnetic transformation of $Fe_{0.8}Al_{0.2}$ alloy ....See Entry 101954

Anomaly of the solubility of hydrogen in ferromagnetic metals near the Curie point ....See Entry 101977

Anomalies of thermal expansion of solid solutions of iron in α-manganese ....See Entry 102021

The low-temperature electrical resistivity of alloys with ferro-and antiferromagnetic interaction ....See Entry 102348

***n*-type $CdCr_2Se_4$: a Mott extrinsic semiconductor** ....See Entry 102387

Magnetic properties and structural chemistry of ternary silicides (RE, Th, U)Ru_2Si_2 (RE=rare earth) ....See Entry 102618

Transport and magnetic properties of layered rare earth disilicides ....See Entry 102619

Neutron diffraction effects of distortion of the structure of Ni-67.7 at.% Fe alloy in a magnetically ordered state ....See Entry 102622

Crystalline and magnetic structures in $REAl_xGa_{2-x}$ systems (RE=Nd, Er; $0\leq x\leq 2$). II. Magnetic structures ....See Entry 102626

Theory of magnetic structure in reentrant magnetic superconductors $HoMo_6S_8$ and $ErRh_4B_4$ ....See Entry 102628

Temperature dependences of the magnetic susceptibility, magnetization, and electrical resistivity of solid solutions of the $GdZn_xMg_{1-x}$ system ....See Entry 102630

Influence of high pressures and magnetic fields on magnetic ordering in Cr-Fe alloy ....See Entry 102632

On the participation of domains in the high spin ($^5T_2$)$\rightleftarrows$low spin ($^1A_1$) transition in dithiocyanatobis (2,2′-bi-2-thiazoline) iron (II) ....See Entry 102633

Magnetic behavior of RRh_3B_2 (R=La to Gd) ternary borides ....See Entry 102636

Exchange anistropy of polycrystalline alloy $FePd_2Au$ ....See Entry 102644

Comments on the use of the Landau theory in some order-order transitions ....See Entry 102670

Magnetic behavior of Fe_xSn_{1-x} amorphous alloys near the critical composition ....See Entry 102673

Phase diagrams for anisotropic spin glasses ....See Entry 102682

Irreversibility and metastability in spin glasses. II Heisenberg model ....See Entry 102692

The magnetio-elastic properties of the Invar alloy, Fe_3Pt ......See Entry 102721

Magnetic properties and hyperfine interactions in concentrated Fe-Ag alloys ....See Entry 102790

75.30S Magnetocaloric effect

102662 Numerical simulation of a phase transition in the nuclear spin system of gallium arsenide with adiabatic demagnetization. S.I.Vasil'ev, L.A.Kalmykova, I.A.Merkulov (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.2, p.77-80 (20 Jan. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.2, p.65-7 (20 Jan. 1983).
The results of a calculation of the phase-transition temperature (T_c), of the ground state of the nuclear spin system of GaAs, and of the process of adiabatic demagnetization of this system in the temperature range below T_c are presented. (5 refs.)

102663 Investigation of the characteristics of a thermomagnetic recording on films of 3d-4f metallic alloys. A.E.Gafner, T.S.Kuli-zade, E.A.Podpalyi, G.I.Rusov, V.T.Sukhomlin, S.O.Shilyadov.
Zh. Nauchnoi & Prikl. Fotogr. & Kinematogr. (USSR), vol.28, no.3, p.204-8 (May-June 1983). In Russian.
The authors investigate the energy sensitivity and energy range of thermomagnetic recording on amorphous films of CdCoX and CdFe, where X=Ni or Mo. It is shown that in the case of specimens with point of compensation above room temperature the recording has a threshold character. The authors examine the form of the recording for a comparatively high energy laser pulse. High resolution interferograms (500 lines/mm) are obtained and the diffraction efficiency was measured. (12 refs.)

75.40 CRITICAL-POINT EFFECTS, SPECIFIC HEATS, SHORT-RANGE ORDER

(inc. spin glasses)

102664 Magnetic correlations in metallic magnetics at finite temperatures. K.R.A.Ziebeck, P.J.Brown (Inst. Laue-Langevin, Grenoble, France), J.Deportes, D.Givord, P.J.Webster, J.G.Booth.
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.117-30 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Neutron scattering measurements confirm that the exchange splitting in iron and other itinerant magnets persists beyond T_c into the paramagnetic phase. Measurements both close to the ground state and in the paramagnetic phase demosntrate the importance of quantum fluctuation which in the case of itinerant magnets are not distinct from the thermal fluctuations. Inelastic neutron scattering measurements close to the ground state indicate that the transverse fluctuations of the magnetisation density are confined to a small value of reciprocal space. Furthermore, measurements made above T_c indicate that the region of spin wave fluctuations remains unchanged. These results are consistent with the predictions of band theory which also suggests the presence of a low level of scattering towards the zone boundary and extending up to the band width. The absence of significant scattering towards the zone boundary has been confirmed by paramagnetic neutron scattering measurements in both iron and nickel. These fluctuations have the same origin as those characterising the static susceptibility in the paramagnetic phase of chromium. (23 refs.)

102665 Magnetisation profiles for anisotropic spin glasses. D.Elderfield (Blackett Lab., Imperial Coll., London, England).
J. Phys. A (GB), vol.16, no.11, p.L385-93 (1 Aug. 1983).
The thermodynamic (field cooled) magnetisation is analysed throughout the spin glass domain (transverse T, longitudinal L or mixed LT phases) for a class of anisotropic *m* vector models, in the limit of a small collinear field. In zero field the field cooled susceptibility $\chi_T(\chi_L)$ is independent of temperature throughout the T (L and LT) phases. In a finite collinear field the author observes the celebrated Parisi '$h^{4/3}$' dependence of the field cooled magnetisation throughout the L and LT phases. For the T phase no simple characterisation is apparent. (19 refs.)

102666 On phase separation in systems with continuous symmetry. N.Angelescu (JINR-Dubna, Moscow, USSR), M.Bundaru, G.Costache.
J. Phys. A (GB), vol.16, no.11, p.2479-95 (1 Aug. 1983).
It is proved that the interface in the isotropic *D*-vector model and its $D\rightarrow\infty$ limit, both with Kac-Helfand interactions (1962), is diffuse at all temperatures. The Sinterface does not stabilise even when a pinning potential of Abraham type (1980) is accommodated. The magnetisation profile is explicitly calculated and the interface width is shown to be proportional to the sample thickness. (21 refs.)

102667 Field and anisotropy effects in spin glasses. I. The collinear case. D.Elderfield, D.Sherrington (Dept. of Phys., Imperial Coll., London, England).
J. Phys. C (GB), vol.16, no.24, p.4865-88 (30 Aug. 1983).
A theoretical analysis is given for the phase structure of a vector spin-glass model in the presence of local uniaxial anisotropy and/or coaxial external magnetic fields and/or spontaneous mean ferromagnetism. Replica analysis is used, including generalisations of Almeida-Thouless stability analysis and of Parisi treatment of replica-symmetry breaking. Phase transition points, lines and surfaces are found, as also irreversibility crossovers. Spin-glass phases include longitudinal, transverse and mixed; ferromagnetic include collinear and randomly canted (ferromagnet plus transverse spin glass). All spin-

glass-type phases are accompanied by ergodicity-breaking of the corresponding symmetry while transverse ordering in a field is also accompanied by weak longitudinal irreversibility, followed by crossover to stronger irreversibility at a lower temperature. (40 refs.)

102668 A probabilistic approach to the models of spin glasses. A.Suto (Central Res. Inst. for Phys., Budapest, Hungary), T.Yalcin, C.Gruber.
J. Stat. Phys. (USA), vol.31, no.3, p.639-59 (June 1983).
Introducing the notions of quenched and annealed probability measures, a systematic study of some problems in the description of spin glasses is attempted. Inequalities and variational principles for the free energies are derived. The absence of spontaneous breakdown of the gauge symmetry is discussed and some high-temperature properties are studied. Examples of annealed models with more than one phase transition are shown. (13 refs.)

102669 Itinerant electron magnetism in the Mo_4 tetrahedral cluster compounds $GaMo_4S_8$, $GaMo_4Se_8$, and $GaMo_4Se_4Te_4$. A.K.Rastogi, A.Berton, J.Chaussy, R.Tournier (Univ. Sci. et Medicale de Grenoble, Grenoble, France), M.Potel, R.Chevrel, M.Sergent.
J. Low Temp. Phys. (USA), vol.52, no.5-6, p.539-57 (Sept. 1983).
The specific heat and magnetic properties of $GaMo_4X_8$ (X=S, Se, SeTe) between 1.4 and 290K are reported. The measurements tend to demonstrate that these compounds have a very high density of states, leading to a Stoner magnetic instability of conduction electrons at low temperatures. The linear temperature-dependent term in the specific heat is enhanced by electron-phonon coupling and spin fluctuation effects. These compounds could indicate an electron-phonon contribution to the Stoner enhancement factor. (14 refs.)

102670 Comments on the use of the Landau theory in some order-order transitions. J.A.Tuszynski (Phys. Dept., Univ. of Calgary, Calgary, Canada).
Phys. Lett. A (Netherlands), vol.96A, no.7, p.358-60 (18 July 1983).
The application of Landau theory of phase transitions to a two-sublattice magnet results in a broad range of magnetic transitions. The use of a two-component order parameter enables one to describe both order-disorder and order-order transitions. In particular, the metamagnetic transitions exhibit thermal hysteresis. It is shown that the Kitell model is a special case of the Landau expansion. Finally, an alternative one-component order parameter expansion is discussed. (6 refs.)

102671 Resonance modes in a Dzyaloshinsky-Moriya spin-glass. C.G.Morgan-Pond (Dept. of Phys., New York Univ., New York, NY, USA).
Phys. Rev. Lett. (USA), vol.51, no.6, p.490-3 (8 Aug. 1983).
Simulations of Ruderman-Kittel-Kasuya-Yosida spin-glasses with Dzyaloshinsky-Moriya anisotropy show three resonance modes which are well described by the triad model. The behavior of the modes and the breakdown of this picture for large anisotropy are studied. A quantitative study is made of the relationship between the microscopic Dzyaloshinsky-Moriya pair anisotropy, H_{DM}, and the macroscopic anisotropy parameter, K, including the effects of relaxation. It is found that the estimate of K from microscopic parameters is still too high, even when corrected for relaxation. (8 refs.)

102672 Effect of high magnetic fields on the heat capacity of strongly Pauli-paramagnetic Pd-Ni alloys. K.Ikeda, K.A.Gschneidner,Jr. (Dept. of Materials Sci. & Engng., Iowa State Univ., Ames, IA, USA), A.I.Schindler.
Phys. Rev. B (USA), vol.28, no.3, p.1457-65 (1 Aug. 1983).
The low-temperature [(1.3-20.0)-K] heat capacity of strongly Pauli-paramagnetic Pd-Ni alloys containing 0.47 and 0.97 at.% Ni was measured in magnetic fields up to 10 T. The electronic specific-heat constant becomes smaller with increasing fields (12% or 13% at 9.98 T). This is probably due to the depression of the spin-fluctuation enhancement of heat capacity by the high magnetic fields and is in accord with the recent theoretical predictions. The coefficient β of the T^3 term in the heat capacity becomes larger with increasing fields and at $H \gtrsim 5.39$ T it reaches almost the same value as that for alloys containing more than ~5 at.% Ni. Two possible mechanisms have been proposed to account for the increase in β. (1) The increase is due to the magnetic quenching of localized spin fluctuations in the vicinity of the nickel atoms, or (2) the increase is due to a magnetic contribution to the heat capacity which results from an induced magnetic moment on the nickel atoms by the applied magnetic field. Additional experiments are needed to determine which mechanism is the correct one. (39 refs.)

102673 Magnetic behavior of Fe_xSn_{1-x} amorphous alloys near the critical composition. M.Piecuch (Lab. de Phys. du Solide, Univ. de Nancy I, Vandoeuvre-les-Nancy, France), Chr.Janot, G.Marchal, M.Vergnat.
Phys. Rev. B (USA), vol.28, no.3, p.1480-9 (1 Aug. 1983).
Amorphous alloys of the tin-iron system have been prepared by the vapor-quenching technique. Bulk magnetic data show typical 'spin-glass-like' behavior in the low-temperature susceptibility and in the remanent magnetization for alloys containing less than about 40 at.% of iron. A multicritical magnetic phase diagram with paramagnetic, and spin-glass-like phases is proposed. High-field magnetization measured up to 150 kOe strongly suggests that local anisotropy, randomly oriented through the material, might successfully compete with exchange interactions for some of the iron clusters. (36 refs.)

102674 High-field specific heat of the spin-fluctuations system UAl_2. G.R.Stewart, A.L.Giorgi (Materials Sci. & Technol. Div., Los Alamos Nat. Lab., Los Alamos, NM, USA), B.L.Brandt, S.Foner, A.J.Arko.
Phys. Rev. B (USA), vol.28, no.3, p.1524-8 (1 Aug. 1983).
Measurements of the low-temperature specific heat, both in 0 and 7-T applied field, and magnetic susceptibility on polycrystalline, unannealed single-crystal and annealed single-crystal samples of UAl_2 show no sample dependence for these properties to ±5%, in contrast to recent results for $TiBe_2$. Measurements of the specific heat of the annealed single crystal of UAl_2 from 2 to 23K in fields to 12.5T and from 4 to 16K in fields to 17 T indicate a partial (~40%) suppression of the spin-fluctuation contribution, which occurs at 2K in 12.5 T, and the possible existence of a small competing effect which increases the specific heat with increasing field above 4K. These results are compared with recent magnetization and magnetoresistivity results which indicate suppression of spin fluctuations in UAl_2 between 15 and 20. (26 refs.)

102675 Limitations of spin-wave theory in $T=0$ spin dynamics. J.H.Taylor (Dept. of Phys., Univ. of Rhode Island, Kingston, RI, USA).
Phys. Rev. B (USA), vol.28, no.3, p.1529-33 (1 Aug. 1983).
The $T=0$ dynamics of a family of one-dimensional quantum spin systems with fully order (ferromagnetic or spin-flop) ground states is investigated. By rigorous calculations, it is demonstrated that the $T=0$ dynamic structure factor is, in general, not a δ function as predicted by linear spin-wave theory but characterized by more complicated structures with nonzero linewidths. The exact result approaches the spin-wave result in the classical limit $s \rightarrow \infty$. The results of this study demonstrate how quantum effects may invalidate spin-wave theory even in the presence of saturated magnetic long-range order. Hence the failure of spin-wave theory is not necessarily linked to the absence or strong reduction of long-range order typical for one-dimensional quantum spin systems. The unreliability of spin-wave theory has therefore to be suspected also for the dynamics of three-dimensional quantum spin systems where the long-range order is always strong at $T=0$. (20 refs.)

102676 Quantum-mechanical ground state of crystals with dipole-dipole and exchange interactions. S.Thanos, A.K.Theophilou (Nuclear Res. Center 'Demokritos,' Aghia Paraskevi, Attikis, Greece).
Phys. Rev. B (USA), vol.28, no.3, p.1534-43 (1 Aug. 1983).
This paper deals with the quantum-mechanical ground state of crystals with dipole-dipole and exchange interactions. The approximation used is that the wave function is a product of the eight-spin wave functions of the magnetic ion supercells. The wave functions of the supercells are assumed to have the same form. Thus spin correlations for magnetic ions in the same supercell are taken into account, whereas in common mean-field theory this effect is neglected. Correlations between ions in different supercells are not taken into account. The eight-spin wave functions are constructed by using the theory of irreducible representations of the translation group. An additional simplification results by taking advantage of the classical solution of the problem. The method developed here is applied for a determination of the ground state of cerous magnesium nitrate, the results of which appear in the following paper. (17 refs.)

102677 Quantum-mechanical ground state of cerous magnesium nitrate. S.Thanos, A.K.Theophilou (Nuclear Res. Center 'Demokritos,' Aghia Paraskevi, Attikis, Greece).
Phys. Rev. B (USA), vol.28, no.3, p.1544-7 (1 Aug. 1983).
This paper deals with the quantum-mechanical ground state of cerous magnesium nitrate (CMN). The approximation used is that of Luttinger and Tisza and of Niemeijer, in which spin correlations for magnetic ions in the same supercell are taken into account, while those between ions in different supercells are neglected. The method used is that presented in an earlier paper of the present authors. It is found that the quantum-mechanical ground state of CMN is a linear combination of the state with spin orientations those of the classical state found by Niemeijer plus the complementary state. Thus the classical state is a good approximation for quick results. This state has nearly the same energy as the three mutually degenerate states belonging to the k_1, k_2, k_3 representations of the translation group. These are formed by linear combinations of states with four spins up and four spins down as is the case with the ground state. The results found fit well with the existing experimental information about CMN. (15 refs.)

102678 ϵ-expansion calculations for spin-glasses. M.Chang (Serin Phys. Lab., Rutgers Univ., Piscataway, NJ, USA).
Solid State Commun. (USA), vol.47, no.7, p.529-31 (Aug. 1983).
The critical properties of the spin-glass transition proposed by Edwards and Anderson (1975) are studied using the minimal subtraction method. The universal ratio of the second correction to scaling amplitude to the square of the first for the order parameter susceptibility χ_0 is calculated to first order in $\epsilon(\epsilon=6\text{-d})$. Comparison is made with Fisch and Harris' (1977) high temperature series analysis which incorporated Rudnick-Nelson-type corrections to scaling. Within the same formalism the critical exponents are calculated to second order in ϵ. They agree with the first order ϵ expansion of Harris et al. (1976). (14 refs.)

Anomalies of thermal expansion of solid solutions of iron in α-manganese ....See Entry 102021

Non-linear spin-density excitations in 1-D organic polymers ....See Entry 102272

Spin alternation in one-dimensional exchange-coupled systems: magnetic behaviour of the $(^1/_2\text{-}1)_N$ chain ....See Entry 102605

Neutron diffraction effects of distortion of the structure of Ni-67.7 at.% Fe alloy in a magnetically ordered state ....See Entry 102622

AC magnetic susceptibility and hysteresis studies on $La_{1-x}Y_xMn_2Si_2$ intermetallic compounds ....See Entry 102637

Collective behavior of magnons in superlattices ....See Entry 102641

Spin-glass behavior as a fuction of concentration and local order by NMR in nearly random NiMn systems ....See Entry 102651

Magnetic properties of ordered $Fe_{1-x}Mn_xPd_3$ alloys ....See Entry 102654

The behaviour of an amorphous ferromagnet with dilution .....See Entry 102658

EPR study of electronic and magnetic properties of bis(*DL*-α-amino-*n*-butyrato) copper (II). A layered magnetic system ....See Entry 102737

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Angle-resolved photoelectron spectroscopy of the nickel magnetism below and above T_c ....See Entry 103029

The mutual influence of magnetic and chemical ordering ......See Entry 103117

Magnetic ordering and phase separation in binary alloys with one magnetic component ....See Entry 103118

75.40D Ising and other classical spin models

102679 The Ising spin glass in a magnetic field. D.Elderfield (Blackett Lab., Imperial Coll., London, England).
J. Phys. A (GB), vol.16, no.12, p.L439-46 (21 Aug. 1983).
The profile of the field-cooled magnetisation is considered in the vicinity of the spin-glass transition for the Parisi (1978, 1980, 1983) solution. In a finite field the flat profile of Parisi and Toulouse (1980) is modified and one observes a weak cusp. Analytic expansions are obtained both for the high-field (low-temperature) and low-field (high-temperature) regimes. (15 refs.)

102680 Order parameter susceptibility in the Parisi solution for spin glasses. A.Khurana (Inst. fur Theoretische Phys., Univ. Heidelberg, Heidelberg, Germany).
J. Phys. A (GB), vol.16, no.12, p.2843-52 (21 Aug. 1983).
An exact expression is obtained for the order parameter susceptibility, χ_R, in the Parisi solution for spin glasses, which shows that the vanishing of the order parameter function, $q(x)$, at the origin, a constant spin susceptibility and the divergence of χ_R in the spin-glass phase are all intrinsically related. This expression for χ_R also suggests that the squared-averaged magnetisation is given by $q(0)$ and not $q(1)$. (16 refs.)

102681 On the location of the critical point of the *q*-state Potts models on the decorated hypercubic lattice. D.Hajdukovic (Dept. of Phys. & Meteorology, Faculty of Natural & Math. Sci., Belgrade, Yugoslavia).
J. Phys. A (GB), vol.16, no.12, p.2881-2 (21 Aug. 1983).
Recently a critical condition for the *q*-state Potts ferromagnet on the hypercubic lattice was obtained. The author extends this result to both ferromagnetic and antiferromagnetic Potts models on the bond-decorated hypercubic lattice. (6 refs.)

102682 Phase diagrams for anisotropic spin glasses. A.J.Bray, L.Viana (Dept. of Theoretical Phys., Univ. of Manchester, Manchester, England).
J. Phys. C (GB), vol.16, no.23, p.4679-92 (20 Aug. 1983).
Phase diagrams are derived, at the mean-field level, for spin glasses with uniaxial anisotropy. Exchange anisotropy and single-ion anisotropy are considered separately. The critical anisotropies at zero temperature are expressed in terms of the internal field distributions for Ising and planar systems, avoiding the replica method. The phase diagrams are qualitatively similar for the two models except that for 'easy-axis' exchange anisotropy two consecutive transitions are predicted as a function of temperature for all values of the anisotropy, whereas for single-ion anisotropy two transitions are predicted only when the anisotropy is sufficiently weak. (17 refs.)

102683 Mixed phase for the infinite-range Potts spin glass. E.J.S.Lage, A.Erzan (Lab. de Fisica, Faculdade de Ciencias, Porto, Portugal).
J. Phys. C (GB), vol.16, no.24, p.L873-6 (30 Aug. 1983).
The stability conditions for the paramagnetic (PM) phase of the infinite-ranged random Potts model are re-examined. A new replica symmetric ansatz with Potts symmetry breaking yields a phase diagram where the line of Curie temperatures for the onset of a mixed ordered phase matches the stability conditions for the PM phase. Extrema conditions for the free energy indicate that Potts symmetry breaking may not exist for $2<s<4$, where the transition is second order, while it is necessary for $s>4$, where the transition is first order. (3 refs.)

102684 Linear response theory and the one-dimensional Ising ferromagnet in a random field. G.Aeppli (Bell Labs., Murray Hill, NJ, USA), R.Bruinsma.
Phys. Lett. A (Netherlands), vol.97A, no.3, p.117-20 (15 Aug. 1983).
Linear response theory applied to the one-dimensional Ising model in a discrete random field shows that for temperatures above a critical value, the integrated local magnetization distribution function is a devil's staircase. For lower temperatures, there is an infinite series of transitions, at each of which this function is explicitly calculable. (5 refs.)

102685 Random-field effects in the diluted two-dimensional Ising antiferromagnet $Rb_2Co_{0.7}Mg_{0.3}F_4$. R.J.Birgeneau (Dept. of Phys., MIT, MA, USA), H.Yoshizawa, R.A.Cowley, G.Shirane, H.Ikeda.
Phys. Rev. B (USA), vol.28, no.3, p.1438-48 (1 Aug. 1983).
The authors report a comprehensive neutron scattering study of the spin correlations in the diluted two-dimensional (2D) Ising antiferromagnet $Rb_2Co_{0.7}Mg_{0.3}F_4$ in an applied magnetic field. As predicted by Fishman and Aharony (1979), an applied field in this system produces a random staggered magnetic field. Random fields are expected to have drastic effects on the cooperative behavior of magnets although the detailed behavior remains controversial. It is found that the applied magnetic field, and by inference the concomitant random staggered fields, destroy the 2D long-range order for all temperatures and fields. The structure factor $\mathscr{S}^{zz}(\vec{Q})=\Sigma_{\vec{r}}e^{i\vec{q}\cdot\vec{r}}\langle S^z_{\vec{r}}\cdot S^z_{\vec{0}}\rangle_T$ is well described as the sum of a Lorentzian plus a Lorentzian squared with the Lorentzian-squared term dominating at low temperatures. The integrated intensity of the Lorentzian-squared term exhibits the same temperature dependence as the Bragg intensity at zero field. The correlation length κ and structure-factor peak intensity $\mathscr{S}^{zz}(\vec{Q}_0)$ exhibit power-law dependences on the applied field H, $\kappa\sim H^{1.6}$, and $\mathscr{S}^{zz}(\vec{Q}_0)\sim H^{-3.2}$ at low temperatures; the measured exponents agree reasonably with the values 2 and -4, respectively, deduced from theories with the lower marginal dimensionality $d_l=3$. The effective exponents initially increase slightly with increasing temperature and then decrease dramatically as $T\rightarrow T_N$, taking on values of about 0.7 and -1.2, respectively, at $T_N=42.5K$. For small but nonzero applied fields the inverse correlation length may be factorized into a random-field part and a thermal part, $\kappa=\kappa_{RF}+\kappa_T$, with $\kappa_T\sim e^{-3.4J(zz)/k(B)T}$ where J^{zz} is the Ising exchange constant. It is also found that for $T<20K$ reproducible results are only obtained when the sample is cooled in the presence of the applied field; this history-dependent behavior is analogous to that found in spin-glasses. (21 refs.)

102686 Domain walls and shape dependence of finite-size correction terms in the two-dimensional Ising-model critical region. P.Kleban, G.Akinci (Dept. of Phys. & Astron., Univ. of Maine, Orono, ME, USA).
Phys. Rev. B (USA), vol.28, no.3, p.1466-74 (1 Aug. 1983).
Ferdinand and Fisher (1969) have analyzed the finite-size behavior of the two-dimensional Ising model with periodic boundary conditions for T near T_c. In the thermodynamic limit the leading correction term to the specific heat has an unusual and unexpected behavior as the shape of the $m\times n$ lattice is changed. For shape parameter $s=m/n=1$, the peak in the specific-heat correction term occurs at a reduced temperature $\tau_{max}=2K_cn(T-T_c)/T_c>0$. With increasing s the peak moves to negative τ values and then increases to 0. The authors show that this effect may be understood by keeping only the two largest eigenvalues of the transfer matrix. To this approximation, which is good for $s=1$ and improves exponentially with increasing s, all the shape dependence of the free energy is due to a factor that can be expressed entirely in terms of a domain-wall energy. Furthermore, the functional form of this factor is the same as that of the finite-length correction to the one-dimensional Ising model. Thus the dependence of τ_{max} on s is qualitatively similar to the dependence of $T_{max}^{\ 1}$, the location of the one-dimensional Ising-model specific-heat peak on N, the number of spins. They also argue that the two-dimensional partition function is expressible at least for $s>1$ as a factor due to domains, and another due to a one-dimensional Ising array of domain walls. Approximate expressions are obtained for the effective number of spins and the effective coupling of the array. They also point out that there is reason to believe the one-dimensional Ising array domain walls at fixed τ connects smoothly with a similar array for $T<T_c$. (13 refs.)

102687 Irreversibility and metastability in spin-glasses. I. Ising model. C.M.Soukoulis (Corporate Res. Sci. Lab., Exxon Res. & Engng. Co., Linden, NJ, USA), K.Levin, G.S.Grest.
Phys. Rev. B (USA), vol.28, no.3, p.1495-509 (1 Aug. 1983).
By studying the evolution (with field H and temperature T) of the free-energy surface the authors numerically calculate various history-dependent magnetizations. The interactions are assumed to be of short range with a Gaussian probability distribution. In this paper, only Ising spin-glasses are discussed. In a companion paper, they treat vector spins. Only the simplest mean-field (MF) approximation to the free-energy functional $F[\ m_i\ ]$ (where m_i is the thermally averaged spin at the *i*th site) is studied. For finite-size systems, it is difficult to include the reaction corrections to F within a self-consistent formalism. Good qualitative agreement with experiment is found for the T and H dependence of the field-cooled and zero-field-cooled, and thermal and isothermal remanent magnetizations. The hysteresis loops are qualitatively similar to those observed in *Au*Fe spin-glasses. The characteristic changes in the shape of the loop as the Fe concentration increases can also be reproduced theoretically. At $T=0$, the corrections to MF theory are negligible and it is shown that the ground states generated iteratively by cooling solutions of the MF equations are obtained much more rapidly and are of lower energy than those found in Monte Carlo simulations. It is demonstrated that the field-cooled state, which is obtained by a series of reversible procedures, is one for which linear-response theory (properly interpreted) and Maxwell's relations all hold. The close correspondence between their theory and experiment supports the hypothesis that on intermediate-time scales the behavior of spin-glasses is primarily determined by the properties of the free-energy surface: Irreversibility occurs when minima of F are destroyed with changing H or T. (59 refs.)

Correlation functions of the transverse Ising chain at the critical field for large temporal and spatial separations ....See Entry 99002

Geometry of equilibrium configurations in the Ising model ....See Entry 102608

Non-linear modes and statistical mechanics of a classical Heisenberg chain with two anisotropies ....See Entry 102690

75.40F Heisenberg and other quantized spin models

102688 Quantum critical behaviour of X-Y spin model with magnetic field. T.K.Kopec (Inst. for Low Temperature & Structure Res., Polish Acad. of Sci., Wroclaw, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.1, p.123-34 (July 1983).
The Wilson renormalization group (RG) approach to critical phenomena is used when a phase transition is induced by an external parameter, i.e. a longitudinal magnetic field in spin X-Y quantum model. The generalization of the effective Ginzburg-Landau functional is also obtained from the Hamiltonian of the system in a form containing a complex order parameter. The RG equations and their fixed points are obtained and investigated in two cases: finite and zero temperature. It is explicitly shown that the model at finite temperature behaves like the standard classical two-component one while at zero temperature its behaviour is described by critical exponents which are unchanged to the first order in $\varepsilon=2-d$, i.e. have still Gaussian values although the nontrivial no-classical fixed point is found. The calculations of the anomalous part of the dimension$-\eta$ and dynamical critical exponent z performed to the second order in ε also showed that they remain unchanged to this order. (15 refs.)

102689 Scaling stiffness of spin glasses. J.R.Banavar (Bell Labs., Murray Hill, NJ, USA), M.Cieplak.
J. Phys. C (GB), vol.16, no.21, p.L755-9 (30 July 1983).
The concept of a scaling stiffness for frustrated systems is introduced. Physical arguments supported by numerical calculations on a 3d Heisenberg spin glass suggest that its apparent lower critical dimensionality is time dependent, being equal to three on short time scales and bigger than three at sufficiently long times. (18 refs.)

102690 Non-linear modes and statistical mechanics of a classical Heisenberg chain with two anisotropies. C.Etrich, H.J.Mikeska (Inst. fur Theoretische Phys., Univ. Hannover, Hannover, Germany).
J. Phys. C (GB), vol.16, no.24, p.4889-900 (30 Aug. 1983).
The authors investigate the relevance of soliton modes for the statistical mechanics of a classical Heisenberg chain with two single-ion anisotropies—a model that has two continuous degrees of freedom and allows one to treat exactly the crossover between broken Heisenberg and planar symmetries. Starting from exact soliton solutions as given by Sklyanin the authors discuss the two branches of the soliton spectrum, small vibrations in the presence of solitons and the stability of solitons. They show that the statistical mechanics of this chain as obtained from the transfer integral method is reproduced exactly by the phenomenological approach using solitons and phonons. The relevance of the model for the properties of the easy-plane antiferromagnetic chain in an external magnetic field is discussed. (18 refs.)

102691 Topological model of a Heisenberg spin glass. I.E.Dzyaloshinskii (L.D. Landau Inst. of Theoretical Phys., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.4, p.227-9 (20 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.4, p.190-2 (20 Feb. 1983).
Two aspects of a model recently proposed for a Heisenberg spin glass are discussed: the asymptotic freedom of the theory and the absence of a long-range order with a correlation radius which vanishes exponentially with the temperature. The latter circumstance means that $d=3$ is the lower critical dimensionality of the model. (13 refs.)

102692 Irreversibility and metastability in spin glasses. II Heisenberg model. C.M.Soukoulis, G.S.Grest (Corporate Res. Sci. Lab., Exxon Res. & Engng. Co., Linden, NJ, USA).
Phys. Rev. B (USA), vol.28, no.3, p.1510-23 (1 Aug. 1983).
For pt.I see ibid., vol.28, p.1495 (1983). The authors numerically compute the various history-dependent magnetizations for Heisenberg spin-glasses with and without anisotropy. The exchange interactions are of short range and have a Gaussian probability distribution. The approach closely follows that of paper I. In the absence of anisotropy, a Heisenberg spin-glass is found to have no irreversibility. The field-cooled and zero-field-cooled magnetizations are macroscopically equivalent and magnetic hysteresis is absent. This macroscopic reversibility is a consequence of the accessibility of the rotationally degenerate field-cooled state and does not correspond to microscopic reversibility. Both Dzyaloshinsky-Moriya (DM) and uniaxial anisotropy introduce macroscopic irreversibility. In the latter case the hysteresis loops are like those found for Ising spins. In the former case, in some situations, they find displaced loops, which look similar to those seen in Mn-containing spin-glasses. To get qualitative agreement with experiment, they must also impose a tendency towards ferromagnetism. This ferromagnetic tendency (which corresponds to a displace Gaussian exchange distribution with $J_0>0$) is essential in order to maintain rigid rotation of the spins in response to field rotations. This rigidity is a fundamental assumption in other approaches which explain analytically why DM anisotropy leads to displace hysteresis loops. Finally they study the coexistent (longitudinal) ferromagnetic-(transverse) spin-glass phase proposed by Gabay and Toulouse (1981). The behavior of the coexistent spin-glass is very similar to that of typical spin-glasses in very large applied fields. They see no indication for reentrant behavior, as is often observed experimentally, in the temperature-dependent moderate field magnetizations. Furthermore, a calculation of the zero-field (J_0,T) phase diagram for isotropic systems shows no evidence for reentrant behavior. They cannot rule out the possibility that a reentrant transition exists only in some narrow range of low magnetic fields. (37 refs.)

75.50 STUDIES OF SPECIFIC MAGNETIC MATERIALS

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75.50B Ferromagnetism of Fe and its alloys

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Metamagnetism of a noncollinear antiferromagnet: the Jahn-Teller garnet Ca$_3$Mn$_2$Ge$_3$O$_{12}$ ... See Entry 102656

Random-field effects in the diluted two-dimensional Ising antiferromagnet Rb$_2$Co$_{0.7}$Mg$_{0.3}$F$_4$ ... See Entry 102685

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Detection of exchange modes in quasi-two dimensional antiferromagnet (NH$_3$)$_2$(CH$_2$)$_3$MnCl$_4$ ... See Entry 102755

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75.50M Magnetic liquids

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75.60 DOMAIN EFFECTS, MAGNETIZATION CURVES, AND HYSTERESIS

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Influence of the macrostructure of a thin anisotropic Fe-3% Si ribbon on electromagnetic losses as a result of elastic treatments ....See Entry 102722

75.60C Domain walls and domain structure

(for magnetic bubbles, see 75.70K)

102693 Neutron depolarisation in zigzag folded 90° walls in silicon iron. W.H.Kraan, J.J.VanLoef, M.Th.Rekveldt (Interuniv. Reactor Inst., Delft, Netherlands), V.Ungemach.
J. Phys. C (GB), vol.16, no.24, p.4901-16 (30 Aug. 1983).
A polarised monochromatic ($\lambda=0.16$ and 0.41 nm) neutron beam is transmitted at various glancing angles $\theta(0\leq|\theta|\leq10°)$ through 90° walls in a Fe (5% Si) single crystal of dimensions $40\times3.2\times1.9$ mm^3 with its bar axis parallel to [110]. From a three-dimensional polarisation analysis after transmission it appears that the effect of the 90° wall on the neutron polarisation vector is present up to at least $|\theta|=10°$. From these observations the authors conclude that the 90° wall is not a plane Bloch wall, but rather a wall region with a thickness of at least 10 μm. This is consistent with the zigzag folding of such walls. Furthermore the technique used enables one to distinguish the mean effects of neighbouring 90° walls. In a transmission experiment over the 'upper' half of the sample they have observed that the effect of neighbouring walls on the polarisation vector is antisymmetric in θ. This result supports the suggestion by Ungemach (1977) that the amplitude of the zigzag folding varies with the height being in antiphase in neighbouring 90° walls. (21 refs.)

102694 Light-induced dynamic instability of the domain structure in $FeBO_3$:Ni. Yu.M.Fedorov, A.A.Leksikov, A.E.Aksenov (L.V. Kirenski Inst. of Phys., Acad. of Sci., Krasnoyarsk, USSR).
JETP Lett. (USA), vol.37, no.3, p.161-4 (5 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.3, p.134-6 (5 Feb. 1983).
Light-induced instability is observed in the domain structure of the crystal $FeBO_3$:Ni, observed in polarised light, in the form of propagating wave excitations in the spin system, whose parameters depend on the intensity and wavelength of the light, external magnetic field, and temperature. (4 refs.)

102695 Interaction of a moving domain wall in a orthoferrite with Lamb waves. M.V.Chetkin, A.P.Kuz'menko, S.N.Gadetskii, V.N.Filatov, A.I.Akhutkina (M.V. Lomonosov State Univ., Moscow, USSR).
JETP Lett. (USA), vol.37, no.5, p.264-7 (5 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.5, p.223-6 (5 March 1983).
It is shown that in the interval from the longitudinal sound velocity to the spin wave velocity, the stationary motion of a domain wall in yttrium orthoferrite occurs with a discrete set of velocities corresponding to the phase velocities of Lamb waves in the plate. The width of the constant-velocity intervals increases with decreasing specimen thickness. (12 refs.)

Anomaly of the solubility of hydrogen in ferromagnetic metals near the Curie point ....See Entry 101977

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Magnetic domain structures in deformed and undeformed foils of a metallic glass ....See Entry 102719

Determination of average domain size on Permalloy and Perminvar by means of complex permeability measurements ....See Entry 102720

^{57}Fe NMR spectra in domain walls of hexagonal ferrites with magnetoplumbite structure ....See Entry 102758

Phase transformation and magnetic properties of Mn-Al-C permament magnets ....See Entry 103142

Effect of thermomagnetic processing on magnetic properties of iron and iron-silicon alloys ....See Entry 103189

Reflected-light microscopy for examining hard ferrites with the Amplival pol.u microscope ....See Entry 103422

The influence of multiple refraction effects on the sharpness of neutron radiographs of ferromagnetic materials ....See Entry 103485

75.60E Magnetization curves, hysteresis, Barkhausen and related effects

102696 Temperature and magnetic field dependence of magnetization and magnetoresistance in amorphous Fe-Ni based alloys. A.Handstein, J.Schneider (Central Inst. of Solid State Phys. & Materials Res., Acad. of Sci., Dresden, Germany), J.Kadlecova.
Acta Phys. Acad. Sci. Hung. (Hungary), vol.53, no.3-4, p.371-82 (1982). [received: Aug. 1983] (CRYOSEM '81. Second International Seminar on Low Temperature Physics, Visegrad, Hungary, 8-10 Oct. 1981).
The behaviour of magnetization M and magnetoresistance $\Delta\rho^H/\rho^0$ of amorphous $(Fe_xNi_{1-x})_{80}P_{10}B_{10}$ alloys is reviewed at low temperatures and high magnetic fields. The behaviour of $M(T,H,x)$ characterizes these alloys over a large concentration range as inhomogeneous and/or heterogeneous magnetic materials. The magnetoresistance data support this picture. (31 refs.)

102697 The influence of ageing on changes in coercivity and in the mechanism of decohesion of CuNiFe permanent magnet alloy. S.Szymura (Inst. of Phys., Tech. Univ. Czestochowa, Czestochowa, Poland).
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.407-12 (Aug. 1983).
Magnetic hardness of the CuNiFe alloy increased from about 300 sec with isothermal ageing time. The absolute value of the maximum coercive force apparently increased as the temperature of the transformation decreased. The isothermal ageing of the CuNiFe alloy is followed by changes in the mechanism of decohesion from a ductile transcrystalline fracture—typical for a quenched state—to a brittle intercrystalline fracture, which is typical for an alloy of maximal coercive force. The changes in the morphology of fractures contributed to a marked increase in tensile strength and a reduction in the striction. (5 refs.)

102698 Distribution of the magnetization in amorphous wire-shaped samples. E.E.Chepurova, A.V.Shtain (M.V. Lomonosov State Univ., Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1088-91 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A magnetooptic micromagnetometer was used to study the characteristics of the distribution of the magnetization and the processes of magnetization reversal in an amorphous microwire of the $Fe_{80}B_{10}P_{10}$ composition. The results indicated formation of a domain structure with a magnetization ripple due to the dispersion of the magnetic anisotropy on the microscopic and macroscopic scales. Magnetization switching in a field applied along the wire axis involved noncoherent rotation of the magnetization. In fields exceeding considerably the coercive force the magnetization switching processes were hindered. This was indicated by retention of the transverse components in the fields such that the magnetization component parallel to the wire axis was practically unaffected. (10 refs.) *A.T.*

102699 Relaxation processes and temperature-time stability of the initial permeability of amorphous alloy $Fe_5Co_{70}Si_{15}B_{10}$. I.B.Kekalo, V.L.Stolyarov, V.Yu.Tsvetkov (Inst. of Steel & Alloys, Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1117-24 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The temperature and time dependences of the initial permeability μ_a were determined for the amorphous alloy $Fe_5Co_{70}Si_{15}B_{10}$ in the initial state and after high-temperature annealing. The characteristic features of the temperature dependence of μ_a were determined mainly by the stabilization of domain walls because of directional composition ordering. Annealed samples exhibited a characteristic thermal reversibility of the processes: the initial value of μ_a was restored by repeating the heat treatment. A magnetic reversibility (recovery of μ_a as a result of demagnetization in an alternating field) was observed only after heating to 60°C. The nature of the processes responsible for this behaviour was analysed. (18 refs.) *A.T.*

102700 Mathematical model of magnetisation of a ferromagnetic in a one-dimensional field. N.A.Zolotarev.
Izv. VUZ Elektromekh. (USSR), no.5, p.5-14 (May 1983). In Russian.
The properties of a perfect magnetisation curve are examined with the aid of a mathematical model for magnetic hysteresis. The model is set up on the assumption of an unambiguous development of the magnetisation process in the ferromagnetic, starting from a fixed initial state, for given changes of the magnetic field intensity with time. A method for investigating theoretically damped magnetic oscillations is explained. (4 refs.) *Z.F.V.*

102701 Magnetic losses in metallic glasses under pulsed excitation. C.H.Smith (Metglas Products, Parsippany, NJ, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.2918-20 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Magnetic losses in ferromagnetic metallic glasses are discussed with respect to their use in particle accelerators. Domain models for magnetization under fast pulse conditions are discussed and compared to experimental measurements. (20 refs.)

102702 New developments in high-magnetic permeability permalloys. T.M.Panakhov.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.6, p.100-4 (1982). In Russian.
The possibility of creating high-magnetic permeability permalloys by doping with Nb4÷10 and Ta 10÷16 at.% was studied. The alloys with maximum magnetic permeability of more than 10^5 and up to 6×10^5 were obtained for optimal composition and heat treatment conditions. (3 refs.)

102703 On the mechanism of generation of magnetization jumps in polycrystalline ferrites. G.Zh.Rankis, V.B.Nikitin, L.N.Averbukh.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.3, p.24-8 (1983). In Russian.
The relation between the amplitude distribution of pulses, induced in the search coil from magnetization jumps in nickel ferrite, and the distribution of grain sizes is discussed. The shapes of observed pulses are described. One may conclude that many of the observed pulses may be the consequence of a collective phenomenon—bounded jumps, which arise when domain walls are moving in some group of adjacent grains. (6 refs.)

102704 Barkhausen effect in polycrystalline ferrites with various values of initial permeability. G.Zh.Rankis, V.B.Nikitin.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.3, p.29-34 (1983). In Russian.
This work is devoted to the explanation of two experimentally found relations in polycrystalline ferrites: the small number of jumps in comparison with the number of grains in the sample of nickel ferrite and the decrease of the amplitudes of pulses with the increase of the initial permeability of the ferrite. These relations are shown to serve as the evidence of the mechanism of hysteresis, determined by the friction of domain wall. (6 refs.)

102705 Magnetization of the rare-earth sublattice in intermetallic compounds of the type $R(Co_{1-x}Ni_x)_5$. V.V.Kelarev, V.V.Chuev, A.N.Pirogov, S.K.Sidorov, V.N.Dvinyaninov.
Phys. Status Solidi b (Germany), vol.118, no.1, p.K75-8 (1 July 1983).
The magnetisation of the rare earthed sublattice in $R(Co_{1-x}Ni_x)_5$ type alloys is considered. Using the expression for the magnetisation of Ermolenko et al. (1975) and neutron difraction data the authors estimate I_{R-Co}^O, the energy of the exchange coupling between the R atoms and the Co sublattice, and K_R^O, the second-order microscopic anisotropy constant per R ion. (4 refs.)

102706 Improving the magnetic properties of electrical steels and magnetic cores by thermomagnetic treatment. M.K.Savchenko, V.I.Efimov, V.I.Sen'kin.
Sov. Electr. Eng. (USA), vol.53, no.3, p.93-6 (1982). Translation of: *Elektrotekhnika (USSR)*, vol.53, no.3, p.50-2 (1982).
An investigation has been made of the influence of thermomagnetic treatment conditions on the magnetization curves and magnetic reversal losses in electrical steels with a silicon content form 0 to 4%. It is shown that in the case of

all unannealed steels, thermomagnetic treatment carried out in an alternating field is most effective from temperatures close to the Curie point. In the case of annealed alloy steels an increase in the thermomagnetic treatment temperature above 400°C does not alter the magnetic properties. In annealed unalloyed steels the effects of thermomagnetic treatment are not apparent. (6 refs.)

Temperature dependences of the magnetic susceptibility, magnetization, and electrical resistivity of solid solutions of the GdZn$_x$Mg$_{1-x}$ system .... See Entry 102630

On the participation of domains in the high spin ($^5T_2$)$\rightleftarrows$low spin ($^1A_1$) transition in dithiocyanatobis (2,2′-bi-2-thiazoline) iron (II) .... See Entry 102633

AC magnetic susceptibility and hysteresis studies on La$_{1-x}$Y$_x$Mn$_2$Si$_2$ intermetallic compounds .... See Entry 102637

Theory of relaxation of magnons in a two-component electron liquid in a ferromagnet .... See Entry 102638

Exchange anistropy of polycrystalline alloy FePd$_2$Au .... See Entry 102644

Magnetic anisotropy and exchange interactions in Li-Al ferrites .... See Entry 102652

Magnetic properties of the Cr$_{7-x}$Fe$_x$Te$_8$ (x=0 to 3) system . See Entry 102659

Magnetic behavior of Fe$_x$Sn$_{1-x}$ amorphous alloys near the critical composition .... See Entry 102673

Irreversibility and metastability in spin-glasses. I. Ising model .... See Entry 102687

Irreversibility and metastability in spin glasses. II Heisenberg model .... See Entry 102692

The new curve for the non-linear magnet .... See Entry 102708

Richter type magnetic after-effect in YIG at helium temperature .... See Entry 102711

Preparation of Co-Cr thin films by DC sputtering technique .... See Entry 102713

Determination of average domain size on Permalloy and Perminvar by means of complex permeability measurements .... See Entry 102720

Effect of thermomagnetic processing on magnetic properties of iron and iron-silicon alloys .... See Entry 103189

75.60G High coercivity materials

102707 Spinodal decomposition and magnetic properties of Fe-Cr-12Co permanent magnet alloys. Tsung-Shune Chin, Tien-Shou Wu, C.Y.Chang (Res. Inst. of Electronics & Electrical Engng., Cheng Kung Univ., Tainan, Taiwan).
J. Appl. Phys. (USA), vol.54, no.8, p.4502-11 (Aug. 1983).
This report is concerned with the spinodal decomposition and magnetic properties of Fe-21∼30 Cr-12Co ternary alloys (by weight) as studied by transmission electron microscopy and magnetic measurements. Wavelength growth of the isothermally aged spinodal structure is found to be proportional to time$^{1/3}$ for the later stage of aging at all aging temperatures, which suggests a coarsening process. Spinodal temperatures of those alloys are found to be higher than each of their properties. Hence, a prerequisite of a higher Curie temperature in the magnetic aging theory is concluded to be unnecessary. Moreover, as the extrapolated onset spinodal wavelength, of 80-100 Å, is superparamagnetic in nature, this suggests a prerequisite for the magnetic aging theory. Before magnetic aging can be operative, the particle should grow to a certain critical size, determined by the aging temperature and the anisotropy energy at that temperature, in order to have thermally stable magnetization. (25 refs.)

102708 The new curve for the non-linear magnet. H.Hoft (Sektion Phys., Tech. Hochschule, Karl-Marx-Stadt, Germany).
Z. Elektr. Inf.- & Energietech. (Germany), vol.13, no.3, p.251-8 (1983). In German.
Discusses a simple model which describes non-linear magnetism phenomenologically instead of using the previous analytical methods. This facilitates the calculation of the interactions between the characteristics of the magnet and provides new insights on its internal structure. The model treats the macrodomains of the magnet as crystallite structures in a polycrystalline solid body. After discussing reversible and irreversible magnetisation processes the author formulates this new hysteresis curve and indicates the information that can be derived from it. (16 refs.) *G.W.*

The influence of ageing on changes in coercivity and in the mechanism of decohesion of CuNiFe permanent magnet alloy .... See Entry 102697

75.60J Fine-particle systems

102709 Electron-microscopic investigation of the magnetic state of planar single-layer systems of small Fe and Fe-Co particles. B.V.Vasil'ev, A.A.Potseluiko, V.G.Pyn'ko (L.V. Kirenski Inst. of Phys., Acad. of Sci., Krasnoyarsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1218-19 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
Particles of pure iron and of an iron-cobalt alloy (composition not given) were of 400-2000 Å size and were separated by short distances from one another. The particles were disk-shaped and separated by lithium fluoride. The thickness of these systems was 300-500 Å thick in the vertical direction. When the distances separating the particles were less than their size, single-domain and single-vortex magnetic states of the systems were observed in the absence of an external field. (1 ref.) *A.T.*

AC magnetic susceptibility and hysteresis studies on La$_{1-x}$Y$_x$Mn$_2$Si$_2$ intermetallic compounds .... See Entry 102637

Microwave absorption of magnetic dielectrics .... See Entry 103002

75.60L Magnetic aftereffects

102710 Hydrogen in Fe$_{40}$Ni$_{40}$P$_{14}$B$_6$ amorphous alloys studied by magnetic aftereffect, internal friction, and positron annihilation. C.M.Mo (Inst. of Solid State Phys., Acad. Sinica, Hefei, China), P.Moser.
Phys. Status Solidi a (Germany), vol.78, no.1, p.201-10 (16 July 1983).
The effect of hydrogen or/and deformation on internal friction, magnetic aftereffect, and positron lifetime in amorphous Fe$_{40}$Ni$_{40}$P$_{14}$B$_6$ alloy is investigated over a temperatue range from 4 to 400K. In both hydrogen charged cold-worked and additively hydrogen charged specimens, an internal friction peak is found at 205K, and a corresponding magnetic aftereffect peak at 163K. Both peaks shift to higher temperature after aging at 340K. The strength of the magnetic relaxation depends on the amplitude of the cold work. (22 refs.)

102711 Richter type magnetic after-effect in YIG at helium temperature. M.Wurlitzer (Sektion Phys., Karl-Marx-Univ. Leipzig, Leipzig, Germany).
Phys. Status Solidi a (Germany), vol.78, no.1, p.K87-91 (16 July 1983).
The author has investigated the complex permeability of polycrystalline YIG samples with additions of Si, Ti, Zr, or Ca in a weak alternating field. Under these conditions magnetic after effect (MA) can be detected if the average relaxation time reaches the period of the alternating magnetic field and causes a dispersion of permeability μ' connected with the appearance of magnetic losses. It can be seen that besides the already known ranges (I, II) below room temperature, at liquid helium temperature, a further MA range (III) exists where the relaxation time is in the order of 10^{-5} s. (15 refs.)

75.60N Magnetic annealing and temperature-hysteresis effects

Spinodal decomposition and magnetic properties of Fe-Cr-12Co permanent magnet alloys .... See Entry 102707

75.70 MAGNETIC FILMS AND PLATES

102712 Structure of domain tips in thin ferromagnetic films. A.V.Gavrilyuk, V.P.Karabanova, V.P.Panaetov, V.I.Popov, V.N.Popov (Pedagogical Inst., Irkutsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1221-3 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of the structure of the tips of planar magnetic domains. The study was carried out by electron-microscopic powder methods on films with the composition 20% Fe-80% Ni. It was found that the nature of the tips depended on the film thickness and on the direction of the easy or difficult magnetization axis. (5 refs.) *A.T.*

102713 Preparation of Co-Cr thin films by DC sputtering technique. T.Takahashi, J.Yoshida (Faculty of Engng., Toyama Univ., Takaoka, Japan).
J. Vac. Soc. Jpn. (Japan), vol.26, no.6, p.571-6 (1983). In Japanese.
Co-Cr films were deposited by DC sputtering on pyrex glass and polyimide film. The crystal structure, the composition ratio and the M-H hysteresis loop of the films were investigated by X-ray diffractometer (XD), Auger electron spectroscopy (AES) and vibrating sample magnetometer (VSM), respectively. The *c*-axis of Co-Cr sputtered film is oriented perpendicular to the film plane. The angle of half-width of the rocking curve in (002) plane ranges from 10° to 13°. The Co/Cr atomic ratio (at.%) in the films is 6.7. The existence of oxygen is observed in excess at a thin layer (∼50 Å) near the film surface. When a perpendicular magnetic field is applied to the film plane, the M-H hysteresis loop (M-H$_\perp$) shows a rectangular loop and a squareness ratio from 0.8 to 0.9 is obtained. Saturation magnetization and coercive force in M-H$_\perp$ are from 580 to 650 emu/cc and from 400 to 600 Oe respectively. (9 refs.)

102714 Structured films of magnetizable surface-active substances. N.G.Taktarov.
Magnetohydrodynamics (USA), vol.18, no.4, p.351-5 (Oct.-Dec. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.4, p.28-32 (Oct.-Dec. 1982).
Films of a magnetic surfactant were produced by depositing on the surface of water a small amount of ferrofluid on kerosene base with a saturation magnetization M_m=100 G=100 kA/m. Visual observation of such films reveals that films of magnetic surfactants can essentially also be subdivided into gaseous, liquid, and solid ones. Films of all three types are transparent. Gaseous and liquid films are mobile and respond easily to a nonuniform magnetic field of a small permanent magnet. When a sufficient amount of ferrofluid has been deposited on the surface of water, a dense solid film will form. The mechanical properties of solid films of magnetic surfactants can be described with the aid of a two-dimensional strain tensor and two dimensional equations of elasticity. The author studies the surface magnetisation of these solid films. (8 refs.)

The annealing behavior of ion-irradiated garnet crystals .... See Entry 101819

Investigation of the characteristics of a thermomagnetic recording on films of 3d-4f metallic alloys .... See Entry 102663

Investigation of the nuclear echo phase in ferromagnetic cobalt .... See Entry 102776

75.70K Domain structure (magnetic bubbles)

102715 The movement of magnetic bubbles in a rotating field gradient. D.J.Breed, P.Q.J.Nederpel (Philips Res. Labs., Eindhoven, Netherlands).
J. Appl. Phys. (USA), vol.54, no.7, p.4054-8 (July 1983).
Magnetic bubbles can move in steady state under the influence of rotating field gradients. In the experiments reported in this paper the rotating field gradient method, as described by Jones et al. (1979), was used. Some technical improvements were introduced and two garnet films with uniaxial anisotropy were studied. The observed bubble mobilities compare very well with the mobilities obtained by the conventional bubble translation technique. The present method appears to be very suitable for studying the dynamic behavior of the magnetic bubbles near critical drive fields. (5 refs.)

102716 Analytical solutions of bubble tracks in periodical propagation structures. J.J.M.Ruigrok (Dept. of Electrical Engng., Univ. of Technol., Delft, Netherlands).
J. Appl. Phys. (USA), vol.54, no.7, p.4059-70 (July 1983).
In this paper a general expression is derived that describes tracks of bubbles in current-access devices, the rotating gradient experiment, etc. A resonance phenomenon resulting from this equation is experimentally verified: The periodical motion of a hard bubble shows a sharp maximum at a certain frequency of operation. This resonance frequency is proportional to the steepness of the magnetic potential well in which the bubble is captured and inversely proportional to the gyrotropic constant of the bubble. Even unichiral bubbles in low damping material may show this phenomenon. From this resonance frequency the gyrotropic constant of the bubble can be accurately determined. The experimental technique of applying a bias field modulation to counter the effects of wall motion coercivity is used. An attempt is made to include this mechanism in the theoretical description. (12 refs.)

102717 Corner clusters in thin soft magnetic layers. The corner cluster—a system of walls. H.A.M.van den Berg (Dept. of Electrical Engng., Delft Univ. of Technol., Delft, Netherlands).
J. Appl. Phys. (USA), vol.54, no.8, p.4512-19 (Aug. 1983).
The domain-wall cluster is a new concept revealing a large number of features about the domain structure and its conversions in thin soft magnetic layers, as used in field-access bubble devices and in integrated tape recorder heads. A wall cluster is a collection of domain walls having one intersection

line, the so-called cluster knot, in common. This paper is confined to the relations in the mutual domain-wall positions in the corner clusters, characterized by a cluster knot that coincides with a corner of the geometry. A one-to-one relationship between the domain-wall positions and the magnetization distribution near the corner exist in a special class of corner clusters, the so-called completely uniform corner clusters. It is shown under which conditions this type of cluster might or have to occur. The other class of corner clusters contains rotation segments, defined as sectors in which the magnetization rotates circularly around the cluster knot. The circulation sense of the magnetization in the rotation segments of a specific cluster is the same for all segments. The magnetization distribution possible in this class of clusters systematically come up for review. Consequently, the paper offers a framework for the interpretation of the observations obtained in the Bitter, TEM and Kerr techniques. (14 refs.)

102718 The description of the domain structure in thin ferromagnetic films with thickness near the critical value. M.Gajdek (Dept. of Phys., Tech. Univ., Kielce, Poland), W.Wasilewski.
J. Magn. & Magn. Mater. (Netherlands), vol.37, no.3, p.246-52 (July 1983).
The magnetization distribution is considered in a thin ferromagnetic film of a thickness near the critical value, for which the continuous phase transition from the homogeneous magnetization state to the domain structure appears. The easy axis of the magnetization is perpendicular to the film plane and the anisotropy constant $\beta<4\pi$. On the basis of the self-consistent theory the vortex-like magnetization distribution in the interdomain wall was obtained. The value of the critical thickness, the period of the domain structure and the amplitudes of the magnetization vector components as dependent on the film parameters were derived. (12 refs.)

102719 Magnetic domain structures in deformed and undeformed foils of a metallic glass. P.E.Donovan, W.M.Stobbs (Dept. of Metall. & Materials Sci., Cambridge Univ., Cambridge, England).
J. Magn. & Magn. Mater. (Netherlands), vol.37, no.3, p.257-66 (July 1983).
The magnetic domain structure of amorphous Co-P films was examined by transmission electron microscopy. A combination of in-situ annealing and magnetisation treatment was used to investigate the relative pinning effects of the surface relief, structural changes and long range stresses associated with the formation of deformation bands. (16 refs.)

102720 Determination of average domain size on Permalloy and Perminvar by means of complex permeability measurements. G.Ban, P.Arato, L.Szentmiklosi (Metalplant of Csepel Works, Budapest, Hungary).
J. Magn. & Magn. Mater. (Netherlands), vol.37, no.3, p.309-14 (July 1983).
Experiments were performed on industrial purity materials of 0.10-0.35 mm strip thickness. The authors tried to apply both the Polivanov bowing wall and the Pry-Bean rigid wall model for characterizing the domain structure of the materials. It was proved experimentally that the main features of domain structure are in agreement with the assumptions of the bowing wall model. By means of fitting theoretical spectra on measured complex permeability spectra, the average size of domains as a function of thickness and annealing temperature was determined. The number of domains related to one grain could be associated with changes of initial permeability and coercive force. (7 refs.)

Light-induced dynamic instability of the domain structure in $FeBO_3$:Ni ....See Entry 102694

75.80 MAGNETOMECHANICAL AND MAGNETOELECTRIC EFFECTS, MAGNETOSTRICTION

102721 The magnetio-elastic properties of the Invar alloy, Fe_3Pt. H.C.Ling (Western Electric Engng. Res. Center, Princeton, NJ, USA), W.S.Owen.
Acta Metall. (USA), vol.31, no.9, p.1343-52 (Sept. 1983).
The variations of the lattice parameter, the Curie temperature (determined from specific heat measurements), and the temperature variation of the elastic constants C, C', and C_L in an applied magnetic field of 0.8 T have all been measured as a function of the long-range order in a single crystal of iron-platinum alloy with very nearly the stoichiometric composition Fe_3Pt. It is found that the Invar effect in partially ordered Fe-25 Pt is larger than in other Fe-Pt alloys or in well-known Invar alloys such as Fe-35 Ni. The results for Fe-25 Pt are analyzed and interpreted in terms of a model of nearest-neighbor exchange interaction which takes account of the spatial variation of the average exchange integral. The best fit with the experimental data is obtained by assuming an average spin of unity. Using ordering as the controlled variable avoids the difficulties inherent in studies which have relied on a compositional variable. The model satisfactorily describes the magnetic contribution to the elastic constants and the variation of Curie temperature with changes in the long-range order. It is concluded that Fe-Pt coupling is ferromagnetic and Fe-Fe coupling antiferromagnetic. (43 refs.)

102722 Influence of the macrostructure of a thin anisotropic Fe-3% Si ribbon on electromagnetic losses as a result of elastic treatments. V.A.Zaikova, N.K.Esina, Yu.N.Dragoshanskii, A.P.Shtin, T.A.Khanzhina (Inst. of Metal Phys., Acad. of Sci., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1125-32 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of the influence of the degree of 'perfection' of the crystallographic texture and of the grain size on the electromagnetic losses occurring in thin Fe-3% Si ribbons subjected to uniaxial elastic stretching or to coating with magnetically active but electrically insulating films. It was found that both stretching and coating reduced the electromagnetic losses in the samples characterized by a high degree of 'perfection' of the structure. (18 refs.)
A.T.

102723 Vibrational modes, elastic stiffness, and piezomagnetic strain of a magnetization rod. L.Lanotte, C.Luponio, F.Porreca (Istituto di Fisica, Univ. degli Studi di Napoli, Napoli, Italy).
J. Appl. Phys. (USA), vol.54, no.8, p.4520-2 (Aug. 1983).
Vibrating-rod experiments in Ni samples, excited by dynamic magnetostriction, reveal three fundamental frequencies: two extensional modes and one shear mode. Both the c_{11}, c_{12}, c_{44} set of microscopic spring constants and the d_{z1}, d_{z3}, d_{r5}, set of piezomagnetic strain constants can be directly evaluated. The frequency changes with a polarizing magnetic field (Δf effect) have been observed for all modes. Suitable elasticity tensors have been written and compared in order to explain the c_{ij} variations from the demagnetized state of saturation. The approach aids interpretation of the observed d_{ij} changes. (10 refs.)

102724 Magnetically induced spatial dispersion of crystals in the exciton region of the spectrum. E.L.Ivchenko, V.P.Kochereshko, G.V.Mikhailov, I.N.Ural'tsev (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.3, p.164-7 (5 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.3, p.137-9 (5 Feb. 1983).
A resonant increase in magnetically induced spatial dispersion of axes in the vicinity of exciton states in crystals without a centre of inversion is predicted. It is found that this effect appears distinctly in regions where the dispersion branches of magnetopolaritons in CdS and CdSe crystals intersect. (7 refs.)

102725 Microscopic approach to magnetostriction of dilute rare-earth alloys. J.Deniszczyk (Inst. of Phys. & Chem. of Metals, Silesian Univ., Katowice, Poland), B.Kozarzewski.
J. Magn. & Magn. Mater. (Netherlands), vol.37, no.3, p.217-27 (July 1983).
The theory of magnetostriction, formulated previously by one of the authors, is partially extended to arbitrary crystal symmetry and compared with experimental results for AgRE dilute alloys. The field dependence of the forced magnetostriction in the ⟨001⟩ direction of the single crystal sample is in general quite well reproduced by the theory. (17 refs.)

102726 The response of an elastomer filled with soft ferrite to mechanical and magnetic influences. Z.Rigbi (Dept. of Chem. Engng., Technion-Israel Inst. of Technol., Haifa, Israel), L.Jilken.
J. Magn. & Magn. Mater. (Netherlands), vol.37, no.3, p.267-76 (July 1983).
The behaviour of a ferrite-elastomer composite is studied under the combined influence of changing elastic stresses and magnetic fields. The instruments used are described, and the results obtained are presented in a series of graphs. The composite behaves erratically unless subjected to a 'shake-down' procedure. In a quasi-stable state, previously unknown magnetomechanical effects are exhibited and described. (10 refs.)

102727 Filtering of fast magnetoelastic waves in a normally magnetized ferrite plate. A.S.Bugayev, Yu.V.Gulyayev, P.Ye.Zil'berman, Yu.A.Filimonov.
Radio Eng. & Electron. Phys. (USA), vol.27, no.10, p.106-10 (Oct. 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.10, p.1979-84 (Oct. 1982).
The dispersion equation of coupled magnetostatic and elastic waves is investigated in a plane-parallel ferromagnetic plate, normally magnetized to saturation. Magnetoelastic resonances appear at wave phase velocities that are much greater than the velocity of sound in an unbounded medium. Two-, three- and even fourfold resonances are possible. The resonance gaps in the spectrum depend on the rate of occurrence of dissipative processes and they can vanish completely with an increase of this rate. In this situation, however, interesting features appear in the transmission spectrum of the plate in the traveling-wave regime—increased frequency passband widths or nearly complete suppression of waves (signal filtering). The theory formulated for this effect makes it possible to estimate the location, shape and width of the transmission or suppressions peaks. In particular, the relative width of the peaks is $\sim 10^{-5}$-10^{-3}. (7 refs.)

Effects of screening on crystal-field magnetoelastic coupling in rare-earth intermetallic compounds ....See Entry 102328

Magnetic order and magnetogyration in π(2p) electron systems ....See Entry 102604

Metamagnetism of a noncollinear antiferromagnet: the Jahn-Teller garnet $Ca_3Mn_2Ge_3O_{12}$ ....See Entry 102656

Exchange-striction mechanism of phase transitions in magnetic crystals ....See Entry 102660

Interaction of a moving domain wall in a orthoferrite with Lamb waves ....See Entry 102695

The influence of ageing on changes in coercivity and in the mechanism of decohesion of CuNiFe permanent magnet alloy .... See Entry 102697

75.90 OTHER TOPICS IN MAGNETIC PROPERTIES AND MATERIALS

102728 Role of surface interactions in stratification of magnetic fluids. A.O.Tsebers.
Magnetohydrodynamics (USA), vol.18, no.4, p.345-51 (Oct.-Dec. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.4, p.21-7 (Oct.-Dec. 1982).
The average-field approximation provided a basis for the formulation of a thermodynamic model that showed the possibility of phase stratification of a magnetic fluid (MF). Stratification of an MF into concentrated and dilute phases is possible if the magnetodipole interaction parameter of the colloidal particles $\gamma=m^2/(2r)^3kT$ (m is the magnetic moment of the ferroparticle, 2r is the distance between the centers of the ferroparticles at their minimum distance apart) is greater than some critical value, which, generally speaking, depends on the external field strength. This dependence is given in this paper. (5 refs.)

76.00 MAGNETIC RESONANCES AND RELAXATION IN CONDENSED MATTER; MÖSSBAUER EFFECT

(for measurement techniques, see 07.58)

76.20 GENERAL THEORY OF RESONANCES AND RELAXATION

NMR imaging [computerized tomography] ....See Entry 104106

76.30 ELECTRON PARAMAGNETIC RESONANCE AND RELAXATION

Tetramethyldithiadiselenafulvalene (TMDTDSF): properties of its hexafluorophosphate salt and alloys with tetramethyltetraselenafulvalene ....See Entry 101681

Magnetic properties of new organic metals. Introduced by the example of the fluoranthene-radical cation salts .... See Entry 102760

76.30F Iron group (3d) ions and impurities (Ti-Cu)

102729 Temperature dependence of the paramagnetic resonance linewidth of Cr^{+3} ion in powdered $AgCrO_2$ sample. M.Krygowska-Doniec, J.Kwiatkowska (Inst. of Nuclear Phys., Cracow, Poland), M.Stojic, V.Spiric.
Acta Phys. Pol. A (Poland), vol.A64, no.1, p.143-6 (July 1983).
Electron paramagnetic resonance in $AgCrO_2$ powder is investigated. Measurements are performed in the X-band and in temperature range from 20K to 300K. The resonance line width is strongly dependent on temperature. The mechanisms of the line width change are discussed. The spectroscopic splitting factor, g, and effective magnetic moment associated with $^4A_2$ ground state is determined and the shape of ERP lines in the whole range of temperature is analysed. (15 refs.)

102730 ESR of Mn^{2+} ions in ZnP_2 and structural correlations. B.Frick, D.Siebert (Inst. fur Phys. Chem., Univ. Freiburg, Freiburg, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.7, p.558-62 (July 1983).
In tetragonal ZnP_2 paramagnetic Mn^{2+} substitutes for the Zn^{2+} ions that are all equivalent. The hyperfine structure constant A of the paramagnetic Mn^{2+} centre was $53(2) \times 10^{-4}$ cm^{-1}. Measurements of the optical activity revealed a characteristic twinning of the red, plate-like crystals. In monoclinic ZnP_2 two different Mn^{2+} centres could be detected in accordance with two different Zn sites. A site assignment was possible by considering a pseudo-orthorhombic unit. The same assignment was obtained by comparing the orientations of the centres' axes with calculated directions of the axes of crystal field tensors. The agreement of the A values of the two different centres in monoclinic ZnP_2 among themselves and with the A value in tetragonal ZnP_2 supports a structure without Zn-Zn bonds for the monoclinic modification. (10 refs.)

102731 Photochromic reactions involving Cr ions and defects in magnesium oxide. R.C.Barklie, C.E.Blount, B.Henderson, D.O'Connell.
J. Phys. C (GB), vol.16, no.23, p.L859-62 (20 Aug. 1983).
Electron spin resonance (ESR) measurements are reported for Cr^+ ions occupying octahedral symmetry sites in MgO. The spin Hamiltonian parameters are: $a=(4.18 \pm 0.02)$ mT; $A=(1.86 \pm 0.02)$ mT; $g=1.9997(4)$. These monovalent ions are produced in additively coloured MgO by optical excitation at 77K in the wavelength range 250-600 nm, presumably by the photoconversion of Cr^{2+} ions. The Cr^+ state is stable at 77K but decays on warming to room temperature. Photoconversion of F centres$\rightarrow F^+$ centres also proceeds during optical excitation, mainly but not exclusively in the F band. Such optical excitation is found to change the effective spin-lattice relaxation time for F^+ centres. There is no correlation between the optical creation of Cr^+ ions and the photoconversion of $F \rightarrow F^+$ centres. (7 refs.)

102732 Reinterpretation of the state of paramagnetic vanadium species in aluminophosphates. M.Narayana, L.Kevan (Dept. of Chem., Univ. of Houston, Houston, TX, USA).
J. Phys. C (GB), vol.16, no.23, p.L863-6 (20 Aug. 1983).
The ESR parameters of vanadium species in oxide-type matrices are reviewed and a reassignment of the paramagnetic vanadium species in aluminophosphates from V^{4+} to VO^{2+} is proposed. (22 refs.)

102733 A trigonal Mn^{2+} centre in SrF_2:Mn. R.Alcala, P.J.Alonso, R.Cases (Dept. de Fisica Fundamental, Univ. de Zaragoza, Zaragoza, Spain).
J. Phys. C (GB), vol.16, no.23, p.4693-700 (20 Aug. 1983).
The EPR spectrum of 'as grown' SrF_2:Mn crystals has been measured. In addition to the well known signal due to cubic Mn^{2+} ions a new Mn^{2+} signal having trigonal symmetry has been observed. The EPR data have been explained using the spin Hamiltonian $\mathcal{H}=g\mu_B \mathbf{S}.\mathbf{H}+D[S_z{}^2-{}^1/_3 S(S+1)]+A\mathbf{S}.\mathbf{I}+\mathcal{H}_{SHF}$ with $S={}^5/_2$, $I={}^5/_2$ and the z axis along a $\langle 111 \rangle$ direction. The values obtained for the parameters are: $g=2.004 \pm 0.005$, $|D|=1615 \pm 10$ MHz, $|A|=265 \pm 10$ MHz with A and D having the same sign. The evolution of the EPR spectrum when measured at different temperatures is also reported. A linear dependence of D on temperature has been found. Changes induced by thermal treatments and low-temperature X-irradiations are given. A tentative model for the manganese centre responsible for the trigonal EPR signal that consists of a fluorine vacancy next to a substitutional Mn^{2+} ion is proposed. (20 refs.)

102734 Electron spin resonance of VO^{2+} in K_2SO_4-$ZnSO_4$ glasses. V.P.Seth, V.K.Jain, R.K.Malhotra (Dept. of Phys., MD Univ., Rohtak, India).
J. Non-Cryst. Solids (Netherlands), vol.57, no.1, p.199-201 (Aug. 1983).
Sulphate glasses prepared from K_2SO_4-$ZnSO_4$ systems can be obtained over a wide range of binary compositions. The authors report the ESR of VO^{2+} ions in K_2SO_4-ZnO_4 glasses at 288K. The ESR spectrum of VO^{2+} ions in K_2SO_4-$ZnSO_4$ glass shows a structure which is characteristic of a hyperfine interaction of a single upaired electron with a ^{51}V (99.8% abundant, spin $I={}^7/_2$) nucleus. The spectra were analysed using an axial spin-Hamiltonian. (8 refs.)

102735 Optical and electron spin resonances studies of copper(II), nickel(II) and oxovanadium(IV) complexes of water-soluble phthalocyanine and porphyrazine chelates absorbed on Sephadex resins, and the effect of added dithionite. A.Skorobogaty, R.Lancashire, T.D.Smith (Chem. Dept., Monash Univ., Clayton, Victoria, Australia), J.R.Pilbrow, G.R.Sinclair.
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.7, p.1123-41 (July 1983).
Electronic and ESR spectral data show that the solute-solute interactions which prevail in aqueous solutions containing copper(II) and oxovanadium(IV) chelates of tetrasulphophthalocyanines persist when the chelates are adsorbed onto the anion exchanger Sephadex DEAE. The distribution of the copper(II) and oxovanadium(IV) into polymeric, dimeric and monomeric species may be adjusted by equilibration of the resin with aqueous solutions containing various amounts of dimethylformamide, which when present in high proportions effects a distribution largely of the monomeric forms. The tetracationic copper(II), cobalt(II) and oxovanadium(IV) tetra-*N*-methyl-2,3-tetrapyridinoporphyrazine chelates, which are free of solute-solute interactions in aqueous solutions, are absorbed in a monomeric distribution on the cation sites of the cation exchange Sephadex CM. A two-electron reduction of the copper(II) and oxovanadium(IV) tetrasulphophthalocyanine chelates occurs in their aqueous solution and while absorbed on the resin as a result of reaction with an aqueous solution of dithionite, whereafter the vanadyl complex has a $g_{\parallel}$ value of 2.024. Reduction occurs by electron addition to the macrocyclic ring system. (19 refs.)

102736 Tetragonal distortions in the Jahn-Teller active copper pyridine-N-oxide complexes. Comparison of experimental and theoretical EPR parameters. C.P.Keijzers, G.van Kalkeren, E.de Boer (Dept. of Phys. Chem., Univ. of Nijmegen, Nijmegen, Netherlands), J.S.Wood.
Mol. Phys. (GB), vol.49, no.5, p.1187-97 (10 Aug. 1983).
The Jahn-Teller (JT) and the EPR parameters of the trigonal, JT-active hexakispyridine-N-oxide complex $Cu(C_5H_5NO)_6{}^{2-}$ are calculated from the results of extended Huckel molecular orbital calculations on a series of distorted geometries of this complex. These geometries are obtained from a recent, low temperature, neutron diffraction study and compared with a monoclinic, static, modification of the corresponding nitrate complex. For two different distortion models, the JT minimum is obtained for a tetragonally elongated octahedron. The JT parameters are in very reasonable agreement with the experimental ones. The EPR parameters are compared with newly determined experimental values obtained by a re-evaluation, using matrix diagonalization instead of a perturbation treatment, of earlier measurements on $Cu(C_5H_5NO)_6(BF_4)_2$ at 4.2K and on $Cu(C_5H_5NO)_5DMF(ClO_4)_2$ at room temperature. On the basis of these computations, the EPR parameters, and especially the very small isotropic copper hyperfine coupling, can be understood. (19 refs.)

102737 EPR study of electronic and magnetic properties of bis(*DL*-α-amino-*n*-butyrato) copper (II). A layered magnetic system. R.Calvo, M.A.Mesa (Inst. Venezolano de Investigaciones Cientificas, Caracas, Venezuela).
Phys. Rev. B (USA), vol.28, no.3, p.1244-8 (1 Aug. 1983).
Single crystals of the copper derivative of the amino acid *DL*-α-amino-*n*-butyric acid were studied by EPR at 300K and 9.3 GHz. Only one exchange-narrowed line was observed for the two inequivalent copper ions in the lattice. The angular variation of its position and linewidth was measured in three perpendicular planes. The data on the position were used to obtain the molecular gyromagnetic factors and the orientation of the molecules within the unit cell. The angular variation of the linewidth shows an important contribution from spin diffusion, as is characteristic of two-dimensional magnetic systems. Anisotropic and antisymmetric exchange interactions contribute also to the linewidth. This two-dimensional behavior of bis(*DL*-α-amino-*n*-butyrato)Cu(II) is supported by existing data on the crystal structure of this salt. A lower limit for the exchange interaction between dissimilar copper ions in the lattice was obtained. (24 refs.)

102738 Hyperfine interactions from EPR of iron in silicon. E.G.Sieverts, S.H.Muller, C.A.J.Ammerlaan (Natuurkundig Lab., Univ. van Amsterdam, Amsterdam, Netherlands), E.R.Weber.
Solid State Commun. (USA), vol.47, no.8, p.631-4 (Aug. 1983).
At high microwave power very well resolved EPR spectra from isolated neutral interstitial iron atoms in silicon can be observed. From these spectra hyperfine interactions with at least three shells of neighbouring lattice sites, containing 18 or 22 atoms, can be determined. The localization of the unpaired electron on these sites is only small. On nearest neighbour sites it is found to be even smaller than on next nearest sites. (12 refs.)

The influence of fluorine upon the structural, chemical, and physical properties of phosphate glasses .... See Entry 101562

ESR study of the change in the local structure of As_2Se_3 caused by the action of high pressure and by annealing .... See Entry 101583

ESR study of effects of pressure treatment, temperature and annealing on the structure of the impurity Cr^{3+} centers in chalcogenide glasses .... See Entry 102320

Dynamics of photohole trapping in silver chloride .... See Entry 102420

Electronic absorption spectrum of Cu^{2+} ions doped in zinc cesium sulphate hexahydrate .... See Entry 102908

76.30H Platinum and palladium group (4d and 5d) ions and impurities (Zr-Ag and Hf-Au)

102739 Cryochemical studies. VII. Electron spin resonance spectrum of Ag_5. J.A.Howard, R.Sutcliffe (Nat. Res. Council of Canada, Ottawa, Ontario, Canada), B.Mile.
J. Phys. Chem. (USA), vol.87, no.13, p.2268-71 (23 June 1983).
The neutral silver cluster $^{107}Ag_5$ has been prepared in several inert matrices in a rotating cryostat at 77K and its ESR spectrum recorded. The spectrum is anisotropic and can be analyzed in terms of $A_{\parallel}(2)=594.5$ MHz, $A_{\perp}(2)=587.5$ MHz, $g_{\parallel}=2.002$, and $g_{\perp}=2.085$. The superhyperfine interactions associated with the perpendicular features of the spectrum give $A_{107}(2)=5.5$ G and $A_{107}(1)=11$ G. This transition-metal pentamer has a distorted trigonal-bipyramidal structure with a $^2B_2$ in C_{2v} electronic ground state. The SOMO has 5s and 4p and/or 4d orbital contributions of 0.6 and 0.2-0.3, respectively, from two equatorial Ag nuclei. The unique equatorial and axial Ag nuclei have a small percentage of negative unpaired 5 s spin population. (50 refs.)

102740 Magnetic resonance of the B_2O_3-Na_2O-MoO_3 vitreous system. S.Simon, A.Nicula (Faculty of Phys., Univ. of Cluj, Cluj, Rumania).
J. Non-Cryst. Solids (Netherlands), vol.57, no.1, p.23-39 (Aug. 1983).
The structure and properties of molybdenum-doped soda-borate glasses were studied by means of electron paramagnetic resonance as functions of the molybdenum oxide concentration in the range 1-25 mol% MoO_3, the keeping time of the samples at the preparation temperature in the range of 15-180 min, the preparation temperature in the range of 900-1300°C, and the soda-borate matrix composition in the range 0-34 mol% Na_2O. The EPR measurements gave evidence of the existence of three types of site for the Mo^{5+} ions, their relative fraction as well as the paramagnetic center density and the EPR lineshape symmetry being dependent on the above-mentioned factors. The evolution of the ^{11}B NMR lineshape in the studied samples also showed that the fourfold-coordinated boron atoms fraction is greatly influenced by the modification of these factors. The good agreement between the structural information obtained by ^{11}B NMR and Mo^{5+} EPR studies recommends the EPR spectra of Mo^{5+} ions as an excellent sensor for the structure of the borate glasses. (22 refs.)

102741 Investigations of the stability of the neutral silver atom in $Na_xAg_{1-x}Cl$ mixed crystals by EPR-spectroscopy. T.Muessig, F.Granzer (Inst. fur Angewandte Phys., J.W. Goethe-Univ., Frankfurt/Main, Germany).
Radiat. Eff. (GB), vol.72, no.1-4, p.123-37 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
In most of the theories of the photographic process in the classical silver halide systems, the neutral silver atom, Ag^0, still plays an important role. Up till now, however, all attempts failed to detect the Ag^0 in pure AgCl and AgBr, while its detection in NaCl, weakly doped with Ag, does not impose any problems applying EPR-spectroscopy. Benefiting from some peculiarities of the NaCl-AgCl-phase diagram, $Na_xAg_{1-x}Cl$-mixed crystals were grown and the stability of the Ag^0-centre with increasing Ag-content was followed by EPR-measurements. From the results obtained by gradually augmenting the Ag-content up to 30 mol.% and cooling down the crystals to 20K, there seems to be only little chance, to detect the neutral silver atom in pure AgCl, even at very low temperatures by EPR-spectroscopy. Simultaneously the EPR-signal of the Ag^{2+}-centre was studied and the occurrence of a very strong EPR-line at $g=1.88$ in decomposed mixed crystals was interpreted. (10 refs.)

$E\otimes\epsilon$-type Jahn-Teller effect of ReO_4^{2-} in KBr crystals: an EPR study .... See Entry 102329

Dynamics of photohole trapping in silver chloride .... See Entry 102420

The effect of Mo^{5+} ions (in the presence of Mo^{6+} ions) on the elastic moduli of molybdenum phosphate glasses .... See Entry 103195

76.30K Rare-earth ions and impurities

102742 Electron spin resonance on the intermediate valence system $Ce(Rh_xPt_{1-x})_2$. R.M.Stein, J.P.Donoso, G.E.Barberis (Inst. de Fisica, UNICAMP, Sao Paulo, Brazil).
Phys. Lett. A (Netherlands), vol.96A, no.8, p.422-4 (25 July 1983).
The authors report ESR experiments for non-S state impurities substituted for Ce in $Ce(Rh_xPt_{1-x})_2$. They analyse their results in the light of other experiments done on similar systems. (5 refs.)

Thermoluminescence, fluorescence and electron paramagnetic resonance properties of synthetic hydrothermal scheelites .... See Entry 102971

76.30L Other ions and impurities

(for colour centres, see 76.30M)

102743 The ⟨110⟩ oriented FCl^- molecule-ion in KF. C.J.Delbecq, E.Hutchinson, P.H.Yuster (Argonne Nat. Lab., Argonne, IL, USA), S.A.Marshall.
J. Chem. Phys. (USA), vol.79, no.3, p.1408-15 (1 Aug. 1983).
The heteronuclear diatomic molecule-ion FCl^- with its molecular axis oriented along a crystal face diagonal, i.e. FCl^- ⟨110⟩, has been produced by ionizing radiation in single crystal KF doped with $PbCl_2$ and KCl. Evidence to support this species identification as well as its orientation relative to the lattice is obtained from anisotropic optical absorption spectral measurements as well as from electron spin resonance (ESR) absorption spectra. Optical absorption spectral data, estimates of the molecular reorientation temperature, as well as ESR absorption spectral parameters are given for the FCl^- ⟨110⟩. A qualitative explanation of the differences of the optical and ESR parameters of FCl^- ⟨111⟩ and FCl^-⟨110⟩ is discussed. (27 refs.)

102744 ESR of a new sulphur centre in KCl. F.Callens, P.Matthys, E.Boesman (Lab. voor Kristallografie, Rijksuniv. Gent, Gent, Belgium).
Phys. Status Solidi b (Germany), vol.118, no.1, p.K35-7 (1 July 1983).
The authors have previously analysed the ESR spectra of two new sulphur centres in NaCl. In order to investigate further the models proposed for these paramagnetic defects, respectively (very likely) an S_2^- ion and (tentatively) an S^- centre, they have studied the ESR of KCl, similary doped with potassium polysulfide. (9 refs.)

102745 Paramagnetic states in doped amorphous silicon and germanium. M.Stutzmann, J.Stuke (Dept. of Materials Sci. & Engng., Stanford Univ., Stanford, CA, USA).
Solid State Commun. (USA), vol.47, no.8, p.635-9 (Aug. 1983).
ESR-results for doped hydrogenated amorphous silicon and germanium are discussed. g-values and linewidths of the resonances as well as effective correlation energies of the corresponding energy states are compared for both materials. It is shown that the existing large differences of these quantities between a-Si:H and a-Ge:H can be explained by the differences of spin-orbit coupling and degree of localization. (14 refs.)

Optical absorption and electron paramagnetic resonance studies of colorless and pink beryl .... See Entry 102907

76.30M Colour centres and other defects

102746 Defect characterization in III-V compounds by ESR. J.Schneider (Fraunhofer-Inst. fur Angewandte Festkorperphys., Freiburg, Germany).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.329-30 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Summary form only given. A summary of present knowledge on $3d^n$ transition metal impurities in GaP, GaAs and InP, as obtained by ESR, is given. The author discusses in detail the current ESR and ODMR investigations on the anion antisite defects P_{Ga}:GaP and As_{Ga}:GaAs. These basic and native point defects are very characteristic for III-V compounds; they are also suspected to play a key role in devices, in a deleterious as well as in a beneficial manner. Finally, the present state of ESR studies on radiation induced defects in GaP, GaAs and InP is summarized. (1 ref.)

102747 Light induced ESR spectra in rutile powders. S.W.Hodgskiss, J.S.Thorp, G.Brown (Dept. of Appl. Phys. & Electronics, Univ. of Durham, Durham, England).
J. Mater. Sci. (GB), vol.18, no.8, p.2361-70 (Aug. 1983).
A series of rutile powders has been examined by electron spin resonance techniques before and after ultraviolet irradiation at low temperautres. Prior to irradiation a broad line was seen at 4.2K whose g-value ($g \approx 1.955$) was similar to that reported by Iyengar in hydrogen-reduced rutile. After ultraviolet irradiation at 4.2K a new line was observed. Computer simulation techniques showed that the best fit to the observed lineshape was obtained by taking $g_1=g_2=2.0077$ and $g_3=2.015$ with Lorentzian broadening. Isochronal annealing of this centre showed marked decreases in the signal intensity at both 10 and 80K; these are attributed, respectively, to thermal release of electrons from a shallow and a deep electron trap giving recombination at the centre. (15 refs.)

102748 Interstitial Tl^0 atoms in alkali halides: ESR study of a ⟨111⟩-oriented Tl_2^+ center. S.V.Nistor, E.Goovaerts, B.-r.Yang, D.Schoemaker (Phys. Dept., Univ. of Antwerp, Wilrijk, Belgium).
Phys. Rev. B (USA), vol.28, no.3, p.1219-26 (1 Aug. 1983).
A ⟨111⟩-oriented Tl_2^+ center is produced above 220K by X-ray irradiation of Tl^+-doped KCl and RbCl. A careful analysis of the X-band electron-spin-resonance spectra establishes that the two Tl nuclei are equivalent, which implies that the center possesses inversion symmetry. The model proposed is a Tl_2^+center on a single cation site. Its production is believed to involve the trapping of a mobile anion vacancy between a distant pair of substitutional Tl^+ impurities and the trapping of an electron in whatever order, an asymmetric relaxation of a Tl_2^+ center towards a cation site and the diffusing away of a divacancy. In a formal sense this Tl_2^+ center may be viewed as being an interstitial Tl^0 atom trapped by a substitutiona Tl^+ impurity, although no mobile interstitial Tl^0 as such is produced by the X-ray irradiation. Its structure is formally analogous to the interstitial halogen atom center, the H center. The possible effect of the presence of ⟨111⟩-oriented Tl_2^+ on the lasing properties of $Tl^0(1)$ centers is briefly discussed. (28 refs.)

102749 Optically and X-ray-induced paramagnetism in amorphous phosphorus. B.V.Shanabrook (Naval Res. Lab., Washington, DC, USA), P.C.Taylor.
Phys. Rev. B (USA), vol.28, no.3, p.1239-43 (1 Aug. 1983).
Two metastable and characteristically different paramagnetic centers are observed by electron-spin resonance (ESR) in amorphous phosphorus (a-P) after either X-ray irradiation or optical excitation below 77K. The wave function of the one center, P_1, is probably localized on a single phosphorus atom and may be identical to centers which exist before optical excitation (dark ESR). The second center, P_2, is characterized by a wave function which is localized on two equivalent phosphorus atoms. The relative intensities of P_1 and P_2 depend upon the excitation source (X-ray irradiation or optical excitation). The metastable P_2 densities decrease rapidly above 80K while those of P_1 decrease more slowly with temperature. Both P_1 and P_2 can be optically bleached with below-band-gap light. Both the bleaching and inducing processes appear to saturate quickly compared to previous measurements on the chalcogenide glasses. There is little increase in the dark ESR with temperature. (11 refs.)

The spin-lattice relaxation and spin-orbit interaction of F center in the relaxed excited state .... See Entry 101700

F^+ centre in (Ca-Sr) carbonated hydroxyapatites .... See Entry 101702

Optical instabilities and localized electronic states in hydrogenated amorphous silicon .... See Entry 102299

Observation of spin-dependent thermal emission from deep levels of semiconductors .... See Entry 102309

Photochromic reactions involving Cr ions and defects in magnesium oxide .... See Entry 102731

NMR and ESR studies of an undoped conjugated polymer: poly-p-phenylene .... See Entry 102775

Optical absorption and electron paramagnetic resonance studies of colorless and pink beryl .... See Entry 102907

76.30P Conduction electrons

Influence of composition on the electronic state of Ce in the intermetallic Ce-Fe-Si system .... See Entry 102359

76.30R Free radicals

102750 Observation of the methyl radical CH_3 in irradiated, high-purity synthetic fused silica. E.J.Friebele, D.L.Griscom (Naval Res. Lab., Washington, DC, USA), K.Rau.
J. Non-Cryst. Solids (Netherlands), vol.57, no.1, p.167-75 (Aug. 1983).
Stable methyl radicals CH_3 have been observed in irradiated high-purity synthetic silicas by electron spin resonance techniques. Analysis of the dependence of the linewidth on the nuclear spin quantum number of the ESR spectrum demonstrates that the radicals tumble at a frequency of ~11 MHz. The authors suggest that this small tumbling rate as compared with the 'free' rotation rate of 10 GHz is due to interaction of the radical with the glass network. Radicals were observed in concentrations of $\sim 3\times 10^{13}$/g SiO_2 in samples fused in a hydrocarbon-oxygen flame, but no radical concentration could be measured in samples fused in either an electric arc or hydrogen-oxygen flame. The methyl radical is presumed to form by radiodissociation of either CH_4 or CO dissolved in the silica during the fusion process and subsequent reaction of C with radiolytic H. (12 refs.)

102751 Influence of chain length on conformations of poly(ethylene glycol) chains grafted on silica [ESR observations]. H.Hommel, A.P.Legrand (Lab. de Phys. Quantique, ERA, Paris, France), H.Balard, E.Papirer.
Polymer (GB), vol.24, no.8, p.959-63 (Aug. 1983).
Electron spin resonance spectroscopy of labelled grafted poly(ethylene glycol) chains has been used to estimate the ratio of the population of end segments free in solution to that of ones adsorbed on the silica surface, as a function of temperature. In particular, the influence of chain length is investigated. The grafted molecules have the following molecular weights, 44, 88, 132, 176, 400, 600, 2000, and are in contact with benzene. Taking the random walk models as reference, two different behaviours are distinguished, one for the oligomers and one for the polymers. The measured values are consistent with an overall picture of 'brush bristles' for oligomers and of weakly overlapping partly collapsed coils for polymers. (28 refs.)

102752 An ESR investigation of environmental effects on polymeric materials. II. Polyethylene. M.Igarashi, K.L.DeVries (Coll. & Engng., Univ. of Utah, Salt Lake City, UT, USA).
Polymer (GB), vol.24, no.8, p.1035-41 (Aug. 1983).
The authors report results on the effect of various environments, O_3, NO_x, SO_2, UV irradiation, combined with stress on the mechanical degradation of polyethylene. Mechanical strength, toughness, free radical production and changes in molecular weight are reported as functions of the ageing time in these environments and at sustained strains corresponding to as much as 90% of the fracture stress for the oriented material and corresponding to the onset of necking in the unoriented material. The results are compared to those previously reported for nylon and discussed in terms of possible molecular mechanisms active during polymer fracture. (8 refs.)

Physicomechanical properties of polytetrafluoroethylene treated in a high-frequency gas-discharge plasma .... See Entry 103360

Long-lived polymer radicals. V. Synthesis of block copolymer by the reaction of living poly(N-phenylmethacrylamide) radical with vinyl monomers .... See Entry 103522

A comparison of the carbon-13 hyperfine constants of carboxylated cyclohexadienyl and hydroxycyclohexadienyl radicals .... See Entry 103554

Adsorption of polysaccharides on a calcite using spin labelled polymers .... See Entry 103604

Influence of the physical structure of irradiated starches on their electron spin resonance spectra kinetics .... See Entry 103984

76.40 DIAMAGNETIC AND CYCLOTRON RESONANCES

102753 High-frequency doppleron excitations in metals. A.Yu.Romanov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1070-8 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
An arbitrary axially symmetric Fermi surface is considered and solutions are found of the dispersion equation in the vicinity of a Doppler-shifted cyclotron resonance at frequencies higher than the threshold frequency of the usual

dopplerons. Such excitations have a circular polarization. The dispersion curves are derived for high-frequency dopplerons in a wide range of frequencies right up to the cyclotron value. It is shown that high-frequency dopplerons can propagate through the transparency 'windows'. (9 refs.) *A.T.*

102754 Resonant free-induction signals in metals in high vacuum. B.P.Smolyakov, E.P.Khaimovich.
JETP Lett. (USA), vol.37, no.2, p.116-18 (20 Jan. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR),* vol.37, no.2, p.95-7 (20 Jan. 1983).
An emission signal has been observed in several metals after an intense microwave pulse. The signal has a resonance in the magnetic field with a decay time $\sim 10^{-4}$ s. The effect apparently results from the appearance of electron surface states on metal sampled in high vacuum. (6 refs.)

Investigation of electrons localized above solid hydrogen by means of the cyclotron resonance method ....See Entry 102110

76.50 FERROMAGNETIC, ANTIFERROMAGNETIC, AND FERRIMAGNETIC RESONANCES; SPIN WAVE RESONANCE

(see also 75.30D Spin waves)

102755 Detection of exchange modes in quasi-two dimensional antiferromagnet $(NH_3)_2(CH_2)_3MnCl_4$. A.A.Stepanov, M.I.Kobets, A.I.Zvyagin.
Fiz. Nizk. Temp. (USSR), vol.9, no.7, p.764-5 (July 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The antiferromagnet resonance (AFMR) of a quasi-two-dimensional antiferromagnet $(NH_3)_2(CH_2)_3MnCl_4$ is studied in the frequency range of 20 to 180 GHz at helium temperature. Optical (or exchange) branches in the AFMR spectrum are detected alongside with the acoustic branches, and their frequencies are determined. (4 refs.)

102756 Low power nonlinear effects in the ferromagnetic resonance of Zn_2Y and MnZnY hexagonal ferrites. L.M.Silber, C.E.Patton, H.F.Naqvi (Dept. of Phys., Colorado State Univ., Fort Collins, CO, USA).
J. Appl. Phys. (USA), vol.54, no.7, p.4071-5 (July 1983).
The room temperature ferromagnetic resonance (FMR) absorption at 8.9-11.2 GHz in two planar hexagonal ferrites, Zn_2Y and MnZnY, has been found to exhibit strong nonlinear behavior at low power levels corresponding to microwave field amplitudes on the order of 10 mOe. For somewhat larger amplitudes, 20-50 mOe, the asymmetric resonance curves show pronounced foldover effects. With increasing static field, the absorption increases gradually to a steep cutoff at a field several hundred Oe above the position of the low power FMR. With decreasing field, a sharp spike occurs coincident with the high field tail of the low power FMR line, followed by a gradual decrease which tracks the upsweep absorption. The detailed shapes of these curves depend strongly on sweep rate. Steady-state absorption curves at the highest powers employed, with 350 mW incident power and a microwave field amplitude of 58 mOe, result only for very slow sweep rates of 20 Oe/min or less. (16 refs.)

Atomic structure, size, and shape of small nickel particles in thin films. [Electron diffraction and FMR observations] ....See Entry 102199

76.60 NUCLEAR MAGNETIC RESONANCE AND RELAXATION

102757 High-resolution NMR spectrometry of solids. II. B.C.Gerstein (Dept. of Chem., Iowa State Univ., Ames, IA, USA).
Anal. Chem. (USA), vol.55, no.8, p.899a-907a (July 1983).
The author discusses applications of transient techniques in NMR to studies of polymers, biopolymers, and fossil fuels. Also discussed are recent technical and theoretical advances, including magnetic angle spinning at low temperatures, recovery of shielding anisotropies in systems with many chemically distinct nuclei, slow spinning, high-resolution NMR of nuclei with quadrupole moments, and multiple-quantum NMR. (24 refs.)

102758 ^{57}Fe NMR spectra in domain walls of hexagonal ferrites with magnetoplumbite structure. H.Stepankova, J.Englich, B.Sedlak (Faculty of Maths. & Phys., Charles Univ., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.7, p.816-25 (1983).
The domain wall NMR spectra of ^{57}Fe were measured on polycrystalline samples of $BaFe_{12}O_{19}$ and $SrFe_{12}O_{19}$ at 4.2K. The authors have calculated the anisotropy of the hyperfine field dipolar component. The measured NMR spectra were interpreted supposing that the hyperfine field anisotropy is caused only by the dipolar field anisotropy. (10 refs.)

102759 Free precession of ^{165}Ho nuclei in a single crystal of holmium iron garnet. O.Prakash, M.A.H.McCausland (Schuster Lab., Univ. of Manchester, Manchester, England).
J. Phys. C (GB), vol.16, no.24, p.L903-6 (30 Aug. 1983).
A well resolved seven-line NMR spectrum has been obtained by measuring the frequency dependence of the free precession signal from holmium nuclei, following a $\pi/2$ pulse, in a single crystal of HoIG at 4.2K. The power- and field-dependence of the signals show that they come from nuclei within domains. The zero-field spectrum has been fitted to a nuclear spin Hamiltonian with dipolar, quadrupolar and octupolar terms. From the measured magnetic dipole splitting the authors deduce that the holmium moment at at least one of the two inequivalent crystallographic sites is (8.065 ± 0.025) μ_B. This result contradicts a recent neutron diffraction study in which the moments assigned to the two sites were (6.0 ± 0.5) μ_B and (9.9 ± 0.5) μ_B. Relaxation behaviour of holmium nuclei in the garnet single crystal is contrasted with results previously obtained from a powder sample of HoIG. (14 refs.)

102760 Magnetic properties of new organic metals. Introduced by the example of the fluoranthene-radical cation salts. E.Dormann (Phys. Inst., Univ. Bayreuth, Bayreuth, Germany).
Phys. Bl. (Germany), vol.39, no.7, p.220-5 (July 1983). In German.
With chains of adjacent plate-shaped organic molecules, such as bis-fluoranthene-hexa fluoro phosphate $(FA)_2PF_6$, metallic properties have been established by measurements of their magnetic susceptibility, electron spin resonance, ESR, and nuclear magnetic resonance, NMR. Local magnetic measurements offer a better criterion of the metallic properties of such organic substances than electrical conductivity, because of the short mean free path of the charged particles which they contain. The order of magnitude of the mean free path is in these cases only of the order of the lattice constant of the single crystal, supposing that this single crystal is chemically pure and mechanically perfect. The temperature dependence of the molar magnetic susceptibility of $(FA)_2PF_6$ can be divided into three temperature ranges. There is the 'metallic' high temperature phase above 190K, the range between 120 to 180K, and the range below 120K. Below 120K there is a difference between the temperature dependence of the total susceptibility and that of the paramagnetic ESR-susceptibility. (15 refs.) *R.S.*

102761 A ^{13}C-NMR study of the microstructure of polyphenylacetylenes prepared with $MoCl_5$ and WCl_6. V.Percec (Dept. of Macromolecular Sci., Case Western Reserve Univ., Cleveland, OH, USA), R.L.Rinaldi.
Polym. Bull. (Germany), vol.9, no.10-11, p.548-55 (April 1983).
The microstructure of polyphenylacetylenes prepared with $MoCl_5$ and WCl_6 catalysts in several solvents was studied by ^{13}C-NMR spectroscopy. Use of $^{13}C\{^1H\}$ INEPT (insensitive nuclei enhanced by polarization transfer) experiment aids the resonance assignments of cis, trans and cyclohexadiene structural units. The NMR spectral data confirm previous findings regarding the roles of isomerization prior to double bond formation and thermal isomerization after double bond formation in the mechanism responsible for the control of polymer microstructure and molecular weight. (20 refs.)

102762 ^{13}C-NMR studies of thermally isomerized polyphenylacetylenes prepared with $MoCl_5$ and WCl_6 catalysts. V.Percec, P.L.Rinaldi (Case Western Reserve Univ., Cleveland, OH, USA).
Polym. Bull. (Germany), vol.9, no.12, p.582-7 (May 1983).
^{13}C-NMR studies of thermally treated polyphenylacetylenes (PPA) prepared with $MoCl_5$ and WCl_6 catalysts provide evidence for intramolecular cyclization and chain scission of both cis and trans polymers. The microstructures of thermally treated cis and trans PPA are different from the microstructure of trans PPA obtained by thermal isomerization during propagation. (20 refs.)

102763 Density of states at each carbon layer of K-intercalated HOPG compounds-high resolution ^{13}C NMR experiment. K.Kume, Y.Maniwa (Dept. of Phys., Tokyo Metropolitan Univ., Tokyo, Japan), H.Suematsu, S.Tanuma.
Solid State Commun. (USA), vol.47, no.7, p.537-40 (Aug. 1983).
The authors have observed high resolution ^{13}C NMR spectra in K-intercalated stages 2,3,4 and 6 HOPG compounds. The sample was a block itself or sliced one of HOPG. From T_1T of each resolved line they obtained a distribution of density of states $N(E_F)$ at the Fermi level among the graphite layers. (17 refs.)

102764 Pressure effects on the quadrupole coupling constant of ^{7}Li in first stage lithium graphite. C.Marinos, S.Plesko, J.Jonas (Dept. of Chem., Univ. of Illinois, Urbana, IL, USA), J.Conard, D.Guerard.
Solid State Commun. (USA), vol.47, no.8, p.645-9 (Aug. 1983).
The pressure dependence of the experimental ^{7}Li NMR spectra is reported for first stage lithium graphite (LiC_6) intercalation compound at temperatures $T=232$ and 293K. This experiment together with the presented point charge model calculation of the ^{7}Li quadrupole coupling constant (e^2qQ/h) allows an unambiguous determination of the sign of e^2qQ/h which is negative: $e^2qQ/h=-52$ kHz at $p=1$ bar and $T=232$K. The averaged location of the electrons transferred from the Li intercalant to the graphite layers, as estimated in this study, is in excellent agreement with earlier theoretical energy-band calculations. The compressibility of LiC_6 in the c-direction is predicted to be $k_c=1.7 \times 10^{-12}$ cm^2 dyn^{-1}, it agrees with estimates derived from the available phonon dispersion relations. (20 refs.)

102765 Solid-state multiple-pulse proton NMR studies of doped poly(*p*-phenylene). J.B.Miller, C.Dybowski (Dept. of Chem., Univ. of Delaware, Newark, DE, USA).
Synth. Met. (Switzerland), vol.6, no.1, p.65-8 (June 1983).
Reports studies of the proton resonance in poly(*p*-phenylene) using multiple-pulse NMR techniques which indicate that these techniques may be useful for probing the environment of such doped conductive polyphenylenes. Many substances have been found to be good dopants for PPP, including electron donors such as metal naphthylides and the pure metals and alloys of lithium, sodium, and potassium, and electron acceptors such as arsenic pentafluoride, antimony pentachloride, fluorosulfonic acid, iodine pentafluoride, and ferric chloride. The authors' studies include PPP doped with all of these except arsenic pentafluoride, the metal alloys, and lithium. (10 refs.)

The NMR-laser — a nonlinear solid state system showing chaos ....See Entry 100775

Elastic constants and structure of the vitreous system H_2O-P_2O_5 ....See Entry 101574

Solvent induced crystallization of syndiotactic poly(methyl methacrylate). Relation to the formation of polymer aggregates in solution. [NMR and IR spectra] ....See Entry 101597

Tetramethyldithiadiselenafulvalene (TMDTDSF): properties of its hexafluorophosphate salt and alloys with tetramethyltetraselenafulvalene ....See Entry 101681

Phase transitions in polypeptide liquid crystals: a reentrant isotropic phase ....See Entry 101965

A four-sublattice model for solid ^{3}He ....See Entry 102111

Hyperfine fields of ^{11}B in ferromagnetic $R_ERh_4B_4$ (R_E=Gd,Tb,Dy,Ho) ....See Entry 102332

Magnetic resonance of the B_2O_3-Na_2O-MoO_3 vitreous system ....See Entry 102740

NMR imaging [computerized tomography] ....See Entry 104106

76.60C Chemical and Knight shifts

102766 ^{15}N NMR chemical shifts in solid NH_4^+ salts. C.I.Ratcliffe, J.A.Ripmeester, J.S.Tse (Div. of Chem., Nat. Res. Council of Canada, Ottawa, Canada).
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.177-80 (29 July 1983).
^{15}N NMR CP/MAS spectra of solid NH_4^+ salts show substantial chemical shift differences. Ab initio calculations indicate that changes in NH_4^+ geometry and anion environment can account for the range of shifts. (14 refs.)

102767 Hydrogen bonding and conformational effects on ^{13}C NMR chemical shifts of hydroxybenzaldehydes in the solid state. F.Imashiro, S.Maeda, K.Takegoshi, T.Terao, A.Saika (Dept. of Chem., Kyoto Univ., Kyoto, Japan).
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.190-2 (29 July 1983).
In high-resolution solid-state CP/MAS ^{13}C NMR spectra of several hydroxybenzaldehydes, the downfield shifts due to hydrogen bonding for the carbonyl carbons are found to vary inversely with the O...O hydrogen-bond distances. Conformations of the aldehyde groups in the solid state are determined by the chemical shifts of the orthocarbons. (14 refs.)

Muon trapping and Knight shift at a dilute structural defect in zinc ....See Entry 102795

Gas-liquid chromatographic and nuclear magnetic resonance study of haloform+di-*n*-alkyl ether+*n*-alkane mixtures at 30°C ....See Entry 103576

76.60E Relaxation effects

102768 Nuclear magnetic relaxation of water nuclei. A study on anisotropic behavior. C.W.R.Mulder, J.Schriever, J.C.Leyte (Dept. of Phys. Chem., Univ. of Leiden, Leiden, Netherlands).
J. Phys. Chem. (USA), vol.87, no.13, p.2336-42 (23 June 1983).
Nuclear magnetic relaxations of the three water nuclei (^1H, ^2H, and ^{17}O) are studied theoretically. A graphical presentation of the relative relaxational behavior of the water nuclei is given and conclusions are drawn with respect to detectability of anisotropic motion by NMR and the usefulness of ^{17}O-enriched samples to analyze such motion. (21 refs.)

102769 Nuclear magnetic relaxation of solvent nuclei in concentrated aqueous poly(methacrylic acid) solutions. C.W.R.Mulder, J.Schriever, W.J.Jesse, J.C.Leyte (Dept. of Phys. Chem., Univ. of Leiden, Leiden, Netherlands).
J. Phys. Chem. (USA), vol.87, no.13, p.2342-8 (23 June 1983).
The nuclear magnetic relaxation times of the water nuclei, i.e. ^1H, ^2H, and ^{17}O, and the polymer protons have been measured in concentrated, aqueous, fully neutralized solutions of three isotopically different forms of poly(methacrylic acid) (PMA, fully protonated, CD_2 deuterated, and fully deuterated). From these results it could be shown that cross relaxation between the polymer and water proton fractions is not important in the systems investigated. The relaxation rates of the three nuclei of the water molecules have been used to investigate the solvent microdynamics using isotropic and anisotropic models for the water motion in the concentrated polyelectrolyte solutions. (31 refs.)

102770 Effect of methyl-group reorientation and spin diffusion on spin-lattice relaxation in some choline and acetylcholine halides. F.Koksal, S.Bahceli (Dept. of Phys., Ankara Univ., Ankara, Turkey).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.7, p.1107-12 (July 1983).
Spin-lattice relaxation times (T_1) have been measured as a function of temperature for polycrystalline choline chloride and acetylcholine chloride, bromide and iodide. Choline chloride has a single minimum in T_1, but two minima for acetylcholine chloride and bromide have been observed. The T_1 results have been interpreted by considering the reorientational motions of methyl groups about C_3 axis and their role of behaving as sinks to rapid spin diffusion of the other protons in the compounds. The two minima in acetylcholine halides have been shown to be due to the two types of methyl groups in their structures. The activation energies for reorientational motions of methyl groups have been determined. (13 refs.)

102771 Inter and intramolecular contributions to the proton dipolar and rotating frame spin-lattice relaxation times in the nematic phase of the liquid crystal 5*CB*-d_{11}. J.S.Lewis, E.Tomchuk (Dept. of Phys., Univ. of Winnipeg, Winnipeg, Manitoba, Canada), E.Bock.
Mol. Cryst. & Liq. Cryst. (GB), vol.97, no.1-4, p.387-96 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
As isotopic dilution study of the proton dipolar and rotating frame spin-lattice relaxation times (T_{1D} and T_{1p}) in the nematic liquid crystal 4-cyano-4′-*n*-pentyl-d_{11}-diphenyl (5*CB*-d_{11}) at 13.8 MHz over the nematic phase temperature range was used to separate the intermolecular and intramolecular contributions to the ring proton relaxation rates. Combined with an earlier proton study in inter/intra Zeeman spin-lattice relaxation (T_1) in 5*CB*-d_{11}, these data permit a critical study of the soft-mode dynamics in the system. A qualitative explanation of the T_{1D} results is presented, but a complete explanation of the T_{1p} results is not possible with existing theory. (13 refs.)

102772 Nuclear quadrupolar relaxation and association in liquid In-Sb. M.Elwenspoek, P.Maxim, R.Brinkmann, E.Weihreter, D.Quitmann (Inst. fur Atom- und Festkorperphys., Freie Univ., Berlin, Germany).
Phys. Lett. A (Netherlands), vol.96A, no.8, p.435-8 (25 July 1983).
A thermodynamic model of associates is applied to discuss the large increase of nuclear quadrupolar relaxation rate R_Q found in many liquid alloys with compound-forming tendency, by considering the concentration and lifetime of associates. Data for concentration and temperature dependence of R_Q of Sb in $In_{1-c}Sb_c$ are presented and explained by known thermodynamic properties of the alloy; a characteristic time of the order of 10^{-11} s is estimated. (23 refs.)

102773 Enhanced nuclear acoustic resonance in $HoVO_4$. B.Bleaney (Clarendon Lab., Univ. of Oxford, Oxford, England), G.A.D.Briggs, J.F.Gregg, G.H.Swallow, J.M.R.Weaver.
Proc. R. Soc. London Ser. A (GB), vol.388, no.1795, p.479-86 (8 Aug. 1983).
A strong resonant absorption is observed for longitudinal acoustic waves at 800 MHz, propagated along the [100] axis of a single crystal of the enhanced nuclear paramagnet $HoVO_4$, in the presence of a magnetic field in the (001) plane. The strength of the resonant absorption is inversely proportional to the absolute temperature T, with a power attenuation coefficient of $45(1)\times10^2T^{-1}$ m^{-1}. From this and the measured velocity of $6.52(6)\times10^3$ m s^{-1}, a rate of $10^{-3}T$s^{-1} is deduced for the intrinsic direct spin-lattice relaxation process. This is orders of magnitude smaller than the Orbach rate (10^{+4} to 10^{+5} s^{-1} at $T=3$K), and slower than the measured rate at 0.2K, that must therefore be attributed to the presence of paramagnetic impurities. (7 refs.)

102774 Molecular dynamics in the ternary intercalation compounds of graphite with potassium and benzene. A.L.Blumenfeld, E.I.Fedin, Yu.V.Isaev, Yu.N.Novikov (Inst. of Organoelement Compounds, Acad. of Sci., Moscow, USSR).
Synth. Met. (Switzerland), vol.6, no.1, p.15-23 (June 1983).
The proton spin-lattice relaxation was studied in the ternary graphite intercalation compound (GIC) $KC_{24}(C_6H_6)_{2.8\pm0.2}$. The relaxation was governed by the reorientations of the benzene molecules, and two types of benzene molecules with different reorientation behaviour were observed in this compound. In the thermal decomposition product of $KC_{24}(C_6H_6)_{2.8\pm0.2}$ the relaxation proceeded via the paramagnetic centers. (11 refs.)

102775 NMR and ESR studies of an undoped conjugated polymer: poly-*p*-phenylene. F.Barbarin, G.Berthet, J.P.Blanc, C.Fabre, J.P.Germain, M.Hamdi, H.Robert (Lab. d'Electronique et Resonance Magnetique, Univ. de Clermont II, Aubiere, France).
Synth. Met. (Switzerland), vol.6, no.1, p.53-9 (June 1983).
Magnetic property measurements (ESR, NMR and DNP) of an undoped aromatic conjugated polymer, poly-*p*-phenylene, have been improved. This analysis was performed on samples synthesized in three different ways. ESR studies at 10 GHz and 35 GHz show that paramagnetic defects strongly depend on the preparation mode and on the thermal treatment of the polymer. The NMR results suggest that two relaxation mechanisms occur in these materials. Moreover, DNP measurements indicate that the paramagnetic species are localized. (15 refs.)

T_1, nuclear Overhauser effects measurements in ^{13}C NMR spectroscopy: analytic relations for short equilibration delays .... See Entry 99140

Prototropic charge migration in water. II. Interpretation of nuclear magnetic resonance and conductivity data in terms of model mechanisms ....See Entry 103515

76.60G Quadrupole resonance

Phase transitions in 3,5-dichloropyridine .... See Entry 101960

76.60L Spin echoes

102776 Investigation of the nuclear echo phase in ferromagnetic cobalt. E.A.Glozman, V.K.Mal'tsev, A.E.Reingardt, V.I.Tsifrinovich (L.V. Kirenski Inst. of Phys., Acad. of Sci., Krasnoyarsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1207-9 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The nuclear echo phase is one of the most important characteristics of pulsed NMR. This phase was investigated for thin (~2000 Å) polycrystalline films of ferromagnetic cobalt. The magnetic-field dependence of the echo phase was determined by the behavior of the electron susceptibility. The shift of the echo phase was always twice as large as the shift of the phase of HF pulses applied to a film. (2 refs.) *A.T.*

102777 Molecular weight and temperature dependence of self-diffusion coefficients in polyethylene and polystyrene melts investigated using a modified NMR field-gradient technique. R.Bachus, R.Kimmich (Sektion Kernresonanzspektroskopie, Univ. Ulm, Ulm, Germany).
Polymer (GB), vol.24, no.8, p.964-70 (Aug. 1983).
Self-diffusion in polyethylene and polystyrene melts has been investigated using a modified NMR field-gradient technique. In both polymer examples, self-diffusion coefficients were found to be proportional to $M_W^{-2.0\pm0.1}$ above and below the critical molecular weight M_c. The observation of undeuterated chains in deuterated matrices of varying chain length indicates only relatively weak matrix effects. The influence of internal field gradients, which have previously been reported for polyethylene melts is demonstrated and discussed. Certain peculiarities have been observed in the temperature dependences of the diffusion coefficients. (34 refs.)

Spin-glass behavior as a fuction of concentration and local order by NMR in nearly random NiMn systems .... See Entry 102651

76.70 MAGNETIC DOUBLE RESONANCES AND CROSS EFFECTS

76.70D Electron-nuclear double resonance (ENDOR)

102778 Progress in the analysis of defect structures with ENDOR spectroscopy. J.R.Niklas (Univ. of Paderborn, Paderborn, Germany).
Radiat. Eff. (GB), vol.72, no.1-4, p.39-53 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
Summarizes progress made in analysing defect structures. For this electron spin resonance has long been a standard tool. However, its applicability is often very limited due to its insufficient power to resolve hyperfine structures, necessary to determine defect structures. Nuclear magnetic resonance provides high resolution, but insufficient sensitivity. The combination of both, electron nuclear double resonance (ENDOR), turned out to be the most powerful technique. However, complicated systems with low symmetry or with several types of defects present simultaneously usually yield very complex ENDOR spectra which cannot be analysed using 'conventional' methods. Considerable progress was made by improving the experimental methods including computer assistance, processing of the data and novel ENDOR measurement techniques. The application and advantages of methods like ENDOR-induced ESR and DOUBLE ENDOR are demonstrated using several recent examples. (57 refs.)

102779 Triple resonance investigation of F centres in BaFCl. R.Bauer, J.R.Niklas, J.M.Spaeth (Univ.-Gesamthochschule Paderborn, Paderborn, Germany).
Radiat. Eff. (GB), vol.72, no.1-4, p.287-92 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
In BaFCl two types of F centres can be produced, where the electron occupies a Cl^- vacancy [$F(Cl^-)$-centres] or an F^- vacancy [$F(F^-)$-centres]. When producing $F(F^-)$-centres the simultaneous production of $F(Cl^-)$-centres cannot be avoided. Both ESR spectra overlap strongly. The ENDOR spectra contain very many lines of both centres and have a very complicated angular dependence. It is shown that the angular dependence of the ENDOR spectra of both F centres can be measured separately by applying a double ENDOR technique (called also triple resonance). The ratio of the signal heights of the ENDOR lines compared to the double ENDOR lines is characteristic for the neighbour shell to which the nuclei involved belong. The use of this effect for the analysis of the spectra and its explanation are discussed. (8 refs.)

76.70E Dynamical nuclear polarization

NMR and ESR studies of an undoped conjugated polymer: poly-*p*-phenylene ... .See Entry 102775

76.70H Optical double magnetic resonance (ODMR)

102780 Energy transfer effects in ODMR spectra: a possible source of misinterpretation. J.J.Davies (Dept. of Phys., Univ. of Hull, Hull, England).
J. Phys. C (GB), vol.16, no.23, p.L867-71 (20 Aug. 1983).
For ODMR spectra observed by monitoring the recombination emission from donor-acceptor pairs, it is usually assumed that signals which correspond to increases in emission intensity can be attributed to the donors and acceptors directly involved in the radiative transitions. It is shown that such an interpretation can be in error if energy transfer is important. (8 refs.)

102781 Optical detection of electron spin resonances via magnetic circular polarization of F-center emission. N.Akiyama, Y.Mori, H.Ohkura (Dept. of Appl. Phys., Osaka City Univ., Osaka, Japan).
Radiat. Eff. (GB), vol.72, no.1-4, p.277-81 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
A new method for the optical detection of electron spin resonance, ESR, for both ground and relaxed excited states of F centers has been tested for KBr,

KI and RbCl using microwave radiation at 49.8 GHz and detecting the microwave-induced change in magnetic circular polarization of F center emission. The g-values and half-widths are tabulated. The dependence of ESR signal intensities of KBr on microwave power, laser power, and pumping photon energy are measured and explained in terms of forms derived from the solutions of rate equations for the optical pumping cycle proposed. (12 refs.)

Magnetic properties of optically excited states of colour centres .... See Entry 101696

Defect characterization in III-V compounds by ESR .... See Entry 102746

A study of recombination centres in $YAlO_3$, $EuAlO_3$, $LaAlO_3$ and Y_2O_3 using ODMR .... See Entry 102947

76.80 MÖSSBAUER EFFECT; OTHER GAMMA-RAY SPECTROSCOPY

102782 Influence of Sn, V, Cr, Mo, Nb and Ta admixtures on the local environment of Fe impurity atoms in α-Zr. V.V.Igrushin, V.G.Kirichenko, I.A.Petel'guzov, V.V.Chekin (A.M. Gorki State Univ., Kharkov, Ukrainian SSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1143-9 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The Mossbauer effect in the ^{57}Fe nuclei at 4.2, 80 and 290K was used to identify iron-bearing phases in zirconium-rich Zr-Fe-Me alloys (Me=Sn, V, Cr, Mo, Nb, Ta) and also in Zr-Fe alloys subjected to various heat treatments. The concentrations of Fe and Me were 1 wt.% each. In the case of the Zr-Fe system the majority of the iron atoms formed the Zr_2Fe phase, whereas in Zr-Fe-V and Zr-Fe-Cr most of the atoms were in $Zr(Fe,V)_2$ and $Zr(Fe,Cr)_2$ mixed phases; the dominant phases in Zr-Fe-Mo were $(Zr,Mo)_2Fe$ and $(Zr,Mo)Fe_2$, in Zr-Fe-Nb they were $(Zr,Nb)_2Fe$ and $(Zr,Nb)Fe_2$, and in Zr-Fe-Ta there was one dominant phase $(Zr,Ta)Fe_2$. The influence of the third element on the local environment of the iron atoms in zirconium was attributed to the characteristic features of the process of crystallization of binary and ternary zirconium-base alloys. (18 refs.) *A.T.*

102783 Mossbauer spectroscopic study of the magnetic relaxation in tris(β-diketonato)iron(III) complexes. S.Yamauchi, Y.Sakai, H.Nishioji, T.Tominaga (Dept. of Chem., Univ. of Tokyo, Tokyo, Japan).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.7, p.977-9 (July 1983).
Mossbauer spectra of eleven kinds of tris (β-diketonato)iron(III) complexes were measured in order to investigate the magnetic relaxation effects. A correlation was observed between the Mossbauer line shape (linewidth) and the average iron-iron distance in crystals, mainly arising from the spin-spin relaxation. The dependency of line shape on temperature was also studied to check the contribution of the spin-lattice interaction. (14 refs.)

102784 Preparation, magnetic and Mossbauer resonance investigation of some perovskite-type oxides containing iridium +V. M.Walewski (Ecole Polyech. de Gdansk, Gdansk, Poland), B.Buffat, G.Demazeau, F.Wagner, M.Pouchard, P.Hagenmuller.
Mater. Res. Bull. (USA), vol.18, no.7, p.881-7 (July 1983).
New Ir(+V) perovskites of formula $MLaMgIrO_6$ (M=Ca, Sr, Ba) have been prepared under high oxygen pressure. The stabilization of Ir(+V) thanks to competition between Ir-O and Mg-O bonds is discussed and compared to that observed for La_2LiIrO_6. Magnetic and Mossbauer resonance measurements allow one to characterize iridium in the materials, which contain some Ir(+IV). (9 refs.)

102785 Lattice instability and γ-recoil effects in HfV_2 lattice. H.C.Jain, M.A.A.Saad (Tata Inst. of Fundamental Res., Bombay, India).
Phys. Lett. A (Netherlands), vol.96A, no.8, p.419-21 (25 July 1983).
The phenomenon of hysteresis and a temperature-dependent electric field gradient at the cubic Hf site have been observed in the superconducting cubic Laves phase (C15) compound HfV_2 which shows lattice instability below 120K. These observations suggest the presence of γ-recoil effects and fluctuating microdomains in the cubic phase of this compound above 120K. (8 refs.)

102786 A Mossbauer study of potassium ferric alum. J.M.Roberts (Dept. of Phys., Univ. of Exeter, Exeter, England).
Phys. Lett. A (Netherlands), vol.96A, no.8, p.428-30 (25 July 1983).
The first temperature-dependent Mossbauer spectra from polycrystalline samples of KFe alum are presented. The FWHM varies considerably with temperature. Application of isotropic relaxation theory suggests that the variation is caused by a change in electron relaxation time due to competition between spin-spin and spin-lattice relaxation processes. (10 refs.)

102787 Spectral distribution of Mossbauer radiation in the presence of non-stationary lattice relaxation processes. A.Gupta (Dept. of Phys., Univ. of Indore, Indore, India).
Phys. Lett. A (Netherlands), vol.96A, no.8, p.431-4 (25 July 1983).
A general expression for the spectral distribution of gamma-rays emitted from nuclei in bound systems has been derived which is applicable even in the presence of non-stationary relaxation processes associated with atomic motion. The expression has been used to calculate the effect of a relaxing thermal spike on the Mossbauer spectral shape. (11 refs.)

102788 Gamma quantum resonance scattering in crystals being irradiated by a laser wave. V.G.Baryshevsky (Dept. of Phys., V.I. Lenin State Univ., Minsk, Belorussian SSR).
Phys. Lett. A (Netherlands), vol.96A, no.8, p.439-42 (25 July 1983).
It is shown that a laser wave can essentially modify the absorption length of a γ quantum being resonantly scattered by crystal nuclei. (9 refs.)

102789 Mossbauer and DTA studies of the crystallisation of borosilicate glasses. T.Nishida, T.Hirai, Y.Takashima (Dept. of Chem., Kyushu Univ., Fukuoka, Japan).
Phys. & Chem. Glasses (GB), vol.25, no.5, p.113-6 (Oct. 1983).
Continuous decreases in quadrupole splitting for Fe^{3+} were observed by isothermal annealing of a series of borosilicate glasses denoted by xR_2O, $100-x(B_2O_3, SiO_2)$, $7Fe_2O_3$, in which R denotes Na, K, Rb, or Cs, at temperatures below the individual glass transition temperatures. The decrease is ascribed to an increased symmetry around Fe^{3+} caused by the diffusion of alkali metal ions and rearrangement of oxygen atoms. Activation energies concerned with the decrease in the quadrupole splitting were found to increase in the order Cs, Rb, K, Na when the alkali content of the glasses was constant. The increase is ascribed to an increasing electrostatic force between the alkali metal ion and the oxygen atom with decreasing ionic radius of the alkali metal ion. It was also found that the activation energies increased with increasing alkali content, and this is ascribed to an increasing fraction of nonbridging oxygens in the glasses. Decreases in quadrupole splitting and linewidth (FWHM) were also observed by isothermal annealing experiments at temperatures above the glass transition temperature. The decrease is attributed to a rearrangement of network formers such as B, Si, and Fe as well as of the oxygens and the alkali metal ions. (12 refs.)

102790 Magnetic properties and hyperfine interactions in concentrated Fe-Ag alloys. C.L.Chien, K.M.Unruh (Dept. of Phys., Johns Hopkins Univ., Baltimore, MD, USA).
Phys. Rev. B (USA), vol.28, no.3, p.1214-18 (1 Aug. 1983).
Fe and Ag, mutually insoluble in both the liquid state and the solid-state, are two elemental with no previously known alloys and compounds. Using a vapor-quench technique, the authors have fabricated, for the first time, noncrystalline, concentrated Fe-Ag alloys. The first measurements of the magnetic properties and hyperfine interactions of Fe-Ag in the solid state are reported. The successful fabrication of these alloys suggests that the vapor-quench method can be used to form other previously inaccessible alloys based on mutually insoluble components. (19 refs.)

102791 Formation of two-impurity complex in dilute alloys observed through perturbed angular correlations of γ rays. A.Z.Hrynkiewicz, K.Krolas (Inst. of Phys., Jagellonian Univ., Cracow, Poland).
Phys. Rev. B (USA), vol.28, no.4, p.1864-9 (15 Aug. 1983).
Interaction between two soluble impurities in metal hosts leads to a nonrandom distribution of the impurity atoms among the lattice sites. The number of the nearest-neighbor impurity-impurity pairs is discussed. It is shown how both the binding energy and the entropy of formation can be extracted for the two-impurity complex from the number of these complexes measured as a function of temperature. The method is illustrated by the perturbed-angular-correlation experiment with ^{111}In in dilute alloys of Cu, Ag, and Au with Pt impurity. The entropy of formation found for the In-Pt pair in Cu, Ag, and Au hosts agrees very well with the number of ways in which the pair can be formed in the FCC lattice. The In and Pt impurities are bound, with the binding energy depending significantly on the host. (12 refs.)

102792 Next-nearest neighbour effects in the Mossbauer spectra of Cr-spinels: An application of partial quadrupole splittings. G.M.Bancroft, M.D.Osborne, M.E.Fleet (Depts. of Chem. & Geology, Univ. of Western Ontario, London, Ontario, Canada).
Solid State Commun. (USA), vol.47, no.8, p.623-5 (Aug. 1983).
Mossbauer spectra of $Fe(Cr,Al)_2O_4$ spinels are reported and interpreted using partial quadrupole splitting theory. Fe^{2+} T site quadrupole splittings are calculated for different next-nearest neighbour configurations. Assuming random distribution of the Cr^{3+} and Al^{3+} in the octahedral M sites, good semiquantitative agreement between calculated and observed quadrupole splittings and absorption intensities is obtained. (18 refs.)

102793 ^{151}Eu Mossbauer studies on graphite-$EuCl_3$. P.Boolchand, G.Lemon, W.Bresser, D.McDaniel (Univ. of Cincinnati, Cincinnati, OH, USA), R.E.Heinz, P.C.Eklund, E.Stumpp, G.Nietfeld.
Intercalated Graphite. Proceedings of a Symposium, Boston, MA, USA, 1-3 Nov. 1982 (New York, USA: North-Holland 1983), p.393-6
^{151}Eu Mossbauer experiments on $EuCl_3$-$AlCl_3$ graphite flakes and HOPG samples have been performed as a function of temperature in the range $4.2K<T<300K$ and indicate the presence of a narrow line characteristic of Eu^{3+}. No evidence of Eu^{2+} was found. This suggests that enhanced conductivity of graphite upon intercalation with rare earth chlorides derives from a transfer of charge to the co-intercalated Cl. (10 refs.)

A simple inexpensive cryostat for measurement of Mossbauer spectra from 77K to 300K .... See Entry 99107

On a certain inverse problem in γ-acoustic spectroscopy .... See Entry 99245

The influence of fluorine upon the structural, chemical, and physical properties of phosphate glasses .... See Entry 101562

On chalcogenide-iodates of antimony SbXI (X=Si, Se, Te): structure and Mossbauer spectra of ^{121}Sb .... See Entry 101653

Nature of defects in heavily Te-doped GaAs .... See Entry 101710

Iron-ion−implantation effects in MgO crystals .... See Entry 101730

Reduced paramagnetism in γ-cerium .... See Entry 102620

Influence of V on the Fe site spin and charge densities in BCC-iron .... See Entry 102653

Differential incoherent scattering cross sections of 661.6 keV gamma rays in elements derived from differential incoherent scattering cross sections in compounds .... See Entry 102983

Spectroscopic standard for tetrahedrally coordinated ferric iron: γ $LiAlO_2$:Fe^{3+} .... See Entry 102999

Youngs modulus and linear expansion coefficient anomalies in 18Cr8Ni and 18Cr25Ni alloys at low temperatures .... See Entry 103190

Effect of the conditions of synthesis and heat-treatment regime on the magnetic properties of iron sulfides with a Curie temperature of 570°C .... See Entry 104341

76.90 OTHER TOPICS IN MAGNETIC RESONANCES AND RELAXATION

(inc. muon probe studies)

102794 Muons and muonium in solids. A.M.Stoneham (Theoretical Phys. Div., AERE, Harwell, England).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.449-59 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
A muon is a very special probe of solids, since its spin polarisation can be monitored to define its behaviour in the solid: the site it occupies, the local magnetic field it experiences, and the time-dependence of the local field. The muon is a sensitive, robust and (since resonance is exploited) accurate probe. If its application has left many ambiguities of interpretation, these have usefully eliminated complacency from several areas of solid-state studies. The author surveys how muons can be exploited both as a probe of the host solid and as a unique analogue of hydrogen in topics as varied as spin glasses, phase transitions and quantum diffusion. (26 refs.)

102795 Muon trapping and Knight shift at a dilute structural defect in zinc. F.N.Gygax, A.Hintermann, W.Ruegg, A.Schenck, W.Studer, A.J.van der Wal (Lab. of High Energy Phys., Swiss Inst. for Nuclear Res., Villigen, Switzerland), H.Wehr.
Phys. Rev. Lett. (USA), vol.51, no.6, p.505-8 (8 Aug. 1983).
The interaction of a light hydrogen isotope with a structural defect is traced by means of the temperature dependence of the muon Knight shift K_μ in the HCP metal Zn. A surprising result is the huge and negative K_μ (-520 ppm) at the defect site, probably a multivacancy cluster. (13 refs.)

77.00 DIELECTRIC PROPERTIES AND MATERIALS

(for conductivity phenomena, see 72.20 and 72.80)

77.20 PERMITTIVITY

102796 Correlation of changes in the electrical conduction and dielectric constant in naphthalene due to magneto-electret formation. A.K.Bhatnagar, M.L.Khare, C.S.Bhatnagar (Dept. of Phys., MA Coll. of Technol., Bhopal, India).
Indian J. Pure & Appl. Phys., vol.21, no.6, p.365-7 (June 1983).
Electrical conductivity of naphthalene is measured at different voltages before and after its magneto-electret formation. It is observed that electrical conduction decreases by 5-20%, depending on the forming parameters of magneto-electret. The variation of percentage decrease in electrical conduction with forming temperature closely follows the variation of percentage increase in dielectric constant with the forming temperature. An attempt is made to correlate the two phenomena. (6 refs.)

102797 Dielectric dispersion and dynamics near the transition temperature in crystalline ammonium hydrogen bischloroacetate. R.Jakubas, H.A.Kolidziej (Inst. Chem., Uniwersytet Wroclawski, Wroclaw, Poland), S.Sorriso.
J. Phys. C (GB), vol.16, no.21, p.L761-5 (30 July 1983).
Dielectric permittivity and losses measurements were carried out on crystalline ammonium hydrogen bis-chloroacetate in the frequency range 100-2000 MHz near the transition temperature. The observed dielectric relaxation process was nearly monodispersive. From the analysis of the various experimental results it is suggested that the most probable model of the transition observed in this crystal is the so-called pseudo-spin lattice coupled model given by Nath and co-workers (1979). (13 refs.)

102798 Enhancement of the dielectric constant near a percolation threshold. D.Wilkinson, J.S.Langer, P.N.Sen (Schlumberger-Doll Res. Center, Ridgefield, CT, USA).
Phys. Rev. B (USA), vol.28, no.2, p.1081-7 (15 July 1983).
When one of the components of a mixture of two materials is a conductor, geometrical effects can lead to a dielectric constant for the mixture which is much greater than that of either constituent. Here the authors illustrate a simple example of this effect in a two-dimensional network consisting of randomly placed conductors and capacitors. The dielectric enhancement is obtained as a function of frequency and the concentration of conductors. The calculational technique used is the position-space renormalization group in which smaller units are combined iteratively to form larger units. (19 refs.)

102799 Improved wideband coaxial methods for dielectric measurements on nitrogen ceramics. A.B.Ahmad.
Univ. Durham, England thesis, March 1983
Two methods of measuring the dielectric properties of materials—matched termination and coaxial line resonance—have been developed and used to study the properties of two groups of nitrogen ceramics, namely, silicon nitrides and oxynitride glasses. In these methods advantage is taken of the wide frequency range, from 500 MHz up to about 9 GHz, covered by a single apparatus—the General Radio slotted coaxial line. The silicon nitride ceramics were in various degrees of nitridation given by the weight gain which ranged from 38% for partially-nitrided to a maximum of 63.2% for the fully-nitrided samples. The dielectric constant at 1 GHz increased from 4.51 for fully-nitrided to about 9.9 for the 38% weight gain samples. The fully-nitrided material has a loss factor of 7.6×10^{-3}; this increased to 1.85×10^{-1} as the weight gain decreased to 38%. These values have been extrapolated to 'zero weight gain' and compared with pure silicon for which the dielectric constant is 11.7 and the loss factor approximately 0.2. The oxynitrides have dielectric constants between 6.5 and 7.5 depending on the cation present and the percentage of nitrogen substituted for oxygen in the glasses. ϵ' increased in the cation order Mg, Y, Ca and increased with increasing nitrogen substitution in each cation series. The loss factor, however, depends not only on these cation types but also on the other constituents of the glasses.

Dielectric anisotropy of nematic liquid crystals at centimeter wavelengths .... See Entry 99128

Use of an immersion method to measure the dielectric constant of glassy semiconductors .... See Entry 99136

Carrier dependent parameters in a silicon optical waveguide . See Entry 100888

Evaluation and meaning of ionic and dipolar lattice sums ...... See Entry 101627

Some applications of conditionally convergent lattice sums ... See Entry 101629

Semiconductor dynamics from first principles: Phonons, forces, and dielectric properties .... See Entry 101876

Propagation of strong electromagnetic waves in Kane semiconductors .... See Entry 102398

Magnetically induced spatial dispersion of crystals in the exciton region of the spectrum .... See Entry 102724

The electret effect in water vapour condensates and phase transformation in ice .... See Entry 102801

Dielectric relaxation studies in pure lutidines at different microwave frequencies .... See Entry 102809

Conduction and dielectric polarization in neodymium fluoride thin films .... See Entry 102818

Effect of CuO addition on the electrical and dielectrical properties of semiconducting barium titanate ceramics .... See Entry 102826

The influence of foreign ions impurities on the dielectric properties of TGS-like crystals .... See Entry 102832

Scanning electron microscopic investigations of peculiarities of the $BaTiO_3$ ferroelectric domain contrast .... See Entry 102834

Lattice vibration spectra XXXIII. Far-infrared reflection spectra, TO and LO phonon frequencies, optical and dielectric constants, and effective charges of the spinel-type compounds MCr_2S_4 (M=Mn, Fe, Co, Zn, Cd, Hg), MCr_2Se_4 (M=Zn, Cd, Hg), and MIn_2S_4 (M=Mn, Fe, Co, Ni, Cd, Hg) .... See Entry 102873

A simple best fit method for the far infrared reflectivity spectra by using the four-parameter semi-quantum model: application to the sodium nitrite spectrum .... See Entry 102883

Development of methods of nondestructive quality control for ferrofluids .... See Entry 103435

Effect of dielectric constant on EDTA-metal chelates—an ultrasonic study .... See Entry 103503

77.30 POLARIZATION AND DEPOLARIZATION EFFECTS

102800 'Ionic polarization' in real FCC alkali halide crystals. I. Analysis of ionic polarization on the basis of three-positional Lidiard's model. J.Pozniak (Inst. for Low Temperature & Structure Res., Polish Acad. of Sci., Wroclaw, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.1, p.21-9 (July 1983).
The ionic polarization denotes the polarization induced by a DC electric field related to thermally stimulated jumps of free charge carriers in ionic crystals. The calculations were performed on the basis of the rate equations for the three-positional Lidiard's model in which the probability of thermally stimulated jumps of ions and vacancies in terms of jump frequencies and the potential barriers separating the individual positions were considered. The solutions obtained point to the formation of a space charge. In further steps the density of the isothermal depolarization current and thermally stimulated ionic current density ITC were calculated. As the expressions obtained are applicable to any charge carrier one should expect that their contribution to the ionic conductivity during polarization would give rise to the appearance of appropriate ITC peaks. (10 refs.)

102801 The electret effect in water vapour condensates and phase transformation in ice. J.Chrzanowski, B.Sujak (Inst. of Experimental Phys., Univ. of Wroclaw, Wroclaw, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.1, p.107-13 (July 1983).
A correlation between the known phase transformations of ice cryocondensates and the generation of surface charges during condensation process of water vapour onto a cold substrate is discussed. The main source of the observed electret effect seems to be a low temperature polarization process of the molecular dipoles. Local changes of the dielectric permittivity associated with the first order phase transformations may affect the experimentally observed electret effect. (25 refs.)

102802 Electrical properties of polystyrene doped with leucomalachite green for correlation with its electrothermographic behaviour. P.K.C.Pillai, A.K.Gupta (Dept. of Phys., Indian Inst. of Technol., New Delhi, India).
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.397-9 (Aug. 1983).
The aim of the authors' work is to gain a better insight into the process of the electrothermographic behaviour of doped polystyrene (PS) films. Leucomalachite green (LMG)-doped films of PS form a good electrothermographic system where electrostatic image formation takes place by heat dissipation of electrical charges on corona charged surfaces. In addition to thermal sensitization on doping, significant changes in the electrical properties of PS have been observed. (6 refs.)

102803 Forces and torques acting on plane and cylindrical electrets in slot-effect transducers. A.Abazi, O.D.Jefimenko (Phys. Dept., West Virginia Univ., Morgantown, WV, USA).
J. Appl. Phys. (USA), vol.54, no.7, p.4076-82 (July 1983).
A theoretical discussion of forces and torques acting on electrets in slot-effect transducers of plane and cylindrical geometry is presented. Both bipolar and monopolar electrets are considered. The electrets are assumed to carry arbitrary internal and surface charges. The dependence of forces and torques on the magnitude and location of the charges and on other electret parameters is analyzed. (8 refs.)

102804 Thermally stimulated currents in polymers driven by temperature gradients. J.Sworakowski, M.T.Figueiredo, G.F.Leal Ferreira, M.Campos (Dept. de Fisica e Ciencia dos Materiais, Univ. de Sao Paulo, Sao Carlos, Sao Paulo, Brazil).
J. Appl. Phys. (USA), vol.54, no.8, p.4523-30 (Aug. 1983).
Nonisothermal currents were measured in poly(methyl methacrylate) and poly(tetrafluoroethylene) samples, not polarized with external fields before the measurements. The currents were attributed to thermally stimulated reorientation of dipoles driven by temperature gradients across the samples. Calculations, based on a model put forward in the paper, are shown to satisfactorily reproduce basic features of the experimental curves. It is suggested that the room temperature peak in poly (tetrafluoroethylene) is due to a pyroelectric effect and is associated with a reorientation of impurity dipoles during the phase transition. (28 refs.)

102805 Field due to a dipole in a polarisable molecular lattice. R.W.Munn, I.Eisenstein (Dept. of Chem., Univ. of Manchester Inst. of Technol., Manchester, England).
J. Phys. A (GB), vol.16, no.12, p.2853-9 (21 Aug. 1983).
The effective electric field due to a permanent dipole in an arbitrary Bravais lattice of polarisable non-polar molecules is expressed exactly, taking account of the different polarisability of the polar guest molecule. The asymptotic behaviour of the field at large distances from the dipole is evaluated. An interpretation is offered for the rescaled dipole moment required to give agreement with continuum dielectric theory. (20 refs.)

102806 Theoretical analysis of the dipole polarization and depolarization in Me^{++}-doped NaCl-type alkali halide crystals. II. Next-nearest neighbour approach. J.Pozniak (Inst. for Low Temperature & Structure Res., Polish Acad. of Sci., Wroclaw, Poland), G.Berg.
Phys. Status Solidi a (Germany), vol.78, no.1, p.69-76 (16 July 1983).
For pt.I see ibid., vol.38, p.115 (1976). A theoretical analysis of the relaxation processes of the dipoles is made on the basis of the classic Lidiard model (1955) assuming the presence of both nn and nnn dipoles in the crystal lattice. The calculated ITC curves distinctly change with the polarizing field intensity. At strong polarizing fields ($E_p \geq 10^6$ V cm^{-1}) the ITC curves are composed of two peaks while at weak fields ($E_p \leq 10^5$ V cm^{-1}) only one peak exists, however, even in the latter cases the shape of the ITC curve at the low-temperature side somewhat differs from that obtained for nn dipoles only. The concentration of ordered (by the polarizing electric field) nnn dipoles decrease with increasing temperature. The decay of the nn dipoles is preceded by a less or more distinct concentration raise. This effect suggests that a part of the nnn dipoles undergoes disorientation changes into oriented nn dipoles. (25 refs.)

102807 Microwave dielectric echoes in Na β-alumina. M.Von Schickfus (Max-Planck-Inst. fur Festkoperforschung, Stuttgart, Germany), U.Strom.
Phys. Rev. B (USA), vol.28, no.2, p.1068-75 (15 July 1983).
Microwave dielectric echoes have been observed in Na β-alumina at temperatures between 18 and 75 mK. The results provide further evidence for the existence of low-energy two-level tunneling systems (TLS). The TLS electric dipole moment p and density of states $\bar{P}$ were determined to be $p=4.8\pm0.8$ D and $\bar{P}=1.15\times10^{32}$ erg^{-1} cm^{-3}, respectively. The nonexponential time-dependent echo decay provides evidence for spectral diffusion. Previously proposed models incorporating spectral diffusion processes in echo decay are shown to approximate the observed time-decay rates at a given temperature. However, the observed dependence of the echo decay on temperature was much weaker than predicted by spectral diffusion models. (25 refs.)

102808 Electrical and dielectric properties of poly(vinylbutyral). III. Effect of iodine doping on thermally stimulated discharge behavior. P.C.Mehendru, S.Chand, N.Kumar (Nat. Phys. Lab., New Delhi, India).
Thin Solid Films (Switzerland), vol.105, no.2, p.103-6 (15 July 1983).
For pt.II see ibid., vol.70, p.7 (1980). The depolarization behaviour of poly(vinylbutyral)(PVB) (with three degrees of polymerization) was studied as a function of iodine concentration using the thermally stimulated discharge technique. Two relaxation peaks were observed in pure as well as in iodine-doped PVB films. However, the peak temperatures, peak currents, charges and activation energies associated with these peaks decrease continuously with increasing iodine concentration. These effects of iodine on the two relaxations are explained on the basis of the formation of charge transfer complexes. (14 refs.)

New contribution to spontaneous polarization of ferroelectric liquid crystals ....See Entry 101542

Field-induced first-order orientation transitions in ferroelectric liquid crystals .. ....See Entry 101554

Structural glasses and $Rb_{1-x}(NH_4)_xH_2PO_4$ ....See Entry 101565

Some applications of conditionally convergent lattice sums ... See Entry 101629

Impurity-vacancy dipoles in cadmium-doped silver bromide crystals ....See Entry 101743

Defects induced in single thoria crystals by X and far UV irradiation ....See Entry 101793

Field-assisted thermally stimulated current of mobile ions in a dielectric layer of a metal-oxide-semiconductor structure ....See Entry 102046

Compensation temperature in low density polyethylene β and γ relaxations as determined by thermally stimulated depolarization measurements ....See Entry 102811

Conduction and dielectric polarization in neodymium fluoride thin films ....See Entry 102818

Linear equations of state for electrically polarized ceramics .See Entry 102823

Pulse amplitude method for determining the pyroelectric coefficient of pyroelectric materials ....See Entry 102824

The influence of foreign ions impurities on the dielectric properties of TGS-like crystals ....See Entry 102832

Anomalously small dissipation of electromagnetic waves in an ionic crystal ....See Entry 103005

Regressive of the latent image in carboxyl-containing cellulose materials under the influence of an electric field ....See Entry 103558

77.40 DIELECTRIC LOSS AND RELAXATION

102809 Dielectric relaxation studies in pure lutidines at different microwave frequencies. O.Vir Singh (Dept. of Phys., Univ. of Jammu, Jammu, India).
Indian J. Pure & Appl. Phys., vol.21, no.6, p.339-43 (June 1983).
Dielectric constant (ϵ') and dielectric loss (ϵ'') have been determined for pure 2, 4-, 2, 6- and 3, 5-lutidines at frequencies 720 kHz, 6.118, 9.8 and 19.22 GHz for four different temperatures. Dielectric relaxation time (τ) and the distribution parameter (α) have been evaluated by Cole-Cole arc plots obtained at temperatures 20, 30, 40 and 50°C. It is observed that α decreases with the increase of temperature for 2, 4- and 2, 6-lutidines. On the contrary it increases for 3, 5-lutidine with temperature. Various thermodynamic parameter have been evaluated by considering the relaxation as a chemical rate process. (19 refs.)

102810 Dielectric relaxation & molecular motion in highly viscous medium. A.Singh, A.Rastogi, S.K.Saxena, J.P.Shukla, M.C.Saxena (Dept. of Phys., Lucknow Univ., Lucknow, India).
Indian J. Pure & Appl. Phys., vol.21, no.6, p.344-8 (June 1983).
Dielectric measurements have been made on some rigid polar molecules in dilute solutions of paraffin oil and benzene mixture at 9.8 GHz microwave frequency and over a temperature range of 298-322K. The relaxation behaviour has been resolved using the dielectric data by applying the methods of Higasi (1966), and Higasi, et al. (1971). The high value of the distribution parameter obtained for these systems indicates the possibility of hindered motion in highly viscous media. The flexible behaviour of these solutes has been interpreted in terms of recoiling and consequent trapping of the solute molecules between the solvent holes. The hindered motion observed in highly viscous medium in the case of the investigated rigid molecules exhibits good agreement with the earlier study of G.A. Balogun and C.W.N. Cumper [J. Chem. Soc. Faraday Trans II (GB), 69 (1973) 1172]. (10 refs.)

102811 Compensation temperature in low density polyethylene β and γ relaxations as determined by thermally stimulated depolarization measurements. D.Ronarc'h, P.Audren, S.Haridoss, J.Herrou (CENT, Lannion, France).
J. Appl. Phys. (USA), vol.54, no.8, p.4439-45 (Aug. 1983).
A thermally stimulated depolarization current technique has been used to deduce the compensation law in low density polyethylene β and γ relaxations. The linear relationship between the activation energy and the logarithm of the preexponential factor of the relaxation time has been discussed in terms of compensation temperature and variation of the thermal expansion coefficient through the β and γ processes. (36 refs.)

102812 Kinetic Ising model for polymer dynamics: applications to dielectric relaxation and dynamic depolarized light scattering. J.L.Skinner (Dept. of Chem., Columbia Univ., New York, NY, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.1955-64 (15 Aug. 1983).
The author introduces a new one-dimensional kinetic Ising model to study the cooperative dynamics of linear chain molecules. Correlation functions for the model are calculated approximately. He discusses the connection between these correlation functions and certain relaxation functions that can be measured by dielectric and dynamic depolarized light scattering experiments. These relaxation functions are extremely well represented by the Williams-Watts empirical function $\phi(t)=\exp[-(t/\tau)^{\beta}]$ with β between 1/2 and 3/4. This is in reasonable agreement with both dielectric and light scattering experiments on amorphous polymers. Our results lead to a microscopic interpretation of this 'universal' nonexponential decay function. (55 refs.)

102813 Dielectric and electromechanical properties of calcium-doped lead zirconate titanate. A.Tawfik (Phys. Dept., Tanta Univ., Tanta, Egypt), A.I.Eatah, F.Abd El-Salam.
Mater. Sci. & Eng. (Switzerland), vol.60, no.2, p.145-9 (Aug. 1983).
The dielectric and piezoelectric properties of calcium-doped lead zirconate titanate compounds were studied. For compounds with calcium concentrations higher than 0.05 at.% the measured properties showed a marked change in their behaviour. The results are explained on the basis of the role played by lattice defects and their interactions with the doped ions. From experimental results, the most useful composition for industrial work is lead zirconate titanate ceramic containing 0.05 at.% Ca. (10 refs.)

102814 Dielectric relaxation behaviour of some complexed species—a modified equation for relaxation times. M.Chauhan, M.Gupta, J.P.Shukla (Phys. Dept., Lucknow Univ., Lucknow, India).
Phys. & Chem. Liq. (GB), vol.13, no.1, p.47-54 (1983).
Dielectric relaxation behaviour of four rigid substances and their complexes were investigated at microwave frequency of 9.8 GHz and at varying temperatures. A modified equation for calculating apparent relaxation time of complexed species having short range interactions was suggested. The apparent relaxation time values so calculated were compared with the experimentally observed values of the complex systems. A good agreement has been reached for the systems having nearly negligible distribution, exhibiting a Debye type dispersion. (16 refs.)

New contribution to spontaneous polarization of ferroelectric liquid crystals ....See Entry 101542

The influence of the iron ions admixture and domain walls upon the propagation of longitudinal ultrasonic waves in TGS crystals ....See Entry 101867

Dielectric dispersion and dynamics near the transition temperature in crystalline ammonium hydrogen bischloroacetate ....See Entry 102797

Improved wideband coaxial methods for dielectric measurements on nitrogen ceramics ....See Entry 102799

Theoretical analysis of the dipole polarization and depolarization in Me^{++}-doped NaCl-type alkali halide crystals. II. Next-nearest neighbour approach ....See Entry 102806

Conduction and dielectric polarization in neodymium fluoride thin films ....See Entry 102818

Effect of CuO addition on the electrical and dielectrical properties of semiconducting barium titanate ceramics ....See Entry 102826

Correlation of dielectric relaxation and positron annihilation in glass-forming liquids ....See Entry 102991

Anomalously small dissipation of electromagnetic waves in an ionic crystal ....See Entry 103005

Development of methods of nondestructive quality control for ferrofluids ....See Entry 103435

77.50 DIELECTRIC BREAKDOWN AND SPACE-CHARGE EFFECTS

102815 Thermal dielectric breakdown with cylindrical electrodes. B.L.Beers (Beers Associates Inc., Reston, VA, USA), J.J.O'Dwyer.
J. Appl. Phys. (USA), vol.54, no.7, p.4083-6 (July 1983).
Solutions to the equations of thermal breakdown are computed for cylindrical electrodes with different boundary conditions. The development of the electric field and the temperature distributions are followed as functions of time, consequent on the application of a constant interelectrode voltage. The implications for possible breakdown by modes other than thermal are briefly discussed. (3 refs.)

102816 Suppression of dielectric breakdown in MgO crystals at high temperatures by impurity doping. K.L.Tsang (Dept. of Phys., Univ. of Alabama, Birmingham, AL, USA), Y.Chen.
J. Appl. Phys. (USA), vol.54, no.8, p.4531-5 (Aug. 1983).
The effect of impurities and their concentrations on the dielectric breakdown of MgO crystals at 1473 K is studied using an electric field of 1500 V/cm. Crystals doped with H, Cu, Co, Fe, Ni, Cr, or V are used. The current behavior and the characteristic time for breakdown, but the presence of Fe, Ni, Cr, or V enhances it. The suppression or enhancement of the breakdown depends on the dopant concentration. (17 refs.)

102817 Study of breakdown fields of oxides grown on reactive ion etched silicon surface: improvement of breakdown limits by oxidation of the surface. N.Lifshitz (Bell Labs., Murray Hill, NJ, USA).
J. Electrochem. Soc. (USA), vol.130, no.7, p.1549-50 (July 1983).
The oxide breakdown field is known to be low if the silicon surface prior to oxidation was treated by reactive ion etching (RIE) in Cl_2 or other ambient with high Si etching rate. It is believed that the early breakdown is due to poor morphology of Si surface, viz. pores and spikes caused by RIE and associated inhomogeneities of the electric field in the oxides grown on such surface. A method to upgrade the oxide to a device quality is suggested. The method consists in growth of a thin sacrificial oxide and its chemical removal prior to gate oxidation. For example, with the sacrificial oxide as thin as 180 Å, this process results in improving the breakdown field from 4 to approximately 6 MV/cm. Growth of sacrificial oxide about 600 Å thick yields a breakdown field as high as that of oxides grown on virgin silicon wafers. (5 refs.)

Reactively RF magnetron sputtered AlN films as gate dielectric ....See Entry 102197

Space-charge waves in multilayered heterostructures ....See Entry 102499

Dielectric breakdown study of thin La_2O_3 films ....See Entry 102819

Development of methods of nondestructive quality control for ferrofluids ....See Entry 103435

77.55 DIELECTRIC THIN FILMS

102818 Conduction and dielectric polarization in neodymium fluoride thin films. V.S.Dharmadhikari (Dept. of Electrical & Computer Engng., Univ. of New Mexico, Albuquerque, NM, USA).
J. Appl. Phys. (USA), vol.54, no.7, p.4087-92 (July 1983).
Measurements are reported on the capacitance, loss tangent, and permittivity of vacuum-deposited films of neodymium fluoride in the frequency range 0.050-100 kHz, thickness range 400-900 nm, and over a wide temperature range extending from 80-400K. A detailed examination of these results reveals the contribution of dipolar orientation polarization to the dielectric dispersion. It is shown, based on the modified Debye theory, that the observed relaxation is a true dielectric dispersion phenomena resulting from the orientation of dipoles. The dipoles are shown to arise from a fluorine deficiency within the film. The density of equivalent dipoles estimated is about 10^{20} cm^{-3}. The activation energy for this relaxation process is determined to be 1.02 eV. The physical and chemical nature of the deposited films is characterized by X-ray diffraction and X-ray photoelectron spectroscopy. (28 refs.)

102819 Dielectric breakdown study of thin La_2O_3 films. A.Singh (Dept. de Phys., Univ. Laval, Quebec, Canada).
Thin Solid Films (Switzerland), vol.105, no.2, p.163-8 (15 July 1983).
The dielectric breakdown in La_2O_3 films of thickness 40-400 Å incorporated in capacitors is reported. The experimental results were analysed in the light of the theory of ionization avalanche breakdown. The dielectric breakdown strength was found to be a power function of thickness, varying as $d^{-0.66}$. Furthermore, these films are amorphous and have high breakdown fields (about 10 MV cm^{-1}). (34 refs.)

Field-assisted thermally stimulated current of mobile ions in a dielectric layer of a metal-oxide-semiconductor structure .... See Entry 102046

Averaged local field intensities in composite films .... See Entry 102289

Poole-Frenkel centres in dielectrics. Kind and space density in plasma-polymerized organosilicon films .... See Entry 102405

High electric field poling of electroded poly(vinylidene fluoride) at room temperature .... See Entry 102820

77.60 PIEZOELECTRICITY AND ELECTROSTRICTION

(for piezo-optical effects, see 78.20H)

102820 High electric field poling of electroded poly(vinylidene fluoride) at room temperature. T.T.Wang, H.von Seggern (Bell Labs., Murray Hill, NJ, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4602-4 (Aug. 1983).
Room temperature electrode poling is by far the simplest and the most convenient way of preparing piezoelectric films of poly(vinylidene fluoride) PVF_2. A shortcoming of this poling technique is, however, the relatively low electric field (<3.5 MV/cm) that can be applied to the film without incurring instantaneous flashover or arcing around the film edge. The authors demonstrate that by simply adding a rubber O ring and a plastic plate to the regular electrode poling setup, it is possible to pole biaxially oriented PVF_2 films with fields up to about 9 MV/cm for at least 5 s without incidence of breakdowns. The piezoelectric e_{31} coefficient of the poled film rises sharply with increasing field but, after reaching a value of about 21 mC/m^2(d_{31}=7.5 pC/N) t 2.5 MV/cm, it levels off gradually to a value of about 31 mC/m^2(d_{31}=11 pC/N) at fields above 6 MV/cm. (13 refs.)

102821 Stability of PZT type piezoelectric ceramics under fast uniaxial stress. H.Ohanessian, P.Gonnard, M.Troccaz, L.Eyraud, P.Eyraud (Lab. de Genie Electrique et Ferroelectricite, Inst. Nat. des Sci. Appliquees, Villeurbanne, France).
Rev. Phys. Appl. (France), vol.18, no.8, p.479-86 (Aug. 1983). In French.
The purpose of the paper is the characterisation of lead zirconate titanate piezoelectric ceramics suitable for reversible impact-striking applications. Energy-measurements and stability tests under various pulse-width impacts were achieved; it is found that the main parameters are the following: the stability is a decreasing function of the pulse-width; efficiency and stability of the material depend on the vacancy-state and electric balance of this composition, as also on the Zr/Ti ratio. (10 refs.)

102822 Influence of anion impurities and X-rays on the piezoelectric effect in ammonium dihydrogen phosphate crystals. A.M.Shikin (N.P. Ogarev State Univ., Moscow, USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.73-4 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.123-5 (Jan.-Feb. 1983).
Gives the results of an investigation of the piezoeletric properties of ADP crystals in the temperature interval 293-403K. The piezoelectric effect in ADP crystals depends on the addition of doping (controllable) impurities, is topographically distributed by volume, and is enhanced by the action of X-rays. (10 refs.)

102823 Linear equations of state for electrically polarized ceramics. B.A.Kudryavtsev (Inst. of Chem. Machinery Construction, Moscow, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.954-6 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.610-14 (Nov. 1982).
Calculations for piezoelements made from electrically polarized ceramics are carried out using the linear theory of electroelasticity for a piezoelectric medium having symmetry ∞m. In this case it is assumed that the elastic and electric properties of the polarized ceramic are described by the same matrices of elastic, piezoelectric, and dielectric constants that apply to piezoelectric crystals of the class 6 mm. When the electrical polarization is taken into account the linear equations of state of a piezoceramic differ from the corresponding equations for a piezoelectric medium. (7 refs.)

Nature of the instability associated with parametric excitation of acoustic waves by electromagnetic fields .... See Entry 100851

Contribution to the study of tetragonal and rhombohedral phase coexistence in the $PbZrO_3$-$PbTiO_3$ system .... See Entry 101985

Dielectric and electromechanical properties of calcium-doped lead zirconate titanate .... See Entry 102813

Ferroelectric polymers .... See Entry 102827

Dielectric and nonlinear optical properties of new nonstoichiometric phases of tetragonal tungsten bronze containing lead and thorium .... See Entry 102830

Three dimensional constitutive relations for ferroelectric materials in the presence of quasi-static domain switching .... See Entry 102831

Fracture mechanics in the presence of electrical fields .... See Entry 103329

77.70 PYROELECTRIC AND ELECTROCALORIC EFFECTS

102824 Pulse amplitude method for determining the pyroelectric coefficient of pyroelectric materials. A.J.Tuzzolino (Lab. for Astrophys. & Space Res., Univ. of Chicago, Chicago, IL, USA).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.505-16 (1 July 1983).
A simple amplitude method of measuring the pyroelectric coefficient of pyroelectric materials is described. Intense, short-duration (0.4 μs) light pulses generated by a semiconductor laser diode are absorbed at one surface of a thermally insulated sample of pyroelectric material, resulting in thermal pulses in the sample. The time and amplitude characteristics of the resulting charge pulses from the sample are measured using electronics of the type used with semiconductor charged-particle detectors. Theoretical calculations of the charge pulse shapes expected from samples having various assumed volume polarisation distributions and measured charge rise times are used to determine optimum time constants for the pulse shaping electronics. These techniques are applied to a number of pyroelectric samples of polyvinylidene fluoride and lithium tantalate with thickness in the range 9 μm to 1 mm, and area of 0.07 cm^2 and 0.28 cm^2. The absolute pyroelectric coefficient of the sample is obtained directly from the measured amplitude distribution of the charge pulses, the measured sample reflectivity, and the photon and electronic calibrations for the system. In addition, useful information regarding the polarisation distribution in the sample is directly obtained during measurements. (35 refs.)

102825 Currents generated in pyroelectrics by γ irradiation. B.A.Levin.
Sov. At. Energy (USA), vol.53, no.6, p.863-5 (Dec. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.6, p.401-2 (Dec. 1982).
The author has investigated the individual components of the short-circuit current $I_{s.c.}$ or the charge generated in ferroelectric ceramics ZTP-19 (Zr-Ti-Pb), $BaTiO_3$, and a single crystal of $LiNbO_3$ under continuous and pulsed gamma irradiation at dose rates $W_\gamma=16\text{-}3\times10^8$ R/sec (1 R=2.58×10^{-4} C/kg). The author studied the effect of the input parameters of the pyroelectrics and of the irradiation conditions on the photovoltaic current and other components of the short-circuit current. For W_γ=16-600 R/sec the author used an arrangement with ^{60}Co, and for $W_\gamma=10^3\text{-}4\times10^8$ R/sec studied the effect of a single pulse of γ radiation of 2-3 msec duration at the IIN and 'Hydra' reactors. (12 refs.)

Thermally stimulated currents in polymers driven by temperature gradients .... See Entry 102804

Ferroelectric polymers .... See Entry 102827

77.80 FERROELECTRICITY AND ANTIFERROELECTRICITY

102826 Effect of CuO addition on the electrical and dielectrical properties of semiconducting barium titanate ceramics. M.Kuwabara (Kyushu Inst. of Technol., Kitakyushu, Japan).
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.403-6 (Aug. 1983).
Both the electrical and the dielectrical properties of porous semiconducting barium titanate ceramics with grain boundaries consecutively insulated by the addition of CuO have been investigated in the light of the relationship between the resistivity-temperature and the dielectric constant-temperature characteristics. The feature of a consecutive change in the resistivity-temperature characteristics from the one for the PTCR (positive temperature coefficient of resistivity) material to that for the GBBL (grain boundary barrier layer) material was made clear. The result indicates that the electrical property of the GBBL material is an extreme case of that of the PTCR material, and that the dielectric constant-temperature characteristics of the materials with intermediately insulated grain boundaries yield two-step PTCR properties. The present experiments may suggest that controlling the texture of the ceramic material should be considered for producing the GBBL materials with prominent electrical and dielectrical properties. (12 refs.)

102827 Ferroelectric polymers. A.J.Lovinger (Plastics Res. & Dev. Dept., Bell Labs., Murray Hill, NJ, USA).
Science (USA), vol.220, no.4602, p.1115-21 (10 June 1983).
Piezoelectricity and pyroelectricity, traditionally encountered in certain single crystals and ceramics, have now also been documented in a number of polymers. Recently, one such polymer—poly(vinylidene fluoride)—and some of its copolymers have been shown to be ferroelectric as well. The extraordinary molecular and supermolecular structural requirements for ferroelectric behavior in polymers are discussed in detail, with particular emphasis on poly(vinylidene fluoride). Piezoelectric, pyroelectric, and ferroelectric properties are also briefly reviewed, as are some promising applications of such polymers. (39 refs.)

New contribution to spontaneous polarization of ferroelectric liquid crystals .... See Entry 101542

Field-induced first-order orientation transitions in ferroelectric liquid crystals .... See Entry 101554

Microtwins in $LiNbO_3$ crystals observed by high-voltage and high-resolution electron microscopy .... See Entry 101719

Contribution to the study of tetragonal and rhombohedral phase coexistence in the $PbZrO_3$-$PbTiO_3$ system .... See Entry 101985

(Ba,Sr)TiO_3 heteroepitaxial films .... See Entry 102201

Dipolar energy of a modulated structure .... See Entry 102621

Currents generated in pyroelectrics by γ irradiation .... See Entry 102825

77.80B Transitions and Curie point

102828 The influence of radiation defects on the nonlinear properties of TGS in the neighbourhood of the temperature of ferroelectric transition. Z.Pretczynski (Inst. of Fundamental Technol. Res., Polish Acad. of Sci., Warszawa, Poland).
J. Tech. Phys. (Poland), vol.23, no.2, p.111-18 (1982).
Experimental studies of the properties of TGS suggest that imperfections of the test piece (crystal lattice defects internal stresses) influence the coefficients *A* and *B* of expansion of the thermodynamic potential, therefore the objective of the work reported was to study the influence of crystal lattice defects, introduced purposely, on the nonlinear properties of TGS in the neighbourhood of the temperature of phase transition. (7 refs.)

102829 Proton tunnelling in KH_2PO_4. R.Blinc, B.Zeks (J. Stefan Inst., E. Kardelj Univ. of Ljubljana, Ljubljana, Yugoslavia), R.J.Nelmes.
Phase Transitions (GB), vol.3, no.4, p.293-308 (1983).
The spectroscopic and crystallographic evidence for a symmetric (single-minimum) versus a double-minimum type O-H-O potential in KH_2PO_4-type crystals is reviewed. The results clearly show that both the protons in KH_2PO_4 and the deuterons in KD_2PO_4 move between two off-centre sites and freeze onto one of these two sites below the ferroelectric transition temperature T_c. A self-consistent determination of the proton-tunnelling frequency from the observed soft-mode frequency, and other static and dynamic properties, requires the use of the four-particle cluster model as the short-range correlations of the protons around a given PO_4 group cannot be neglected. The pressure and temperature-dependence of the proton-tunnelling frequency can be understood on the basis of some very general properties of the O-H-O potential. (27 refs.)

102830 Dielectric and nonlinear optical properties of new nonstoichiometric phases of tetragonal tungsten bronze containing lead and thorium. J.Ravez, A.Simon, P.Hagenmuller (Univ. de Bordeaux I, Talence, France), J.Thoret, W.Freundlich, H.Le Person.
Rev. Chim. Miner. (France), vol.20, no.3, p.404-10 (1983). In French.
The thorium-lead substitution in $Pb_{2.50}Nb_5O_{15}$ and $Pb_2KNb_5O_{15}$ has allowed the authors to prepare new phases with tetragonal tungsten bronze structure. These compounds are piezoelectric, have a coupled ferroelastic-ferroelectric behavior and are characterized by a second harmonic generation. Replace-

ment of lead by thorium is responsible of a decrease of the spontaneous strain, the ferroelectric Curie temperature and the harmonic yield. (12 refs.)

Structural glasses and $Rb_{1-x}(NH_4)_xH_2PO_4$ .... See Entry 101565

The crystal structure of $RbHSeO_4$: A neutron diffraction study of the paraelectric phase .... See Entry 101660

Dielectric dispersion and dynamics near the transition temperature in crystalline ammonium hydrogen bischloroacetate .... See Entry 102797

The influence of foreign ions impurities on the dielectric properties of TGS-like crystals .... See Entry 102832

77.80D Domain structure and effects; hysteresis

102831 Three dimensional constitutive relations for ferroelectric materials in the presence of quasi-static domain switching. P.J.Chen (Sandia Nat. Labs., Albuquerque, NM, USA).
Acta Mech. (Austria), vol.48, no.1-2, p.31-42 (1983).
The author proposes three dimensional constitutive relations for the stress and the electric displacement for ferroelectric materials taking into account the changing material properties which occur during quasi-static domain switching. These constitutive relations are characterized for the ceramic PZT 65/35 via experimental results entailing acoustic, electromechanical and electrical measurements. The author also establishes the correspondence of these constitutive relations to the standard relations in the literature which describes the responses of poled ferroelectric materials in the absence of domain switching. (6 refs.)

102832 The influence of foreign ions impurities on the dielectric properties of TGS-like crystals. J.Stankowska (Inst. of Phys., Adam Mickiewicz Univ., Poznan, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.1, p.115-22 (July 1983).
Triglycine sulphate and selenate crystals, pure as well as admixtured with foreign ions (Cu^{2+}, Cr^{3+}, Fe^{3+}) are studied. The impurities are found to induce a change in the dielectric properties of the crystals. Particularly, they generate a fine and fixed domain structure, prolong the aging time, lower the permittivity and spontaneous polarization and increase the coercive field; also, they cause a slight decrease in Curie temperature. Temperature measurements of coercive field E_c at various frequencies of the measuring field indicate that the activation energy of P_s increases with increasing amount of impurity and decreases with increasing temperature, being all the time considerably smaller in deuterated triglycine sulphate crystals (DTGS) than in TGS crystals. (17 refs.)

102833 Heterogeneous states with ferroelectric soliton-fluctuons. I.I.Cherkashenin, V.E.Yurkevich, B.N.Rolov (Dept. of Theoretical Phys., Latvian State Univ., Riga, Latvian SSR).
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.4, p.245-53 (1983).
The paper considers a Hamiltonian of crystal fluctuations as a functional of three kinds of fields, i.e. ordering field, a field corresponding to the distribution of solitons and a field connected with the distribution of coupled electron-fluctuon systems. A thermodynamic potential of soliton-fluctuon system was analysed and the fluctuation theory of this system was developed elsewhere. The paper analyses basic kinetic equations describing the process of domain wall motion within the framework of the given model. (17 refs.)

102834 Scanning electron microscopic investigations of peculiarities of the $BaTiO_3$ ferroelectric domain contrast. V.V.Aristov (Inst. of Solid State Phys., Acad. of Sci., Chernogolovka, USSR), L.D.Kokhanchik, K.-P.Meyer, H.Blumtritt.
Phys. Status Solidi a (Germany), vol.78, no.1, p.229-36 (16 July 1983).
Possibilities and conditions for SEM observations on barium titanate domain structures are discussed. The optimum conditions to observe domains of the samples with no conducting layer are those providing a positive charge on the surface. The samples under study are examined in the secondary electron mode at 2 to 4 kV. Under these conditions the electron microscopic contrast of the domains of different types is found to arise due to the potential effects. The mechanism of the formation of the potential contrast in $BaTiO_3$ is proposed and discussed. The charge accumulated on the surface at electron bombardment is considered to mainly cause the appearance of such a contrast, the latter being determined by the anisotropy of dielectric permittivity and different conduction in various sites of the sample. (14 refs.)

The influence of the iron ions admixture and domain walls upon the propagation of longitudinal ultrasonic waves in TGS crystals .... See Entry 101867

77.90 OTHER TOPICS IN DIELECTRIC PROPERTIES AND MATERIALS

The influence of a third constituent in binary solutions on critical properties studied by the nonlinear dielectric effect .... See Entry 101939

Adsorption of coumarin on faces of a bismuth single crystal .... See Entry 102178

78.00 OPTICAL PROPERTIES AND CONDENSED MATTER SPECTROSCOPY AND OTHER INTERACTIONS OF MATTER WITH PARTICLES AND RADIATION

(for phonon spectra, see 63.)

Spectroscopy and excitation dynamics of condensed molecular systems .... See Entry 98672

78.20 OPTICAL PROPERTIES AND MATERIALS

(see also 81.40T Optical properties related to materials treatment; for masers, and lasers see 42.52 and 42.55 respectively)

Kinetics of the photochromic processes in glasses under the action of light irradiation at intensities which vary in time .... See Entry 100869

Use of the photochromic properties of mercury dithizonate in hydrodynamics .... See Entry 101365

Interrelation of crystal structure with physical properties in complex perovskite-type oxides .... See Entry 101675

Picosecond time-resolved detection of plasma formation and phase transitions in silicon .... See Entry 101765

Femtosecond time resolved reflectivity of optically excited silicon .... See Entry 101766

Time-resolved study of silicon during pulsed-laser annealing .. See Entry 101771

F and photochromic centers in $LiYF_4$:Nd crystals .... See Entry 101794

Photoacoustic study of plasmon resonance absorption in a diffraction grating .... See Entry 102284

Magnetically induced spatial dispersion of crystals in the exciton region of the spectrum .... See Entry 102724

78.20D Optical constants and parameters

102835 Optical properties of ferromagnetic alloy $Fe_{81}Si_{12}B_7$ in amorphous and crystalline states. Yu.V.Knyazev, G.A.Bolotin, A.P.Potapov (Inst. of Metal Phys., Acad. of Sci., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1107-11 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of the optical properties of ferromagnetic alloy $Fe_{81}Si_{12}B_7$ in amorphous and crystalline states in the wavelength range 0.22-21 μm at room temperature. The process of amorphisation of this alloy altered considerably the optical constants as well as the plasma and relaxation frequencies of conduction electrons, and it also modified the spectral profile of the frequency dispersion of the optical conductivity. An analysis was made of the reasons for these anomalies. (7 refs.) *A.T.*

102836 Optical properties of a-Si and a-Si:H prepared by DC magnetron techniques. D.R.McKenzie, N.Savvides, R.C.McPhedran (School of Phys., Univ. of Sydney, Sydney, NSW, Australia), L.C.Botten, R.P.Netterfield.
J. Phys. C (GB), vol.16, no.24, p.4933-44 (30 Aug. 1983).
The authors investigate the optical properties of amorphous silicon and hydrogenated amorphous silicon films prepared by DC magnetron reactive sputtering and by glow-discharge techniques. Optical constants n and k are determined for six films over the wavelength range 0.4-2.5 μm (photon energy range 0.5-3.1 eV) and are used to obtain the optical band gaps, density-of-states constant, and the width of the Urbach tail of the bands. The authors investigate the effect of a small percentage of metal additives on the optical properties of the materials, and the effect of heat treatment on hydrogenated material. (23 refs.)

102837 Angle-of-incidence derivatives of the complex parallel and perpendicular reflection coefficients and their ratio for a film-substrate system. R.M.A.Azzam (Dept. of Electrical Engng., Univ. of New Orleans, Lakefront, New Orleans, LA, USA).
Opt. Acta (GB), vol.30, no.8, p.1113-24 (Aug. 1983).
Angle-of-incidence derivatives of the complex parallel (p) and perpendicular (s) reflection coefficients R_p and R_s, and their ratio $\rho=R_p/R_s$, for an absorbing substrate coated by a transparent film are investigated as functions of the angle of incidence ϕ and film thickness d. Such derivatives are of importance to AIDE*R* (angle-of-incidence derivative ellipsometry and reflectometry). R'_p/R_p, R'_s/R_s and ρ'/ρ (where the prime indicates $\partial/\partial\phi$) are shown to be aperiodic spiral functions of d at constant ϕ, except in the limiting cases of normal and grazing incidence when they become periodic. In the latter case ($\phi=90°$), the locus of R'_ν/R_ν (ν=p or s) is found and proved to be exactly a circle. The complementary family of constant-thickness contours of these derivative functions are also plotted in the complex plane. Finally, graphs representing the real AIDE*R* signals $\mathcal{R}'_p/\mathcal{R}_p$, ψ' and Δ' (where $\mathcal{R}=|R|^2$, $\tan\psi \exp(j\Delta)=\rho$) versus d at constant ϕ, and versus ϕ at constant d, are given. (10 refs.)

102838 Temperature dependence of the index ellipsoid of Rochelle salt over the 4.2-318K range. N.A.Romanyuk, V.M.Gaba, A.M.Kostetskii.
Opt. & Spectrosc. (USA), vol.54, no.1, p.106-7 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.186-9 (Jan. 1983).
Reports a study of the temperature and spectral changes in the index ellipsoid of Rochelle salt crystals over essentially the entire temperature range in which the crystal exists (4.2-318K). The results reveal qualitatively new information on the properties of Rochelle salt crystals: (a) the appearance of an isotropic direction along the crystallography X axis and (b) the sizes of the temperature and spectral regions in which this direction exists. (10 refs.)

102839 Time-resolved reflectivity measurements in silicon [with reply]. M.Combescot, J.Bok (Groupe de Phys. des Solides, Ecole Normale Superieure, Paris, France), C.V.Shank, R.Yen, C.Hirlimann.
Phys. Rev. Lett. (USA), vol.51, no.6, p.519-20 (8 Aug. 1983).
In a recent Letter (see ibid., vol.50, p.454, 1983), Shank, Yen, and Hirlimann (SYH) report experiments on time-resolved reflectivity of laser-irradiated silicon using femtosecond pulses. Combescot and Bok show that SYH have overestimated by one order of magnitude the value of the density of electron-hole pairs produced in their experiments, and that their conclusion on the absence of Auger recombination is thus incorrect. They believe that these experiments give a good evidence for plasma-assisted melting. In reply SYH state that the attempts by Combescot and Bok to interpret the experimental results as a verification of their theory of plasma-assisted melting are not on a firm basis. A new, more accurate method of determining the plasma density under conditions of high excitation is required. (5 refs.)

102840 Description of coloration and discoloration processes in inorganic photochromic materials. T.Kaczor (Tech. Univ., Radom, Poland), S.Nowak, J.Zmija.
Phys. Status Solidi a (Germany), vol.78, no.1, p.187-92 (16 July 1983).
A description of photochromic processes with regard to self-acting discoloration mechanisms is presented. Mathematical formulations on the time-dependent number of filled active states in photochromic processes are introduced and their boundary values are discussed. Changes of the absorption coefficient of photochromic materials during radiation based on relations obtained are defined. (3 refs.)

102841 Calculation of optical properties of semiconductors with the use of simple orbitals. A.-B.Chen, S.Phokachaipatana (Auburn Univ., Auburn, AL, USA), A.Sher.
Phys. Rev. B (USA), vol.28, no.2, p.1121-3 (15 July 1983).
To assess the applicability of a simple-orbital method to the optical properties of disordered semiconductor alloys, the reflectivity spectra of GaAs, GaP, and InP have been calculated. With a flexibility to adjust the band energies and effective masses, this methods produced spectra compared favourably with experiments and more sophisticated calculations. (16 refs.)

102842 Optical electron transitions in a two-dimensional disordered semiconductor. V.L.Bonch-Bruevich, To Tkhi Bik Nguet (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Sov. Phys. J. (USA), vol.25, no.11, p.994-6 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.22-4 (Nov. 1982).
The frequency dependence of the light absorption coefficient associated with electron transitions between strong and weak localization is studied. (5 refs.)

102843 Intermediate order and interband optical absorption. V.D.Iskra (Acad. of Agriculture, Ukrainian SSR).
Sov. Phys. J. (USA), vol.25, no.11, p.1005-10 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.35-41 (Nov. 1982).
Based on simple model concepts, taking into account the presence of intermediate order, the frequency dependence of the light absorption coefficient is determined in the region of the optical tail, formed by the 'intrinsic' random field of an amorphous semiconductor. (20 refs.)

102844 Investigation of the refractive index profiles of multilayer $Ga_{1-x}Al_xAs$ laser heterostructures. O.V.Bogdankevich, A.N.Georgobiani, V.G.Solin, P.A.Todua (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.240-1 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.426-7 (Feb. 1983).
The method of spatial modulation of the reflection of light from a cleaved section was used to find the refractive index profiles of three- and four-layer $Ga_{1-x}Al_xAs$ laser heterostructures (with GaAs substrates). The dependences of the concentration of Al in $Ga_{1-x}Al_xAs$ solid solutions and of the band gap on the coordinate perpendicular to the plane of growth were calculated. A spatial resolution of $\sim 0.4\ \mu$ was achieved, the sensitivity in the determination of the gradient of the refractive index $\sim 10^{-4}\ \mu^{-1}$, and the absolute error in the measurement of the layer thicknesses was $\sim 0.05\ \mu$ (for layer more than $0.4\ \mu$ thick). (3 refs.)

102845 Effect of thermoradiation treatment on the radiation stability of glasses. G.I.Ikramov, I.Kh.Isaev, A.N.Kononov, G.T.Petrovskii, D.M.Yudin (S.I. Vavilov State Optical Inst., Leningrad, USSR).
Sov. J. Glass Phys. & Chem. (USA), vol.8, no.4, p.317-19 (July-Aug. 1982). Translation of: *Fiz. & Khim. Stekla (USSR)*, vol.8, no.4, p.462-4 (July-Aug. 1982). [received: May 1983]
Using thermoradiation treatment it is possible to change not only the radiation-optical properties of glasses but also their transparency. The latter is of great practical interest in connection with the development of fiber optics and of importance for increasing the transparency of the materials in use. (3 refs.)

Determining the optical constants of high index thin films (II-VI compound thin film) with optical waveguides .... See Entry 99143

Vacuum-ultraviolet refractive index of LiF and MgF_2 in the temperature range 80-300K .... See Entry 99160

New graphical method for the determination of the optical constants of thin films .... See Entry 99161

Optical constants of some commercial microwave materials between 90 and 1200 GHz .... See Entry 99203

Saturation of interband transitions in semiconductors and the effect of optical bistability .... See Entry 100838

Preparation of new fluoride glasses in ZrF_4-BaF_2-TlF system .... See Entry 100868

Calculation of the temperature regimes for the fine anneal of quartz discs .... See Entry 101026

Preparation of fluoride glasses based on heavy metals. Optical transmission studies .... See Entry 101579

Channeling and optical study of thin Si crystals distorted by pressure .... See Entry 102135

IR laser-induced deposition of silicon thin films .... See Entry 102213

Evidence of nonparabolic-band effect on two-photon spectrum of ZnSe .... See Entry 102253

Dielectric function of 'undoped' In_2O_3 .... See Entry 102290

Electrical and optical properties of RF-SP a-Ge:O:(H) deposited from GeO_2 .... See Entry 102382

Method of the study of diamagnetic anisotropy of polypropylene fibers .... See Entry 102849

Lattice vibration spectra XXXIII. Far-infrared reflection spectra, TO and LO phonon frequencies, optical and dielectric constants, and effective charges of the spinel-type compounds MCr_2S_4 (M=Mn, Fe, Co, Zn, Cd, Hg), MCr_2Se_4 (M=Zn, Cd, Hg), and MIn_2S_4 (M=Mn, Fe, Co, Ni, Cd, Hg) .... See Entry 102873

Urbach rule behavior in strongly absorbing fine particle solids .... See Entry 102902

Optical absorption of 3*d* transition metal and rare earth elements in zirconium fluoride glasses .... See Entry 102913

Theoretical study of optical absorption in hydrogenated amorphous silicon .... See Entry 102916

Optical characteristics of alkali zinc silicate glasses containing iron sulfide .... See Entry 102918

Optical and electrical properties of RF-sputtered indium-tin oxide films .... See Entry 102976

Optical constants of amorphous hydrogenated carbon and silicon-carbon alloy films and their application in high temperature solar selective surfaces .... See Entry 102977

RF-plasma deposited amorphous hydrogenated hard carbon thin films: preparation, properties, and applications .... See Entry 103073

Possibilities and limits of the interference microscopic phase analysis .... See Entry 103424

Transient decay following pulse excitation of diffuse scattering samples .... See Entry 103622

78.20E Optical rotatory power

Liquids with cubic orientational order—the cholesteric blue phase .... See Entry 101537

Mutarotation of glucose solution under ultrasonic irradiation .... See Entry 102850

78.20F Birefringence

(inc. stress birefringence, flow birefringence, etc)

102846 Investigation of the birefringence of natural alkali-halide crystals with the help of interference of polarized rays. A.Kh.Zil'bershtein.
J. Appl. Spectrosc. (USA), vol.37, no.4, p.1189-91 (Oct. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.4, p.641-4 (Oct. 1982).
The most accurate methods for the determination of birefringence are interference methods. The transmission spectrum of a birefracting transparent crystalline plate positioned between parallel polarizers so that the azimuth of the cross section being analyzed of the optical indicatrix of the crystal makes an angle of $\pi/4$ with the principal plane of the polarizers (a 45-degree orientation) is the interference pattern of the polarized rays. Such an interferogram permits determining the birefringence spectrum of the crystal from the spectral position of the interference fringes when the crystal thickness (in the direction of light propagation) and the corresponding interference orders (k) are known. In the general case the determination of k presents appreciable difficulties. However, for crystals with weak birefringence Δn (i.e. under the condition $|\Delta n| l < \lambda^m$, where λ^m is the shortest wavelength of light in the spectral interval being investigated and l is the crystal thickness) it is evident that $|k| < 1$ for the entire range. The authors consider a method for the determination of this weak birefringence. (6 refs.)

102847 Photoelastic constants of calcite from its first-order Raman spectrum. G.Swarna Kumari, N.Rajeswara Rao (Dept. of Phys., Osmania Univ., Hyderabad, India).
Phys. Rev. B (USA), vol.28, no.4, p.2172-82 (15 Aug. 1983).
A formalism to connect photoelastic constants and Raman intensities of a crystal is developed. The internal coordinates of the crystal are related to the strains and the polarizability derivatives are obtained from Raman intensities and expressions are derived for photoelastic constants of calcite. With Raman intensities taken from the spectra taken by Kondilenko et al. (Opt. Spectrosc. 40, 402, 1976), the photoelastic constants are evaluated. They compare favorably with the experimental values determined by Pockel and recently by Nelson and his colleagues (1970, 1971, 1972). The constants thus evaluated form a 9×9 matrix as the internal coordinates are related to displacement gradients μ_{ij} in accordance with Nelson's ideas. As a result of the fact that calcite has only one line in its A_{1g} species, the ratio $(P_{11}+P_{12})/P_{13}$ is found to be independent of the refractive index or Raman intensities of the crystal; the ratio evaluated is 1.007, which may be compared with 1.332 obtained from Pockel's values and with 1.124 from the work of Nelson and collaborators. The ratio P_{13}/P_{33} is dependent entirely on the intensities of A_{1g} line in the *yy* and *zz* spectra: the authors obtained 2.147, as compared with 1.838 of Pockel's and 2.074 of Nelson and collaborators' experimental values. (27 refs.)

102848 Study of photoelastic properties of films of styrene-butadiene ternary block copolymers. V.S.Skazka, A.E.Ruchin, A.D.Vilesov, S.Ya.Frenkel'.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.7, p.1525-9 (July 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The temperature dependence of photoelastic coefficient ϵ has been studied for films of ternary styrene-butadiene block copolymer obtained from toluene solutions and from solutions in two selective solvents. The essential increase of ϵ in the region of T_g of PS is explained by the effect of the shape of PS domains in the lattice of block copolymer. The following enhancement of temperature results in decrease of ϵ related to melting of the supercrystalline lattice. Annealing and long storage of annealed films at room temperature leads to decrease of the influence of the effect of the shape of PS domains of ϵ. The time dependences of ϵ point out the existence of two relaxational processes in polybutadiene matrix and PS domains. (6 refs.)

102849 Method of the study of diamagnetic anisotropy of polypropylene fibers. S.I.Fedotov, Yu.V.Zelenev, I.P.Fedotov, Yu.A.Volkov.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.7, p.1555-7 (July 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The results of the study of birefringence are compared with the data about the diamagnetic anisotropy of PP fibers. The values of birefringence and of refractive index calculated from the diamagnetic anisotropy are in better agreement with experimental data, than the values of these characteristics calculated from the values of polarizabilities of -C-C- bonds. (11 refs.)

Surface order in nematics .... See Entry 101545

Structural glasses and $Rb_{1-x}(NH_4)_xH_2PO_4$ .... See Entry 101565

Flow birefringence and viscosity of chitozane solutions in acetic acid at various ionic power .... See Entry 102035

Long range surface plasmons in birefringent media .... See Entry 102274

Rheo-optical Fourier transform IR spectroscopy of polyurethane elastomers. I. Principle of the method and measurements at ambient temperature .... See Entry 102886

Rheo-optical fourier transform IR (FTIR) spectroscopy of polyurethane elastomers. II. Measurements at elevated temperature .... See Entry 102887

Rheo-optical Fourier transform IR (FTIR) spectroscopy of polyurethane elastomers. II. Investigation of NH-deuterated specimens .... See Entry 102888

78.20H Piezo-, elasto- and acousto-optical effects

102850 Mutarotation of glucose solution under ultrasonic irradiation. B.V.Gurunadha Rao, V.P.Bhatnagar, S.B.Agarwal (Dept. of Phys., Delhi Coll. of Engng., Delhi, India).
Indian J. Pure & Appl. Phys., vol.21, no.6, p.349-51 (June 1983).
Mutarotation of fresh and equilibrium solutions of glucose have been studied under irradiation of ultrasonic waves of 1.5 MHz. The process of mutarotation has been found to be accelerated under ultrasonic exposure. Further, a marked decrease in the optical rotation was noted in case of equilibrium solution. This effect increased with the exposure time to ultrasonic waves and attained a saturation. The time-constant by which the glucose solution attained its new equilibrium value was found to depend on ultrasonic power. The observed effect indicates that the structural state of the glucose can be changed by ultrasonic irradiation. (6 refs.)

102851 Piezoreflection of mechanically free natural graphite crystals after an impact load. A.Kh.Zilbershtein.
Opt. & Spectrosc. (USA), vol.54, no.1, p.72-4 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.127-31 (Jan. 1983).
It is shown that anisotropy of light reflection from the (0001) plane of mechanically free natural graphite crystals after an impact load X in the 100-300-kbar range is caused by piezoreflection induced by residual mechanical stresses X_{11}. It was found that the influence of cracks and twins on the degree of anisotropy was small. The magnitudes of residual stresses in these crystals were evaluated. The linear dependence of the reflection anisotropy of

the (0001) plane of graphite on $\rho_0^{1/2}$ (ρ_0 is the density of cracks) was observed, which allowed the authors to assume the existence of a linear dependence of residual uniaxial stress on the applied stress in the studied range of loads. The proportionality coefficient for graphite deformed along $[1\bar{1}00]$ was $X/X_{11} \simeq (1.5\text{-}0.5) \times 10^3$. (13 refs.)

102852 Acoustooptical effect in a nematic liquid-crystal layer in an ultrasonic field. N.K.Gus'kov, E.N.Kozhevnikov (State Univ., Kuibyshev, USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.21-4 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.38-43 (Jan.-Feb. 1983).
It is shown that for normal incidence of an ultrasonic beam on a nematic liquid-crystal layer the sound field rotates the molecules of the crystal and clears the layer within the boundaries of the ultrasonic beam. The results of the calculations are compared with experiment. (15 refs.)

High pressure measurements on photopumped low threshold $Al_xGa_{1-x}As$ quantum well lasers ....See Entry 100768

Photoelastic constants of calcite from its first-order Raman spectrum ....See Entry 102847

Study of photoelastic properties of films of styrene-butadiene ternary block copolymers ....See Entry 102848

Rheo-optical Fourier transform IR spectroscopy of polyurethane elastomers. I. Principle of the method and measurements at ambient temperature ....See Entry 102886

Rheo-optical fourier transform IR (FTIR) spectroscopy of polyurethane elastomers. II. Measurements at elevated temperature ....See Entry 102887

Rheo-optical Fourier transform IR (FTIR) spectroscopy of polyurethane elastomers. II. Investigation of NH-deuterated specimens ....See Entry 102888

Cathodoluminescence from deformed CaO ....See Entry 102964

78.20J Electro-optical effects

102853 Electroreflectance study of π-adsorption. A.B.Ershler, A.M.Funtikov, I.M.Levinson.
Sov. Electrochem. (USA), vol.18, no.11, p.1410-15 (Nov. 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.11, p.1577-82 (Nov. 1982).
Aromatic hydrocarbons when undergoing adsorption take up a position parallel to the surface of mercury electrodes. In this orientation they do not affect electric double layer capacity and the amount adsorbed is weakly potential-dependent. Such is the situation when the electrode is charged positively. At small negative surface charge densities this parallel orientation changes to 'perpendicular'. Here the adsorption behavior is the same as found for aliphatic compounds. In the planar orientation the molecules are presumed to form a complex with the positively charged electrode, more precisely a charge transfer complex (CTC) where the electrode functions as the electron acceptor. This is indicated by the negative displacement of the potential of zero charge following adsorption of aromatic compounds in a planar orientation. Evidently the highest occupied π-orbital of the aromatic molecules is involved in CTC formation, hence the term, π-adsorption (one should not speak about the π-orbital but about a narrow surface band arising upon CTC adsorption on the metal). It is the aim of the work to detect adsorbate-electrode CTC by electroreflectance. (16 refs.)

Electrohydrodynamic domain patterns in freely suspended layers of nematic liquid crystals with negative dielectric anisotropy ....See Entry 101538

Observations of electrically surface-induced regular arrays of focal conics in a homeotropic NPOB smectic A liquid crystal ....See Entry 101549

Growth peculiarities of graded band gap GaAsSb/GaAs heterostructures and effective light modulation in the 1.06 μm wavelength region ..See Entry 102502

78.20L Magneto-optical effects

102854 Magnetooptic effects in diffuse reflection of light. G.S.Grinchik, L.V.Nikitin, O.V.Kasatkina.
Opt. & Spectrosc. (USA), vol.54, no.1, p.75-6 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.132-5 (Jan. 1983).
The magnetooptic effect is measured for the first time on a diffusely reflecting finely divided ferromagnet. It is discovered that the equatorial Kerr effect in diffuse reflection from finely divided structures of nickel is increased approximately by an order of magnitude, and its dependence on the frequency and angle of incidence of the light is changed. The results were successfully explained on the basis of the assumption that the magnetooptic constants of nickel are maintained, and the optical characteristics of the surface are subject to the Maxwell-Garnette equations. (5 refs.)

102855 Magneto-optical studies of atomic thallium centers in KCl: Magnetic circular dichroism tagged by spin resonance. F.J.Ahlers, F.Lohse, J.M.Spaeth (Experimentalphys., Univ. Gesamthochschule Paderborn, Paderborn, Germany), L.F.Mollenauer.
Phys. Rev. B (USA), vol.28, no.3, p.1249-55 (1 Aug. 1983).
The authors report measurement of the magnetic circular dichroism (MCD) of radiation-damaged crystals of KCl doped with Tl. By using microwaves resonant with ground-state magnetic splittings, they have been able to tag such MCD spectra to specific species. In particular, they have shown that bands peaking at 1040, 725, 550, 405, 340, and 254 nm all belong to the $Tl^0(1)$ center, where that center, as determined by earlier spin-resonance studies, consists of a neutral Tl atom perturbed by the field of an adjacent anion vacancy. The experiment constitutes the first direct evidence that a recently discovered, thallium-associated, laser-active center whose pump band peaks at 1040 nm is indeed the $Tl^0(1)$ center; furthermore, the MCD of the two lowest energy bands are in rough quantitative agreement with predictions of a simple electronic model of that center. Finally, the technique has allowed the discovery of two other centers having distinctly different spin resonances, yet whose optical spectra bear some striking similarities to that of the $Tl^0(1)$ center. Because their fundamental bands overlap those of the $Tl^0(1)$ center, the new centers may affect the operation of $Tl^0(1)$-center lasers. (10 refs.)

102856 Magneto-optical response of f- and d-states in uraniummonosulfide. W.Reim, J.Schoenes, O.Vogt (Lab. fur Festkorperphys., ETH Zurich, Zurich, Switzerland).
Solid State Commun. (USA), vol.47, no.8, p.597-601 (Aug. 1983).
High field magnetooptic Kerr-rotation and -ellipticity measurements in the energy range between 0.55 and 5.1 eV are reported for a 5f-metal for the first time. The remarkable size of the magneto-optical response is explained with the large overlap of f- and d-orbitals and the enhanced spin-orbit energies in heavy atoms. The diagonal as well as the off-diagonal conductivity is discussed in a microscopic model. The authors obtain a conduction band occupancy of 1.1 d-electrons per uranium ion with a negative spin-polarization of -42%. The spin-polarization of the F-electrons is found to be 62%. (25 refs.)

102857 Effect of multiple reradiations on the shape of the magnetic depolarization contour. III. The influence of the Faraday effect. V.P.Afanas'ev (Moscow Power Inst., Moscow, USSR).
Sov. Phys. J. (USA), vol.25, no.11, p.1018-21 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.50-3 (Nov. 1982).
For pt.II see Izv. VUZ Fiz. (USSR), no.12, p.30-5 (1976). The effect of anomalous dispersion on the transfer of polarized resonance radiation in the presence of a magnetic field is theoretically investigated. The magnetic rotation of the plane of polarization is studied under unusual Faraday-effect conditions of small optical thicknesses ($\tau \simeq 1\text{-}10$) and weak magnetic fields ($H \simeq 10\text{-}100$ Oe). It is shown that the angle of rotation of the plane of polarization can take negative values. The results of numerical calculations are presented in the form of graphs. The results obtained are compared with experiments. (10 refs.)

Magnetic circular dichroism and anomalous fluorescence spectra of azulenothiophenes ....See Entry 100436

Evidence for shallow bound states in PbTe ....See Entry 102313

Evidence for shallow bound states in PbTe: A reply ....See Entry 102314

Impurity-ligand effects on the magneto-optically measured spin-orbit splitting of trapped electron centres ....See Entry 102334

Light-induced dynamic instability of the domain structure in $FeBO_3$:Ni ....See Entry 102694

78.30 INFRARED AND RAMAN SPECTRA AND SCATTERING

102858 Raman scattering of light off magnetically doped superconductors. Xiong Shijie, Cai Jianhua (Inst. of Solid State Phys., Nanjing Univ., Nanjing, China).
Chin. Phys. (USA), vol.3, no.2, p.473-83 (April-June 1983).
Raman scattering of light off magnetically doped superconductors is theoretically investigated, in cases both of absence and presence of magnetic order. In the former case, the authors have solved an integral equation for the four-vertex function to obtain a general expression for the scattering efficiency relative to the normal state, and in the latter case, they have studied the influence of spin excitations on the relative scattering efficiency. (6 refs.)

102859 The dependence of SERS on the vibrational mode, exciting radiation and applied potential. M.L.A.Temperini, W.J.Barreto, O.Sala (Inst. de Quimica, Univ. de Sao Paulo, Sao Paulo, Brazil).
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.148-52 (29 July 1983).
The surface-enhanced Raman spectra of 4-methylpyridine adsorbed on a silver electrode were investigated. A ratio of intensities, given by the intensity of each Raman band divided by the sum of the intensities of all the bands in the same spectrum, was defined in order to cancel out the surface concentration effect. This ratio was plotted versus applied potential and exciting radiation for several vibrational modes. The representation so obtained shows more clearly the modulation produced in the SERS by the molecular vibrations, as compared with the usual Raman intensity representation. The results are tentatively interpreted on the basis of a charge-transfer mechanism. (18 refs.)

102860 Spectral detail in liquid acetonitrile at far-infrared frequencies. G.J.Evans (Edward Davies Chem. Lab., Univ. Coll. of Wales, Aberystwyth, Wales).
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.173-6 (29 July 1983).
The existence of spectral detail in the far-infrared absorption spectrum of a polar, associated liquid (CH_3CN) is reported. The details are resolved on the low-frequency side of the spectral profile. A tunable far-infrared laser system suggests that the detail is not completely resolved at the 4 cm^{-1} resolution used in the interferometric study. It is proposed that the origin of the detail resides in the cooperative motion of molecules in this liquid. (17 refs.)

102861 Enhancement by polar solute of interaction-induced IR absorption in liquid CS_2. S.Weiss, U.Dinur (Dept. of Chem., Ben Gurion Univ., Beer-Sheva, Israel).
Chem. Phys. Lett. (Netherlands), vol.99, no.3, p.197-200 (5 Aug. 1983).
The enhancement of the 'forbidden' infrared absorption in the ν_1, symmetric stretch, band of CS_2 by small concentrations of CH_3CN, was studied both experimentally and via MC simulation. (11 refs.)

102862 A quantitative analysis of the ν_s(IR) bands of H-bonds. II. Adipic acid crystals. Y.Marechal (Dept. de Recherche Fondamentale, CENG, Grenoble, France).
Chem. Phys. (Netherlands), vol.79, no.1, p.85-94 (15 Aug. 1983).
For pt.I see ibid., vol.79, no.1, p.69-83 (1983). The theory described in the preceding article is applied to the ν_s bands (X-H...Y) of adipic (H and D) acid monocrystals. The lineshape $g(\omega)$ that ν_s is supposed to exhibit in the absence of Fermi resonances is computed at temperatures ranging from 10 to 300K. This lineshape has at least two components in the case of H-adipic acid which the author preferentially attributes to the ν_s-ν_s interaction (≈ 100 cm^{-1}) between the two H-bonds of the cyclic dimers $(RCOOH)_2$. The author cannot however exclude that these two components are due to a tunnelling of the protons through the H-bonds of these dimers. The precise determination of the second centered moments (or width) of $g(\omega)$ at various temperatures gives results which are consistent with the value of the first moment and can be simply accounted for with the assumption that the modulation of ν_s by low-frequency modes is quadratic. The question as to whether this low-frequency mode is a stetching mode or a bending mode in an isolated H-bond remains unanswered. (18 refs.)

102863 Intrinsic infrared absorption of halide glasses. H.B.Rosenstock, L.L.Boyer (Naval Res. Lab., Washington, DC, USA).
Glass Technol. (GB), vol.24, no.3, p.168-9 (June 1983). (Symposium on Halide and other Nonoxide Glasses, Cambridge, England, 23-26 March 1982).
A scheme has been developed for calculating the 'intrinsic' infrared absorption of multicomponent halide glasses. The model used emphasises the interaction of the phonons; it is, therefore, based on an interaction potential (the so-called Morse potential) that is essentially (rather than secondarily) anharmonic, yet exactly solvable. (12 refs.)

102864 Electronic spectra of complexes of neodymium (III) and praseodymium (III) with amino acid. M.P.Bhutra, A.K.Gupta (Dept. of Phys., Univ. of Jodhpur, Jodhpur, India).
Indian J. Pure & Appl. Phys., vol.21, no.6, p.374-5 (June 1983).
The electronic spectra of complexes of praseodymium (III) and neodymium (III) with amino glycine, alanine and valine have been recorded in the 360-920 nm region in water. The energies and intensities of various transitions calculated using the Judd-Ofelt relation are in good agreement with those obtained experimentally. (15 refs.)

102865 On the optical properties of trans-polyacetylene. H.Eckhardt (Allied Corp. Corporate Technol., Morristown, NJ, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.2085-6 (15 Aug. 1983).
The optical properties of trans-polyacetylene are of fundamental importance in understanding the electronic structure of this conjugated polymer and they have been extensively studied in the past few years. One of the most emphasized results is the contrasting behavior of trans and cis polyacetylene; the trans isomer showing a broad unstructured band and the cis isomer showing significant vibrational structure in both transmission and reflection spectroscopy. The author shows that, with careful control of the cis-to-trans isomerization conditions, the trans spectrum does contain vibrational structure and the spectra produced in previous work are dominated by effects due to chemical and structural disorder. He suggests that the present evidence is now overwhelming that the lowest energy optical peak in trans-$(CH)_x$ is excitonic in origin. The author presents specular reflection data from free standing cis- and trans-$(CH)_x$ films and compare these spectra with transmission spectra from thin $(CH)_x$ films. (12 refs.)

102866 A classic example of an Evans hole caused by intermolecular interaction in solid $2ND_3.D_2O$ at 15 to 145K. J.E.Bertie, J.P.Devlin (Dept. of Chem., Univ. of Alberta, Edmonton, Alberta, Canada).
J. Chem. Phys. (USA), vol.79, no.4, p.2092-3 (15 Aug. 1983).
It has recently been noted that a sharp dip at 2333 cm^{-1} in the higher-frequency, infrared, O-D stretching band of $2ND_3.D_2O$ at 100K may be an Evans hole. In a study of the infrared spectra of the isotopic species $2NA_3.B_2O$, where A and B are independently H or D, the authors confirmed this possibility with evidence that is so unusually complete that they report it here separate from the main body of their results. (12 refs.)

102867 Infrared characterization of α- and β-crystalline silicon nitride. J.P.Luongo (Bell Labs., Murray Hill, NJ, USA).
J. Electrochem. Soc. (USA), vol.130, no.7, p.1560-2 (July 1983).
Silicon nitride, Si_3N_4, used as a passivating layer in microelectronics, exists in the crystalline forms α-Si_3N_4 and β-Si_3N_4, and as amorphous material. Although the two crystalline modifications differ only slightly in their structure, it has been found that each modification can be distinguished by infrared spectroscopy. The spectral characteristics of α-and β-Si_3N_4 are described and a method for determining the concentration of one phase in the presence of the other has been developed. (10 refs.)

102868 Resonance inverse Raman spectroscopic study of proflavin-DNA intercalation. Tsuey Ing Chen, M.D.Morris (Dept. of Chem., Univ. of Michigan, Ann Arbor, MI, USA).
J. Phys. Chem. (USA), vol.87, no.13, p.2314-17 (23 June 1983).
Resonance inverse Raman spectroscopy is used to probe the proflavin-DNA complex. Raman hypochromism to about 30-40% of the initial intensity is observed for most bands of proflavin upon complexation. However, the 1485-cm^{-1} band is only attenuated to 80% of its intensity in the absence of DNA. This band is assigned to Wilson 19 a mode of the central ring of the acridinium system. From the slight attenuation of this band it is inferred that intercalation disturbs the electronic distribution on the outer rings more strongly than on the central ring. (35 refs.)

102869 Raman scattering study of the structural phase transitions in $RbAlF_4$. A.Bulou, M.Rousseau, J.Nouet (Lab. de Phys. de l'Etat Condense, Univ. du Maine, Le Mans, France), P.L.Loyzance, R.Mokhlisse, M.Couzi.
J. Phys. C (GB), vol.16, no.23, p.4527-37 (20 Aug. 1983).
A Raman scattering study of the non-ferroic and of the improper ferroelastic structural phase transitions (SPT) in the perovskite-type layer compound $RbAlF_4$ is reported. It is shown that the SPT occurring at $T_{c1}=551K$ $(D_{4h}{}^1 \rightleftharpoons D_{4h}{}^5)$ and at $T_{c2}=282K$ $(D_{4h}{}^5 \rightleftharpoons D_{2h}{}^{13})$ are related to displacive mechanisms owing to the occurrence of one and two soft phonons below T_{c1} and T_{c2} respectively. The results are consistent with a first-order character for the SPT at T_{c1}, and a second-order character for that at T_{c2}. Moreover, in the tetragonal $D_{4h}{}^1$ and $D_{4h}{}^5$ phases, the Raman spectra exhibit a number of features which cannot be explained by the selection rules at $q=0$. In particular, one of these additional lines exhibits a soft-mode behaviour above the T_{c2} transition, while the condensing phonon is a zone-boundary mode. Such features are imputed to the loss of translational symmetry caused by the existence of intrinsic structural disorder. (12 refs.)

102870 Asymmetry of the lineshape in one-magnon Raman scattering from FeF_2. S.R.P.Smith, M.G.Cottam, J.Ariai, D.H.Coule (Dept. of Phys., Univ. of Essex, Colchester, England).
J. Phys. C (GB), vol.16, no.23, p.4701-17 (20 Aug. 1983).
Presents measurements of the one-magnon Raman scattering spectrum from antiferromagnetic FeF_2, which show a temperature-dependent asymmetric lineshape with a pronounced tail on the high-frequency side. The degree of asymmetry, and also the overall linewidth, increase with temperature over the temperature range studied (up to ${}^1/{}_2T_N$, where $T_N=78K$). It is shown that the mechanism responsible for the linewidth is the scattering of a magnon by the disorder at finite temperatures in the longitudinal spin components. This gives rise to a damping $\Gamma(\omega)$ that is frequency dependent, and hence a lineshape that is asymmetrical. A good empirical description of the lineshape is obtained using a high-density perturbation expansion method. The theoretical estimates of the linewidth are smaller than the experimental values, and we discuss how these estimates may be affected by the presence of optic magnon modes. (26 refs.)

102871 IR-spectral study of vanadate vitreous systems. Y.Dimitriev, V.Dimitrov (Higher Inst. of Chem. Technol., Sofia, Bulgaria), M.Arnaudov, D.Topalov.
J. Non-Cryst. Solids (Netherlands), vol.57, no.1, p.147-56 (Aug. 1983).
Some structural conclusions have been reached concerning vanadate glasses according to the influence of the M^{n+}-ions on the vibrations of the isolated V-O-bonds and the location of the bands in the IR-spectra. They may shift with the compositions or preserve their positions. Ions of predominant electrostatic interactions are distributed between the chains and the layers in the glass structure, they interact directly with the isolated V-O bonds. As a result of this the transition from VO_5 into VO_4 is achieved directly or through intermediate complexes. It is likely that ions which participate in covalent bonds fit into vanadate chains of the glass network in substitution positions. (67 refs.)

102872 Excitation of lines in the infrared spectrum of Hg_2Cl_2 crystals due to cell doubling with a phase transition. A.A.Kaplyanskii, M.F.Limonov, Yu.F.Markov (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.5, p.251-4 (5 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.5, p.212-15 (5 March 1983).
Excitation of new lines in the infrared spectra of crystals due to doubling of the unit cell accompanying a structural phase transition (for improper ferroelastics Hg_2Cl_2) is observed for the first time. The number and polarization of lines excited for $T<T_c$ coincide with the predictions of a group-theoretical analysis. The dispersion of optical branches is determined experimentally from the critical orientation $\Gamma \rightarrow X$ of the Brillouin zone of the paraelectric phase. (6 refs.)

102873 Lattice vibration spectra XXXIII. Far-infrared reflection spectra, TO and LO phonon frequencies, optical and dielectric constants, and effective charges of the spinel-type compounds MCr_2S_4 (M=Mn, Fe, Co, Zn, Cd, Hg), MCr_2Se_4 (M=Zn, Cd, Hg), and MIn_2S_4 (M=Mn, Fe, Co, Ni, Cd, Hg). H.D.Lutz, G.Waschenbach, G.Kliche, H.Haeuseler (Lab. fur Anorganische Chem., Univ. Siegen, Siegen, Germany).
J. Solid State Chem. (USA), vol.48, no.2, p.196-208 (1 July 1983).
Far-infrared reflection spectra of hot-pressed samples of the spinels MCr_2S_4 with M=Mn, Fe, Co, Zn, Cd, and Hg, MCr_2Se_4 with M=Zn, Cd, and Hg, and MIn_2S_4 with M=Mn, Fe, Co, Ni, Cd, Hg have been recorded in the range from 40 to 700 cm^{-1}. The spectra show four reststrahlen bands in the case of normal spinels and up to five in the case of inverse spinels. The transverse and longitudinal optical phonon frequencies at wave vector $|\mathbf{q}|\simeq 0$ are determined by Kramers-Kronig analysis and the classical oscillator-fit method. Effective ionic charges (normalized splitting, transverse effective charge, Szigeti charge) were calculated from the experimentally determined TO/LO splittings and from the high frequency dielectric constants. The obtained data reveal an increasing covalency of the chalcide spinels in the order selenides>sulfides, chromium compounds>indium compounds, inverse spinels>normal spinels, $NiM_2'X_4>CoM_2'X_4>FeM_2'X_4MnM_2'X_4$, $HgM_2'X_4>ZnM_2'X_4>CdM_2'X_4$. (25 refs.)

102874 Relation between mechanical properties and spectrum for chrysotile asbestos. E.P.Kraineva, V.L.Petrov, T.I.Polupanova.
J. Appl. Spectrosc. (USA), vol.37, no.4, p.1157-9 (Oct. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.4, p.604-7 (Oct. 1982).
Vibrational spectroscopy can be used to establish relationships between the quality and the structural and chemical factors for one of the representatives of the serpentine minerals: chrysotile asbestos (CA). The authors have examined the IR spectra of three types of chrysotile asbestos having the same space group but differing in mechanical properties, in particular in strength: specimens of normal strength, and broken and weathered ones. The chemical formula of chrysotile is $Mg_3Si_2O_5(OH)_4$. The structure of CA resembles that of a clay mineral in being composed of polar layers. The layers are constituted by silicon-oxygen networks (chemical complex Si_2O_5) and magnesium hydroxide, and these have a tendency to buckle with the formation of cylindrical cavities of diameter up to 100 Å. The IR spectra were measured in the range 4000-200 cm^{-1}. (7 refs.)

102875 Hydrogen bonds in modified isocyanates of peat and lignite waves studied by IR spectroscopy. E.A.Yurkevich, S.V.Drozdovskaya, S.F.Aksinovich.
J. Appl. Spectrosc. (USA), vol.37, no.4, p.1166-9 (Oct. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.4, p.614-18 (Oct. 1982).
The study of the nature of the bonds of isocyanates with the individual components of natural waxes found in antiadhesion lubricants is carried out in connection with the development of directed synthesis of new grades of modified waxes, due to the instability of the waxes with respect to the action of isocyanates. The use of IR spectroscopy for the analysis of the structure of modified waxes has been most effective, since the complexity of the systems prevents the use of chemical methods alone to obtain sufficient information. IR spectroscopy is also one of the best ways of observing hydrogen bonds. (9 refs.)

102876 Raman studies of $\langle P_2\rangle$ and $\langle P_4\rangle$ of some homologous nematic liquid crystals with small optical anisotropy. R.Seeliger, H.Haspeklo, F.Noack (Phys. Inst., Univ. Stuttgart, Stuttgart, Germany).
Mol. Phys. (GB), vol.49, no.5, p.1039-63 (10 Aug. 1983).
Presents results of Raman studies of the order parameters $\langle P_2\rangle$ and $\langle P_4\rangle$ for some liquid crystalline cyanophenylcyclohexanes (PCH-3, PCH-5 and PCH-7), which, in contrast to most data available in the literature, are in remarkably close accordance with predictions by the mean-field theories for the nematic order. Measurements do not reveal a significant dependence on the molecular length. The PCHs differ from materials for which the theory is not capable of reproducing the experimental findings on $\langle P_4\rangle$, by their rather low optical and dielectrical anisotropy. In the authors' opinion, this difference seems to be the key for the solution of the $\langle P_4\rangle$ problem of the Raman scattering technique. Due to the lack of a proper theory, the influence of the anisotropic local electric field on the depolarization ratios of the Raman intensities has been neglected in the past in the formalism developed to evaluate the order parameters from the measurements. It will be shown that this disregard cannot be correct generally, with the error becoming larger with increasing anisotropy. In the light of this concept the authors' verification of the theoretical predictions is a consequence of the very small local field anisotropy in the PCH series. The magnitude of the local field effect is estimated by means of a two-dimensional model. (14 refs.)

102877 Raman study of the low-temperature dispersion of the dielectric properties of lithium tantalate. N.S.Abdullaev, V.S.Gorelik, B.S.Umarov.
Opt. & Spectrosc. (USA), vol.54, no.1, p.70-2 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.123-6 (Jan. 1983).
The Raman-scattering spectra of $LiTaO_3$ have been studied at 5, 80, and 300K in the Y(ZZ)X scattering geometry in which transverse A_1 (T) phonons should be seen. The spectra were excited by the 514.5-nm line from an Ar laser with a power of ~0.5 W. At 5K, the spectrum reveals four transverse fundamental A_1 vibrations. In the region of the low-frequency fundamental vibration there is an additional maximum, which corresponds to a bound state. The static permittivity has been calculated for 5, 80, and 300K from the results found for the frequencies and halfwidths of the Raman lines in the quasi-harmonic approximation. Dispersion curves have been plotted for the basic dielectric properties of the crystal over the 0-900-cm^{-1} frequency range. The results agree satisfactorily with direct measurements in the IR part of the spectrum. (7 refs.)

102878 Low-temperature electronic absorption spectra of the sodium nitrite crystal. V.P.Fedorov, V.A.Naumov, A.Ya.Korets.
Opt. & Spectrosc. (USA), vol.54, no.1, p.108-9 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.189-91 (Jan. 1983).
Reports measurements of the electronic absorption spectra of the sodium nitrite crystal in polarized light. The authors studied free and deformed samples (the latter grown in quartz cuvettes of specified thickness) at 4.2-200K. (18 refs.)

102879 Homogeneously broadened far-infrared absorption line due to the $\bar{E}\rightarrow 2\bar{A}$ transition of excited chromium ions in ruby. N.Retzer, H.Lengfellner, K.F.Renk (Inst. fur Angewandte Phys., Univ. Regensburg, Regensburg, Germany).
Phys. Lett. A (Netherlands), vol.96A, no.9, p.487-90 (1 Aug. 1983).
By use of far-infrared laser spectroscopy, the authors have found that for a high-quality ruby crystal at low temperature, the absorption line due to the electronic transition between the excited states $\bar{E}(^2E)$ and $2\bar{A}(^2E)$ of Cr^{3+} ions is homogeneously broadened. From the linewidth (0.011 cm^{-1}) the life-

time of the 2Ā level against emission of 29 cm^{-1} phonons is obtained. (12 refs.)

102880 Infrared-active combination band in a surface formate species. B.E.Hayden, K.Prince, D.P.Woodruff, A.M.Bradshaw (Fritz-Haber-Inst., Max-Planck-Gesellschaft, Berlin, Germany).
Phys. Rev. Lett. (USA), vol.51, no.6, p.475-8 (8 Aug. 1983).
Infrared reflection-absorption spectroscopy of a formate species on Cu(110) shows not only ν_s(COO) and ν(CH) stretching modes characteristic of a bridge species but also a combination band $\nu_a(COO)+\delta(CH)$. Both components of this band have dynamic dipoles parallel to the surface and are thus forbidden themselves. Adsorbate-adsorbate dynamic dipole interactions cause the frequency to shift downwards with increasing coverage. The high absorption cross section of the band is attributed to a Fermi resonance with ν(CH). (15 refs.)

102881 Role of electromagnetic resonances in the surface-enhanced Raman effect. S.A.Lyon (Dept. of Electrical Engng. & Computer Sci., Princeton Univ., Princeton, NJ, USA), J.M.Worlock.
Phys. Rev. Lett. (USA), vol.51, no.7, p.593-6 (15 Aug. 1983).
The magnitude of the plasma-resonance contribution to surface-enhanced Raman scattering on silver-island films has been measured with use of an experimental arrangement in which the resonance can be suppressed. The measured reduction in Raman scattering is ~300, but theoretical analysis indicates that there may remain an additional unsuppressed factor $\lesssim 3$. The data show that plasma resonances are not essential for observation of Raman scattering by molecular monolayers using standard detection techniques. (23 refs.)

102882 Polarized IR reflectance spectra of pure and neutron irradiated Qn(TCNQ)$_2$ mosaics. K.Kamaras (Central Res. Inst. for Phys., Budapest, Hungary), R.Swietlik, A.Graja.
Phys. Status Solidi b (Germany), vol.118, no.1, p.K43-6 (1 July 1983).
In order to learn more about the change occurring at IR frequencies in conducting uniform-stack salts upon irradiation, the authors have measured the polarized reflectance spectra of oriented quinolinium $(TCNQ)_2$ mosaics in the mid-infrared region (4000 to 200 cm^{-1}), pure and irradiated to have up to 8% impurities on the TCNQ stack. (11 refs.)

102883 A simple best fit method for the far infrared reflectivity spectra by using the four-parameter semi-quantum model: application to the sodium nitrite spectrum. M.El Sherif, F.Brehat, B.Wyncke (Lab. Infrarouge Lointain, Univ. de Nancy, Nancy, France).
Phys. Status Solidi b (Germany), vol.118, no.1, p.K47-50 (1 July 1983).
The authors have measured the low frequency reflectivity spectra (10 to 600 cm^{-1}) of $NaNO_2$ in the temperature range 30 to 500K. The electric field $\vec{E}$ of the incident light is oriented along the crystallographic axis $\vec{a}$, $\vec{b}$, and $\vec{c}$. The reflectivity curves are fitted by using a simple computer best fit program based on minimizing the difference at a limited number of test points, between the experimental (R_{exp}) and calculated (R_c) values of the reflectivity. The model chosen for the dielectric permittivity is the four-parameter semi-quantum model (F.P.S.Q.). (7 refs.)

102884 Polarization-dependent infrared reflectivity spectra of CuInSe$_2$. H.Neumann (Sektion Phys., Karl-Marz-Univ. Leipzig, Leipzig, Germany), R.D.Tomlinson, W.Kissinger, N.Avgerinos.
Phys. Status Solidi b (Germany), vol.118, no.1, p.K51-6 (1 July 1983).
The authors have measured and analysed polarization-dependent infrared reflectivity spectra on carefully oriented $CuInSe_2$ single crystals. Infrared reflectivity spectra for the polarization directs $\vec{E}\parallel\vec{c}$ and $\vec{E}\perp\vec{c}$ were measured at room temperature in the wave number range $\bar{\nu}$ of 40 to 4000 cm^{-1} using a Perkin-Elmer spectrophotometer model 58 OB at $\bar{\nu}=180$ to 4000 cm^{-1} and a single-beam spectrometer at $\bar{\nu}=40$ to 400 cm^{-1}. To determine the mode parameters the spectra were analysed in terms of a multiharmonic damped oscillator model. (12 refs.)

102885 Vibrational spectra and structure of stereoregular poly(methyl methacrylates) and of the stereocomplex. J.Dybal, J.Stokr, B.Schneider (Inst. of Macromolecular Chem., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Polymer (GB), vol.24, no.8, p.971-80 (Aug. 1983).
Infra-red and Raman spectra of films and solutions of syndiotactic and isotactic poly(methyl methacrylate) (PMMA) and of the stereocomplex of PMMA were measured. Vibrational bands sensitive to conformational transitions were determined. Differences of band intensities in spectra of stereoregular PMMA and of the stereocomplex indicate changes of populations of conformational forms of polymer chains accompanying stereocomplex formation. For syndiotactic PMMA in the stereocomplex, the extended chain conformation predominates. (38 refs.)

102886 Rheo-optical Fourier transform IR spectroscopy of polyurethane elastomers. I. Principle of the method and measurements at ambient temperature. H.W.Siesler (Bayer AG, Dormagen, Germany).
Polym. Bull. (Germany), vol.9, no.8-9, p.382-9 (March 1983).
Rheo-optical FTIR spectroscopy has emerged as an extremely valuable tool to study deformation phenomena in polymeric solids. With the aid of a specially designed stretching apparatus short-time spectroscopic and mechanical data can be obtained simultaneously during the deformation and relaxation of polymers. Apart from a general introduction to the principle of the technique and its application to polyurethanes the data obtained with a series of three model polyester urethanes of different hard and soft segment content at ambient temperature are discussed in terms of the segmental orientation induced during uniaxial elongation and recovery. (12 refs.)

102887 Rheo-optical fourier transform IR (FTIR) spectroscopy of polyurethane elastomers. II. Measurements at elevated temperature. H.W.Siesler (Bayer AG, Dormagen, Germany).
Polym. Bull. (Germany), vol.9, no.10-11, p.471-8 (April 1983).
For pt.I see ibid., vol.9, p.382-9 (1983). In part I the application of rheo-optical FTIR spectroscopy to a series of model polyester urethanes at ambient temperature has been discussed with reference to the phase separation and segmental orientation of these polymers during uniaxial elongation and recovery. In the present work, the results of variable-temperature FTIR measurements and rheo-optical FTIR investigations at elevated temperature are presented and interpreted in terms of the temperature dependence of hydrogen bonding and structural organization of the hard segments. (11 refs.)

102888 Rheo-optical Fourier transform IR (FTIR) spectroscopy of polyurethane elastomers. II. Investigation of NH-deuterated specimens. H.W.Siesler (Bayer AG, Dormagen, Germany).
Polym. Bull. (Germany), vol.9, no.12, p.557-62 (May 1983).
For pt.II see ibid., vol.9, p.471 (1983). Previously the results of rheo-optical FTIR investigations at ambient and elevated temperature obtained from a series of model polyester urethanes with varying composition have been discussed in terms of the phase separation and segmental orientation of these polymers. In the present work the potential is demonstrated of this technique applied to NH-deuterated specimens of these polyester urethanes with reference to a more detailed insight into phase separation and the orientation mechanism of the phase-separated hard segments during uniaxial elongation and recovery. (11 refs.)

102889 Raman scattering of pure, singly- and doubly perturbed interstitial hydrogen atom centers in alkali halides. E.Goovaerts, Z.-F.Zhou, D.Schoemaker (Phys. Dept., Univ. of Antwerp, Wilrijk-Antwerp, Belgium).
Radiat. Eff. (GB), vol.72, no.1-4, p.81-7 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
Hydrogen atoms occupying interstitial tetrahedral sites are produced by UV excitation of OH^- impurities in alkali halides. A single narrow Raman line is associated with this U_2 center and polarization studies confirm the $A_1 \rightarrow T_2$ nature of the vibrational transition. In alkali halides containing also heavier halogen ion impurities, the interstitial hydrogen can be trapped next to them and a singly perturbed U_2 center of C_{3v} symmetry as well as a doubly perturbed U_2 center of C_{2v} symmetry are produced. Their identification was based on a careful analysis of polarized Raman studies on both randomly oriented and preferentially oriented centers. $RbBr:I^-, OH^-$ is a typical example: the fundamental $A_1 \rightarrow T_2$ of the pure U_2 center is at 330 cm^{-1}; the singly perturbed U_2 center yields a $A_1 \rightarrow A_1$ Raman line at 284 cm^{-1} and a $A_1 \rightarrow E$ transition at 345 cm^{-1}. The doubly perturbed center exhibits a single line at 269 cm^{-1}. A qualitative discussion of these results is attempted. (19 refs.)

102890 Raman scattering induced by V centers and their aggregates in alkali halides. L.Taurel, E.Rzepka, S.Lefrant (Lab. de Phys. Cristalline, Univ. de Paris-Sud, Orsay, France).
Radiat. Eff. (GB), vol.72, no.1-4, p.115-21 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
The Raman spectroscopy technique allows one to determine the nature of stable non-paramagnetic V-centers created in KI and KBr X-irradiated in the range 100-300K. In the early stage of X-irradiation, trihalide ions X_3^- (X=I, Br) are created. They are characterized by the 111 cm^{-1} (KI) and the 175 cm^{-1} (KBr) stretching vibrational mode of the linear ion. The X_3^- ions are responsible for the V_2 (about 350 nm) optical absorption band in KI and of the V_4 (275 nm) band in KBr. By increasing the X-ray dose, polyhalide ions characterized by the I_2 vibrational mode in I_n^- (n=5,...) ions are formed. In the case of KI, it is shown that the polyiodides are precursors of iodine aggregates which have the iodine crystal structure. Studies of KI (Ca^{2+}) and KBr (Sr^{2+}) near RT proves that the X_3^- ions are stabilized by the divalent cations. (12 refs.)

102891 Reconsidering the existence of cubic sublimated P$_4$S$_{10}$. M.C.Demarcq (Lab. de Chimie Organique, Inst. Nat. des Sci. Appliquees de Lyon, Villeurbanne, France), M.Lamalle.
Rev. Chim. Miner. (France), vol.20, no.3, p.396-403 (1983).
No confirmation could be gained of the actual existence of the cubic sublimated modification of P_4S_{10}, as described by Cueilleron and Vincent (1970). Strong evidence suggests, on the contrary, that the latter could rather be a balanced mixture of amorphous P_4S_{10}+cubic P_4S_9+sulphur. (23 refs.)

102892 Raman effect in single crystal NiSO$_4$.6H$_2$O. L.S.G.Cancela, G.M.Gualberto (Inst. de Fisica, Univ. Estadual de Campinas, Campinas, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.2, p.305-14 (June 1982).
The Raman spectrum of $NiSO_4.6H_2O$ was obtained at room temperature and 77K. A theoretical study of the number, type and activity of the optical phonons in this material, permitted a classification of the observed phonons. The data showed an anomalous temperature dependence for the peak at 42 cm^{-1} with symmetry B_2 and for the peaks at 75 and 115 cm^{-1} with symmetry A_1. (10 refs.)

102893 On the nature of IR absorption peaks introduced by the absorbed hydrogen on Si surface. T.S.Shi, S.N.Sahu, J.W.Corbett (Phys. Dept., State Univ. of New York, Albany, NY, USA).
Surf. Sci. (Netherlands), vol.130, no.1, p.L289-90 (July 1983).
The authors analyse the IR peaks due to hydrogen bonds at the silicon surface. They use a model proposed earlier for the SiH vibration centers in crystalline Si based on the chemical effect of the nearest neighbor atoms on the band character and on the IR vibration frequency. (3 refs.)

102894 Optical microanalysis of small semiconductor structures. D.V.Murphy, S.R.J.Brueck (Lincoln Lab., MIT, Lexington, MA, USA).
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.81-94
Raman spectroscopy is a powerful tool for evaluating semiconductor crystal characteristics with a diffraction-limited spatial resolution of approximately 0.5 μm, comparable to device structure dimensions. Examples are presented of the use of Raman scattering to measure stress variations across Si-on-insulator and Si-on-sapphire stripes with dimensions down to 2 μm and, to probe the spatial variation in the effectivness of annealing, of a Si layer deposited over metal device structures. Detailed measurements of the variation in the Raman spectra of thin crystalline Si films, with thicknesses down to 3.0 nm, are discussed. Measurements made on roughened Si surfaces are presented which show that surface morphology on a submicron spatial scale results in enhanced Raman intensities. (28 refs.)

102895 Raman scattering as a temperature probe for laser heating of Si. D.Kirillov, J.L.Merz (Dept. of Electrical & Computer Engng., Univ. of California, Santa Barbara, CA, USA).
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.95-102
The frequency of the phonon line in the Raman scattering spectrum recorded during CW laser-beam heating of Si was used as a characteristic of the lattice temperature inside the laser spot. It is shown that Raman scattering is a good temperature probe up to the laser power approaching optical damage of Si. (16 refs.)

Cohesive Properties of Semiconductors under Laser Irradiation. Proceedings of the NATO Advanced Study Institute .... See Entry 98653

Infrared and Raman spectra and normal coordinate calculations for methylisothiocyanate .... See Entry 100389

The conformation and vibrational spectra of isocyanato and isothiocyanatocyclohexane .... See Entry 100395

Infrared study of molecular rotation in liquids .... See Entry 100396

Vibrational study of strong C-H...X hydrogen bonds in solid complexes of boron decachlorocarboranes .... See Entry 100405

Study of conformational structure of macromolecules under stretching. Results of computer simulation and IR-spectroscopy .... See Entry 100621

Selective nonlinear spectroscopy of inhomogeneously broadened phonon resonances in a disordered medium .... See Entry 100847

Photoacoustic observation of third-order absorption in thallium halides at 1.06 μm .... See Entry 100865

Carrier dependent parameters in a silicon optical waveguide . See Entry 100888

The influence of fluorine upon the structural, chemical, and physical properties of phosphate glasses .... See Entry 101562

Silver sulfide based glasses. I. Glass forming regions, structure and ionic conduction of glasses in Ge_2-Ag_2S and GeS_2-Ag_2S-AgI systems . See Entry 101568

Atomic structure of SiS_2 and $SiSe_2$ glasses .... See Entry 101575

Preparation of fluoride glasses based on heavy metals. Optical transmission studies .... See Entry 101579

Correspondence between the results of structural and thermodynamic studies of vitreous silica .... See Entry 101581

Solvent induced crystallization of syndiotactic poly(methyl methacrylate). Relation to the formation of polymer aggregates in solution. [NMR and IR spectra] .... See Entry 101597

Relation of low-frequency skeleton vibrations in glassy polymers with equilibrium rigidity of macromolecules .... See Entry 101602

New fluorides of tetravalent cerium, praseodymium and terbium .... See Entry 101670

Crystal structure of $Cs_4P_4O_8S_4$ .... See Entry 101673

Crystal structure and electronic states of dithieno[3,2-*b*:2′,3′-*d*]thiophene .... See Entry 101683

Study of defect formation in irradiated KL and KI(Pb) by Raman scattering and optical absorption techniques .... See Entry 101694

Raman scattering with nanosecond resolution during pulsed laser heating of silicon .... See Entry 101767

Pulsed Raman measurements of phonon populations: time reversal, correction factors, and all that .... See Entry 101768

A detailed examination of time-resolved pulsed Raman temperature measurements of laser annealed silicon .... See Entry 101769

Microprobe Raman analysis of picosecond laser annealing of implanted silicon .... See Entry 101788

Lattice dynamics of polyacetylene as a one-dimensional system. II. Doping-induced disorder .... See Entry 101888

Structural phase transitions and polaritons in low-frequency region .... See Entry 101951

High-pressure phase transitions in potassium and phase relations among heavy alkali metals .... See Entry 101958

Ionic conduction of sulphide-based glasses in the systems M_2S-GeS_2-MI (M=Li,Ag) .... See Entry 102043

Adsorption layers of surface-active substances and their influence on polyurethane network formation .... See Entry 102162

Spin coated amorphous chalcogenide films: thermal properties .... See Entry 102217

Effective mass of electrons in $BaPb_{1-x}Bi_xO_3$ .... See Entry 102240

Co (III) ions high-spin configuration in nonstoichiometric Co_3O_4 films .... See Entry 102255

Optical and thermal evidence for the metal-insulator transition in 1T-TaS_2 .... See Entry 102260

Secondary emission due to recombination of excitons near indirect band bottom. I. General feature .... See Entry 102265

Coulomb resonance at the Fermi level of the electron-hole liquid in germanium .... See Entry 102268

Effect of dopant on the physicochemical and electrical properties of organic conducting polymers .... See Entry 102361

Electrical and optical properties of RF-SP a-Ge:O:(H) deposited from GeO_2 .... See Entry 102382

Low temperature hopping diffusion in doped semi-conductors .... See Entry 102391

Light-induced effects in amorphous silicon material and devices .... See Entry 102458

Subband energies in accumulation layers on InP .... See Entry 102516

Photoelastic constants of calcite from its first-order Raman spectrum .... See Entry 102847

High-pressure optical spectra of condensed oxygen .... See Entry 102905

Electronic absorption spectrum of Cu^{2+} ions doped in zinc cesium sulphate hexahydrate .... See Entry 102908

Correlation of photoluminescence and symmetry studies with photoexcitation and decay processes of infrared active defects in Si .... See Entry 102910

Optical absorption in PbTe doped with Cr .... See Entry 102911

Optical spectra of Pb^{2+} to monitor the precipitation behavior of NaCl:Cd .... See Entry 102914

The resonant secondary emission of the F center in alkali halides .... See Entry 102951

Observation of population inversion of holes in Ge in crossed *E* and *H* fields from the spontaneous far-infrared emission .... See Entry 102953

Photoinduced changes in optical properties of yellow arsenic .... See Entry 102975

Resonance Raman spectra of benzene adsorbed on Cu^{2+}-montmorillonite. Formation of poly(*p*-phenylene) cations in the interlayer of the clay mineral .... See Entry 103581

Surface enhanced Raman spectra of benzotriazole adsorbed on a copper electrode .... See Entry 103583

Surface-enhanced Raman scattering of colloid-stabilizer systems .... See Entry 103591

Temperature-induced phase transition and structural changes in micellar solutions of sodium oleate observed by Raman scattering .... See Entry 103597

78.35 BRILLOUIN AND RAYLEIGH SCATTERING

102896 Anomalous backscattering of optical radiation in a stratified solution. F.V.Bunkin, M.A.Davydov, N.P.Kitaev, G.A.Lyakhov, K.F.Shipilov, T.A.Shmaonov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
JETP Lett. (USA), vol.37, no.3, p.178-80 (5 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.3, p.147-9 (5 Feb. 1983).
Temperature-selective generation of a powerful pulse, initiated by seed laser radiation, is observed. The experiment is performed with a system that includes a regenerative amplifier and a cell containing the solution (water-γ-collidine), in which the scattering provided the feedback. (2 refs.)

102897 Molecular reorientation of benzene in carbon tetrachloride, tetramethylsilane and neopentane solutions. W.Hartl, H.Versmold (Phys. Chem. IIa, Univ. Dortmund, Dortmund, Germany).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.7, p.1143-53 (July 1983).
The depolarized Rayleigh scattering of benzene in CCl_4, $C(CH_3)_4$ and $Si(CH_3)_4$ solutions has been investigated. Despite the similar molecular sizes polarizabilities of the solvents, the wing spectra in dilute solutions are observed to be very different. Orientational memory functions calculated from the spectra show a pronounced oscillatory pattern in the CCl_4 solutions, the pattern being much less obvious in the $C(CH_3)_4$ and $Si(CH_3)_4$ solutions. Since it is improbable that these changes are due to changes in the interaction-induced scattering, they are attributed to changes in the orientational dynamics. Following previous work on benzene, the oscillatory pattern is attributed to librational motion of the benzene molecule in the liquid. The libration persists if benzene is encaged by heavy molecules such as CCl_4, but diminishes in solutions with light molecules, such as $C(CH_3)_4$ and $Si(CH_3)_4$. (31 refs.)

102898 Determining the dimensions of light-sensitivity and color centers of silver-halide photochromic glasses from measurements of the angular characteristics of light scattering. A.V.Dotsenko, V.K.Zakharov, V.A.Loiko.
J. Appl. Spectrosc. (USA), vol.37, no.4, p.1180-5 (Oct. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.4, p.630-6 (Oct. 1982).
The problem of establishing the dimensions of scattering particles on the basis of measurements of the light-scattering characteristics is a complex inverse problem which may be uniquely solved only in a number of particular cases. The solution of this problem for heterophase photochromic glasses (PCG) is of practical importance in view of the difficulties of determining the dimensions of regions of light sensitivity and color. In particular, measurements of the dimensions of regions occupied by silver-halide phase by means of an electron microscope may give distorted results because of the sensitivity of the microcrystalline phase to the electron beam. Formulas are derived for determining the dimensions of scattering particles in monodisperse and polydisperse ensembles of small homogeneous and two-layer particles. (12 refs.)

102899 Light scattering in nematic liquid crystals in non-equilibrium steady states. H.Pleiner (Univ. Essen, Essen, Germany), H.Brand.
Mol. Cryst. & Liq. Cryst. (GB), vol.97, no.1-4, p.423 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
Summary form only given, as follows. Thermal fluctuations in nematic liquid crystals about a non-equilibrium stationary state due to an external temperature gradient or due to an external shear stress are theoretically investigated. The influence of the non-equilibrium situation on the light scattering spectrum (especially on the equilibrium Lorentzian due to transverse director fluctuations) is discussed. In an external temperature gradient this Lorentzian does not alter its height, but is slightly shifted and is deformed into an asymmetric shape because of the non-equilibrium situation. With the help of a stabilizing magnetic field and by small-angle scattering, it should be possible to resolve experimentally this asymmetry. By the application of an external shear stress, the spontaneously broken rotational symmetry of nematics is broken externally, too. The equilibrium Lorentzian is (in addition to the trivial Doppler shift) flattened and broadened in a symmetric but non-Lorentzian manner due to wave-vector independent non-equilibrium contributions. This anisotropy arising from various possible directions of temperature gradient (or shear stress), director, and wave vector has a pronounced effect on the non-equilibrium contributions to the light scattering spectrum. By the non-equilibrium situation, dynamics and statics are mixed up in an intricate manner.

102900 The $o\rightleftharpoons e$ light scattering during the flow of ionic current in α-$LiIO_3$ single crystals. Xu Zhengyi, Yang Huaguang, Li Yinyuan (Inst. of Phys., Acad. Sinica, Beijing, China).
Sci. Sin. (China), vol.26, no.6, p.637-49 (June 1983).
Summarizes the phenomena of $o\rightleftharpoons e$ light scattering induced by the fluctuation of space charge during the flow of ionic current in α-$LiIO_3$ single crystals. The most noticeable features are as follows: When the incident beam is ordinary (or extraordinary) light, the scattered light is extraordinary (or ordinary) in polarization. The scattering bands extend 360° around the *c*-axis, though generally much stronger in the forward direction. The intensity distribution of scattering bands is asymmetrical with respect to the transmitted light spot. With a D-type crystal used as the specimen, the asymmetry in scattering intensity distribution is also reversed with respect to that observed in an L-type crystal. The authors point out that the nonuniformity and fluctuation of space charge lead to the variation of dielectric tensor such that its non-diagonal elements deviate from zero. Thus, the $o\rightleftharpoons e$ scattering is preliminarily understood as a radiation process of the second order. (33 refs.)

Nature of the instability associated with parametric excitation of acoustic waves by electromagnetic fields .... See Entry 100851

Interaction between components of polymer blends by scattering .... See Entry 101529

Dimensions of poly(styrene) in the vicinity of the theta point .... See Entry 101530

Solution properties of poly(N-butyl methacrylamide) .... See Entry 101531

Liquids with cubic orientational order—the cholesteric blue phase .... See Entry 101537

Temperature dependence of the elastic constants in CsCN measured by Brillouin scattering .... See Entry 101835

Freezing transition phenomena far from equilibrium .... See Entry 101919

Kinetic Ising model for polymer dynamics: applications to dielectric relaxation and dynamic depolarized light scattering .... See Entry 102812

Particle size from optical anisotropy effects in scattered light .... See Entry 103602

Light-scattering studies of hydroxyethylcellulose in water/nonionic surfactant binary mixtures. Evidence for preferential solvation of polymer chains by surfactant micelles .... See Entry 103603

78.40 VISIBLE AND ULTRAVIOLET SPECTRA

102901 Triplet-state optical spectra of highly concentrated isotopically mixed crystals of anthracene A-h_{10}:A-d_{10}. D.Rund, H.Port (Phys. Inst., Univ. Stuttgart, Stuttgart, Germany).
Chem. Phys. (Netherlands), vol.78, no.3, p.357-61 (1 Aug. 1983).
Photoexcitation spectroscopy with a dye laser is applied to study highly concentrated isotopically mixed crystals of anthracene A-h_{10} in the region of the $T_1 \leftarrow S_0$0-0 transition. The spectra of the seperated A-h_{10} and A-d_{10}. The spectra of:A-d_{10} subbands are measured in polarized light at 6K. The concentration-dependent intensities and energetic positions of the subbands are described quantitatively using the moment-expansion method of the mixed-crystal Green's function. (17 refs.)

102902 Urbach rule behavior in strongly absorbing fine particle solids. R.K.Waring,Jr., W.Y.Hsu (Central Res. & Dev. Dept., E.I. du Pont de Nemours & Co., Wilmington, DE, USA).
J. Appl. Phys. (USA), vol.54, no.7, p.4093-6 (July 1983).
The intrinsic absorption spectrum $\alpha(E)$ of fine particles (<0.2 μm) of $PbCrO_4$, $BiVO_4$, CdS, and ZnS, respectively, was measured in the vicinity of the visible absorption edge from 20 to 300K by diffuse reflectance. In $PbCrO_4$ and in isoelectronic $BiVO_4$, the edge is exponential and steepens, while remaining fixed in energy, as T is reduced. The edge fits the Urbach behavior: $\sigma = d\ln\alpha/dE = (2\sigma_0/\hbar\Omega_0)$ tanh $(\hbar\Omega_0/2\ k_BT)$, where σ_0 and Ω_0 are constants and $\sigma \simeq 80$ eV^{-1} at 300K. The authors find $\hbar\Omega_0 = 25\times10^{-3}$ eV in $PbCrO_4$, nearly coinciding with the 23×10^{-3} eV vibration observed in natural crocoite. For the exponential edge in single crystal CdS, $\sigma \simeq 80$ eV^{-1} at 300K and also increases at low T. However, the edge shifts to higher energy at low T. In fine particles of pure CdS, the energy shift was again found, but $\sigma \simeq 20$ eV^{-1}, independent of T. This suggests that in pigmentary CdS σ is controlled by extrinsic factors such as defects. It behaves as a compensated semiconductor in which color arises from a transition between delocalized states. ZnS behaves similarly. The intrinsic nature of edge broadening in fine particle $PbCrO_4$ and $BiVO_4$ may result from the electronically isolated nature of the chromosphore in these solids, wherein the color probably results from a charge transfer transition between localized states. (17 refs.)

102903 Spectroscopic properties of some Eu^{3+} doped scheelite-related rare earth sesquimolybdates and sesquitungstates. J.Huang, J.Loriers (Lab. d'Etude des Materiaux par Techniques Avancees, CNRS, Meudon-Bellevue, France), P.Porcher.
J. Solid State Chem. (USA), vol.48, no.3, p.333-45 (15 July 1983).
The optical properties of Eu^{3+} as a local structural probe are analyzed when incorporated in some rare earth and bismuth scheelite-related molybdates or tungstates: α-$La_2(MoO_4)_3$, $Bi_2(MoO_4)_3$, α-$Gd_2(MoO_4)_3$, and $Gd_2(WO_4)_3$. When the rare earth occupies more than one crystallographic position, the dye laser selective excitation technique is applied to determine the point symmetry of the site and to derive the energy level schemes. In α-$La_2(MoO_4)_3$, the occupation of vacant positions by Eu^{3+} is confirmed and the conditions for an enhancement of the occupation are discussed. The analogy of the α-$Gd_2(MoO_4)_3$ and $Gd_2(WO_4)_3$ spectra constitutes further evidence for their isostructural character. (28 refs.)

102904 ^{13}C isotope shifts of anthracene and naphthalene isomers in triplet state optical spectra. U.Doberer, H.Port, D.Rund, W.Tuffentsammer (Phys. Inst., Univ. Stuttgart, Stuttgart, Germany).
Mol. Phys. (GB), vol.49, no.5, p.1167-78 (10 Aug. 1983).
Position-specific ^{13}C isotope shifts in the $T_1 \leftarrow S_0$ photoexcitation spectra of anthracene and naphthalene crystals containing ^{13}C substituted molecules in natural abundance and of material enriched with various synthesized ^{13}C isomers are compared. From the spectra of matrix isolated A-h_{10} in A-d_{10} and N-h_8 in N-d_8 the individual isotope shifts U_0 of all the ^{13}C monosubstituted isomers are determined (with values U_0 between 0.7 and 3.5 cm^{-1}). An additivity rule is established for the U_0 of the twofold substituted $^{13}C^{13}C$ isomers similar to that found for multiple deuteration. Applying these results also the ^{13}C substructure of the excitonic Davydov components in anthracene and naphthalene crystals is understood quantitatively. A correlation between the specific ^{13}C isotope shifts and the triplet state spin density distribution is discussed. (22 refs.)

102905 High-pressure optical spectra of condensed oxygen. M.Nicol (Dept. of Chem. & Biochem., Univ. of California, Los Angeles, CA, USA), K.Syassen.
Phys. Rev. B (USA), vol.28, no.3, p.1201-6 (1 Aug. 1983).
Optical-absorption spectra (1.5-3.5 eV) of the fluid and three solid phases of O_2 have been recorded up to 40 GPa near 298K. The principal feature of the spectra of the fluid and rhombohedral β-O_2 is the $2^1\Delta_g \leftarrow 2^3\Sigma_g^-$ band; in β-O_2, it is polarized perpendicular to the c axis of the hexagonal cell. The energies of this and other transitions among the $^3\Sigma_g^-$, $^1\Delta_g$, and $^1\Sigma_g^+$ states increase with increasing pressure. The spectra and visual observations of the transformation between orthorhombic and ε-O_2, whose structure has not been determined, suggest that ε-O_2 has a layered structure. Absorption spectra of orthorhombic and ε-O_2 for light propagating perpendicular to the layers are dominated by a moderately strong band which moves from the UV through the visible with increasing pressure and a very strong ultraviolet band. These bands can be assigned as excitations from π^4-π^{*2} states to π^3-π^{*3} states which are mixed with intermolecular-charge-transfer excitations. Both bands move toward longer wavelengths at high pressures. At pressures above 13 GPa, absorption features for light propagating in the planes of the ε-phase structure can be assigned as $2^1\Delta_g \leftarrow 2^3\Sigma_g^-$. However, between 10 and 13 GPa, this feature is absent, and the pressure dependence of the Raman spectrum also is unusual. Both observations suggest that, between these pressures, the molecules reorient with respect to the crystallographic axes. (15 refs.)

102906 Coupling between molecular and charge transfer excitations in mixed alkali halide-cyanide crystals. S.S.Camargo,Jr., J.P.von der Weid (Dept. de Fisica, Pontificia Univ. Catolica, Rio de Janeiro, Brazil).
Radiat. Eff. (GB), vol.72, no.1-4, p.177-83 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
The optical absorption spectra of mixed alkali halide cyanide crystals [$M(CN)_xY_{1-x}$ where M=Na, K, Rb and Y=F, Cl, Br, I] were measured at temperatures ranging from 300K down to 4.2K and CN^- concentrations from 10^{-2}% up to pure cyanide crystals. The absorption cross sections of the parity forbidden $X^1\Sigma^+ \rightarrow a'^3\Sigma^+$ vibronic transitions of the CN^- molecular ions were found to present a strong, non-linear dependence on the x-composition of the mixed crystal as well as on the halide ion. This behaviour is explained by the coupling of the triplet molecular excitations to singlet charge transfer excitations in their neighborhood. The experimental data were fit with a coupling energy of a few meV, depending mainly on the type of excitations involved (localized or collective) and not on the particular halide ion. The coupling mechanism is discussed and it is found to be due to the overlap between the wavefunctions of the two excitations. (7 refs.)

102907 Optical absorption and electron paramagnetic resonance studies of colorless and pink beryl. A.G.Blak, S.Isotani, S.Watanabe (Inst. de Fisica, Univ. de Sao Paulo, Sao Paulo, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.2, p.285-92 (June 1982).
The results of the optical absorption (OA) and electron spin resonance (EPR) measurements of colorless and pink beryl, heated and ultraviolet (UV) irradiated are presented. In the UV region of the OA spectra, bands are observed at 36000 cm^{-1} and 42000 cm^{-1}. The UV irradiation produces atomic hydrogen, stabilized in the crystal lattice at room temperature. This was revealed by the presence of H^0 lines, in the EPR spectrum. (8 refs.)

Change of state of colour centres in alloyed sodium chloride crystals .... See Entry 99222

Magnetic circular dichroism and anomalous fluorescence spectra of azulenothiophenes .... See Entry 100436

Preparation of new fluoride glasses in ZrF_4-BaF_2-TlF system .... See Entry 100868

Calculation of the temperature regimes for the fine anneal of quartz discs .... See Entry 101026

Preparation of fluoride glasses based on heavy metals. Optical transmission studies .... See Entry 101579

Crystal structure and electronic states of dithieno[3,2-*b*:2′,3′-*d*]thiophene .... See Entry 101683

Iron-ion—implantation effects in MgO crystals .... See Entry 101730

Effect of X-irradiation on impurity-vacancy dipoles in lead and calcium-doped NaCl .... See Entry 101746

Irradiation effects in perovskite-type fluorides .... See Entry 101792

Structural phase transitions and polaritons in low-frequency region .... See Entry 101951

High-pressure phase transitions in potassium and phase relations among heavy alkali metals .... See Entry 101958

Electronic structure of amorphous semiconductors .... See Entry 102241

Co (III) ions high-spin configuration in nonstoichiometric Co_3O_4 films .... See Entry 102255

Optical and thermal evidence for the metal-insulator transition in 1T-TaS_2 .... See Entry 102260

Quasi-two-dimensional excitons in GaAs/Al_xGa_{1-x}As semiconductor multiple quantum well structures .... See Entry 102264

Picosecond kinetics of the donor bound exciton in $Cd_{1-x}Mn_xSe$ .... See Entry 102267

Effect of dopant on the physicochemical and electrical properties of organic conducting polymers .... See Entry 102361

Electrical conductivity and optical transmission of phases of the Li_2S-Sb_2S system. Correlation between structure and physical properties .... See Entry 102389

Growth peculiarities of graded band gap GaAsSb/GaAs heterostructures and effective light modulation in the 1.06 μm wavelength region .... See Entry 102502

Off-diagonal s-d coupling and red shift of absorption spectra in magnetic semiconductors .... See Entry 102647

Optical and electron spin resonances studies of copper(II), nickel(II) and oxovanadium(IV) complexes of water-soluble phthalocyanine and porphyrazine chelates absorbed on Sephadex resins, and the effect of added dithionite .... See Entry 102735

The ⟨110⟩ oriented FCl^- molecule-ion in KF .... See Entry 102743

Electronic spectra of complexes of neodymium (III) and praseodymium (III) with amino acid .... See Entry 102864

On the optical properties of trans-polyacetylene .... See Entry 102865

Electronic absorption spectrum of Cu^{2+} ions doped in zinc cesium sulphate hexahydrate .... See Entry 102908

Optical absorption of 3*d* transition metal and rare earth elements in zirconium fluoride glasses .... See Entry 102913

Optical spectra of Pb^{2+} to monitor the precipitation behavior of NaCl:Cd .... See Entry 102914

Optical absorption spectra of mercury centres in KCl and NaCl .... See Entry 102915

Photochemical conversion and optical absorption spectra of V centers in coloured KI crystals .... See Entry 102917

Optical characteristics of alkali zinc silicate glasses containing iron sulfide .... See Entry 102918

Spectral absorption of iron in silicate optical glasses .... See Entry 102919

Optical properties of F_A and $(F_2)_A$ centres in doped KI .... See Entry 102949

Vacuum-UV absorption and thermoluminescence of X-rayed quartz crystals .... See Entry 102968

Optical absorption of transition metal ions in silica coating films prepared by the sol-gel technique .... See Entry 102974

Optical absorption of transition element oxide-silica coating films prepared by sol-gel method .... See Entry 102981

Spectroscopic standard for tetrahedrally coordinated ferric iron: γ $LiAlO_2:Fe^{3+}$ .... See Entry 102999

78.45 STIMULATED EMISSION

(see also 42.65C in nonlinear optics)

Stimulated emission of Ho^{3+} in $BaTm_2F_8$ and Tm^{3+} ions in $BaYb_2F_8:Er^{3+}$ crystals .... See Entry 100777

Stimulated photoluminescence of CdTe .... See Entry 102952

78.50 IMPURITY AND DEFECT ABSORPTION IN SOLIDS

102908 Electronic absorption spectrum of Cu^{2+} ions doped in zinc cesium sulphate hexahydrate. K.Purandar, J.Lakshmana Rao, S.V.J.Lakshman (Dept. of Phys., SV Univ., Tirupati, India).
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.4, p.255-63 (1983).
The optical absorption spectrum of Cu^{2+} ions doped in $ZnCs_2(SO_4)_2.6H_2O$ single crystals has been studied at room (300K) and liquid nitrogen (77K) temperatures. From the nature and positions of the bands observed, a successful interpretation of all the bands could be made assuming D_{2h} site for Cu^{2+} ions in zinc cesium sulphate hexahydrate, ESR studies of the sample confirm

the site symmetry of the central metal ion. Taking $^2A_{1g}(d(x^2-y^2))$ as the ground state in D_{2h} symmetry, the four absorption bands at 77K are attributed to the transitions to $^2A_{1g}(d(z^2))$, $^2B_{1g}(d_{xy})$, $^2B_{2g}(d_{xz})$ and $^2B_{3g}(d_{yz})$, respectively, in the order of increasing energy. (35 refs.)

102909 Spectral properties of glassy tetraphosphate with high neodymium (Nd^{3+}) concentration. Qi Changhong, Gan Fuxi (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, Shanghai, China).
Chin. Phys. (USA), vol.3, no.2, p.433-7 (April-June 1983).
Nd^{3+} doped glassy tetraphosphate laser material with Nd^{3+} concentrations of 0.13×10^{21} to 4×10^{21} cm^{-3} was studied, and the spectral characteristics for this laser glass were reported. Concentration quenching mechanism of Nd^{3+} ions in these materials was discussed. (12 refs.)

102910 Correlation of photoluminescence and symmetry studies with photoexcitation and decay processes of infrared active defects in Si. W.J.Vidinski, A.J.Steckl, J.C.Corelli (Center for Integrated Electronics, Rensselaer Polytech. Inst., Troy, NY, USA).
J. Appl. Phys. (USA), vol.54, no.7, p.4097-103 (July 1983).
Defects introduced in silicon by neutrons and ions which give rise to infrared active electronic defect absorption bands after heat treatment to 500°C were studied using a dual beam optical method. The measurements were made in the 11-90K temperature range on four defect bands found in the 900 (11.1)-1100 cm^{-1} (9.09 μm) region of the infrared spectrum. The studies yield results on the capture cross sections of photoexcited electrons from defects which lead to a model of a defect having three different charge states. These cross sections are much smaller than those reported for the photoionization cross sections of chemical impurities such as Au in silicon. The states found in this study can be identified with photluminescence peaks reported by others near 1 and 0.76 eV. Additionally, there are two different symmetries assumed by the defects responsible for the defect absorption bands. (23 refs.)

102911 Optical absorption in PbTe doped with Cr. M.I.Baleva, L.D.Borissova (Faculty of Phys., Univ. of Sofia, Sofia, Bulgaria).
J. Phys. C (GB), vol.16, no.24, p.L907-11 (30 Aug. 1983).
The absorption spectrum of PbTe doped with Cr is measured in the photon energy range between 0.1 eV and 0.34 eV at room temperature. The observed impurity absorption band is assigned to optical transitions from the bottom of the conduction band to a widened term of the Cr^{3+} ion. The density of states in the Cr^{3+} impurity band is described by a Lorentzian dispersion curve. (10 refs.)

102912 Impurity band in dilute mixed molecular crystals. K.Wanachote (Dept. of Phys., King Mongkut Inst. of Technol., Thonburi, Thailand), I.M.Tang.
J. Sci. Soc. Thailand, vol.9, no.2, p.63-72 (June 1983).
The monomer self energy in dilute mixed molecular crystals is obtained by considering a set of diagrams which when summed yields a self energy expression in the form of a continued fraction. Using some theorem concerning Sturm sequences, the analytic behavior of the exciton propagator is obtained. The bandwidth of the impurity band in dilute $C_{10}D_8/C_{10}H_8$ mixed naphthalene crystals is determined by examining the branch cut appearing in the exciton propagator. (14 refs.)

102913 Optical absorption of *3d* transition metal and rare earth elements in zirconium fluoride glasses. Y.Ohishi, S.Mitachi, T.Kanamori, T.Manabe (Ibaraki Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Ibaraki, Japan).
Phys. & Chem. Glasses (GB), vol.25, no.5, p.135-40 (Oct. 1983).
Absorption spectra of *3d* transition metal and rare earth elements in zirconium fluoride glasses were measured and their absorptivities in the near to mid infrared range have been evaluated. The absorptivities of Fe, Co, Ni, and Cu are, respectively, 90, 130, 90, and 3 dB/2km/2ppm at the 2 μm band; their effective absorption is low above 3 μm. Rare earth elements such as Ce, Pr, Nd, Sm, Eu, Tb, and Dy have sharp adsorption bands in the 2 to 5 μm range and their peak absorptivity is between 1 and 100 dB/km/ppm. In order to obtain a fluoride glass fibre with a transmission loss of less than 0.1 dB/km at 2.5 μm, the Fe, Co, or Nd content should be less than 1 ppb and the Ni, Pr, Sm, or Eu content should be less than 10 ppb. (12 refs.)

102914 Optical spectra of Pb^{2+} to monitor the precipitation behavior of NaCl:Cd. J.Garcia Sole, C.Zaldo, F.Agullo-Lopez (Dept. de Optica y Estructura de la Materia, Univ. Autonoma de Madrid, Madrid, Spain).
Phys. Status Solidi a (Germany), vol.78, no.1, p.85-91 (16 July 1983).
A small concentration of Pb^{2+} ions is introduced into crystals of NaCl:Cd to monitor the aggregation and precipitation behavior of cadmium in NaCl. The evolution of the absorption and emission spectra of Pb^{2+} is followed during ageing and thermal annealing treatments. Moreover, the annihilation behavior of those spectra is correlated with that measured for the Raman peaks associated to Suzuki-phase precipitates. The main conclusion of this work is that Pb^{2+} becomes incorporated in the Suzuki-phase of Cd and gives rise to an absorption band at 274 nm and a corresponding emission band at 460 nm. On the other hand, absorption and luminescence bands occurring at 284 and 390 nm, respectively, are attributed to Pb^{2+} included in another precipitated phase. This phase develops at ageing temperatures $<80°C$ and its structure is not definitely identified. (16 refs.)

102915 Optical absorption spectra of mercury centres in KCl and NaCl. B.S.Acharya (Regional Res. Lab., Buhubaneswar, India), A.K.Panda.
Phys. Status Solidi a (Germany), vol.78, no.1, p.K81-5 (16 July 1983).
γ-irradiation and F-light bleaching were performed on KCl:Hg and NaCl:Hg samples to see their effect and hence to identify the nature of impurity centres. The optical absorption spectra were recorded in a Cary 17-D model spectrophotometer. All the spectra were recorded at room temperature and in the range between 200 to 800 nm. (4 refs.)

102916 Theoretical study of optical absorption in hydrogenated amorphous silicon. W.E.Pickett (Condensed Matter Phys. Branch, Naval Res. Lab., Washington, DC, USA), D.A.Papaconstantopoulos, E.N.Economou.
Phys. Rev. B (USA), vol.28, no.4, p.2232-4 (15 Aug. 1983).
The authors present the first application of the coherent-potential approximation in the evaluation of optical absorption $\alpha(E)$ of α-SiH_x with the use of a realistic multiband model. The optical gap is larger than the calculated density-of-states gap and the theoretical $\alpha(E)$ agrees well with experimental data. These results suggest that $\alpha(E)$ is determined primarily by the local H-Si configuration and short-range order but that it is insensitive to the particular long-range order, which is not included in the model. (10 refs.)

102917 Photochemical conversion and optical absorption spectra of V centers in coloured KI crystals. T.Okada (Phys. Lab., Setsunan Univ., Osaka, Japan).
Radiat. Eff. (GB), vol.72, no.1-4, p.271-5 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
The initial V_2 and V_3 bands observed after quenching of coloured KI crystals are found to be the superposition of absorption bands due to two kinds of V centres with ⟨110⟩ and ⟨111⟩ symmetries. The ratio of concentrations of the former to the latter V centers is estimated to be about 3:1. When a quenched crystal is irradiated at 19K with V_3-light in the 270-nm region, V centers are bleached forming I_2^--like centers. On the basis of the I_3^- molecule-ion model bound to a cation vacancy, a review is given of recent work on the photochemical conversion of V centers at low temperatures. (10 refs.)

102918 Optical characteristics of alkali zinc silicate glasses containing iron sulfide. B.G.Varshal, V.V.Samoteikin, Z.N.Kislyak, L.L.Mirskikh, N.D.Petrova (State Sci.-Res. Inst. of Glass, Moscow, USSR).
Sov. J. Glass Phys. & Chem. (USA), vol.8, no.4, p.304-9 (July-Aug. 1982). Translation of: *Fiz. & Khim. Stekla (USSR)*, vol.8, no.4, p.445-50 (July-Aug. 1982). [received: May 1983]
After heat treatment of a zinc sulfide glass, it was observed that the absorption in the shortwave region decreases and in the longwave region of the spectrum increases; this is associated with the FeS→FeO transformation; the amount of FeO which is formed is equal to the decrement in the FeS. An evaluation has been made of the molar natural absorption index of FeS in the visible region of the spectrum. (10 refs.)

102919 Spectral absorption of iron in silicate optical glasses. A.B.Atkarskaya, L.I.Demkina, G.A.Nikolaeva (S.I. Vavilov State Optical Inst., Leningrad, USSR).
Sov. J. Glass Phys. & Chem. (USA), vol.8, no.4, p.309-12 (July-Aug. 1982). Translation of: *Fiz. & Khim. Stekla (USSR)*, vol.8, no.4, p.451-5 (July-Aug. 1982). [received: May 1983]
It is shown that the approximation method of calculating the concentrating tri- and divalent iron in optical glasses makes it possible to obtain reliable data which is in close agreement with the data obtained using the more exact spectrophotometric method. In the crown-type of glasses, the proportion of Fe (II) is determined by the sum of the oxides of the alkali metals, calcium, and barium and in flints by the oxides of alkali metals and lead. (4 refs.)

A new nonlinear *Q*-switch element—LiF:F_2^- crystal .... See Entry 100864

Effect of X-irradiation on impurity-vacancy dipoles in lead and calcium-doped NaCl .... See Entry 101746

Creation of quasistable lattice defects by electronic excitation in SiO_2 .... See Entry 101798

Lattice dynamics of polyacetylene as a one-dimensional system. II. Doping-induced disorder .... See Entry 101888

Shallow donors in CdF_2 crystals and the semiconductor-insulator transition in mixed $Cd_{x-1}Me_xF_2$ fluorites .... See Entry 102315

The ⟨110⟩ oriented FCl^- molecule-ion in KF .... See Entry 102743

Homogeneously broadened far-infrared absorption line due to the $\bar{E}\rightarrow2\bar{A}$ transition of excited chromium ions in ruby .... See Entry 102879

Optical properties of F_A and $(F_2)_A$ centres in doped KI .... See Entry 102949

Vacuum-UV absorption and thermoluminescence of X-rayed quartz crystals .... See Entry 102968

Spectroscopic standard for tetrahedrally coordinated ferric iron: γ $LiAlO_2:Fe^{3+}$ .... See Entry 102999

Spectrophotometric investigation of the process of colour centre rearrangement during the fixation of a photochemically coloured emulsion ... See Entry 103563

78.55 PHOTOLUMINESCENCE

102920 Fluorescence of rare earth ions adsorbed on porous Vycor glass. H.Mack, R.Reisfeld, D.Avnir (Inst. of Chem., Hebrew Univ. of Jerusalem, Jerusalem, Israel).
Chem. Phys. Lett. (Netherlands), vol.99, no.3, p.238-9 (5 Aug. 1983).
Fluorescence of rare earth (RE) ions arising from f-f transitions in Pr^{3+}, Eu^{3+}, Tb^{3+}, Dy^{3+}, Ho^{3+}, Er^{3+} and Tm^{3+} was observed from the ions adsorbed on porous Vycor glass or on pressed discs of fumed silica. The non-radiative relaxations of the excited states were depressed as a result of a strong chemical bond between the ions and silica acting as a ligand. (10 refs.)

102921 An anomalous emission from $Ru(bpy)_3^{2+}$ adsorbed onto porous Vycor glass. S.Wei, H.D.Gafney (Dept. of Chem., City Univ. of New York, New York, NY, USA), J.B.Clark, D.J.Perettie.
Chem. Phys. Lett. (Netherlands), vol.99, no.3, p.253-7 (5 Aug. 1983).
Tris(2,2′-bipyridine)ruthenium(II), $Ru(bpy)_3^{2+}$, cation exchanges onto porous Vycor glass without a change in its absorption or resonance Raman spectra. When excited with an intense 355 nm laser pulse, the adsorbed complex undergoes biphotonic excitation followed by emission with a maximum at 510 nm and a shoulder at 610 nm. The 510 nm emission decays via a fast non-exponential process whereas that at 610 nm is exponential with a lifetime similar to that in aqueous solution. (15 refs.)

102922 Dynamics of energy of transport in ternary molecular solids. II. Time evolution of naphthalene fluorescence. P.Argyrakis, R.Kopelman (Dept. of Chem., Univ. of Michigan, Ann Arbor, MI, USA).
Chem. Phys. (Netherlands), vol.78, no.2, p.251-63 (15 July 1983).
For pt.I see ibid., vol.57, no.1-2, p.29-44 (1981). The spectrally resolved time-evolution of free and trapped singlet excitons was obtained at liquid-helium temperature for ternary crystals of perdeuteronaphthalene/naphthalene/betamethylnaphthalene (host/guest/supertrap). The naphthalene guest (donor) concentration varied between 0.30 and 0.99 mole fraction, while the supertrap (acceptor) concentrations were 10^{-4}-10^{-5}. At the lower guest concentrations (0.50 and below) the naphthalene-exciton decay time approaches the natural lifetime ($\approx$122 ns). At higher concentrations, the decay is much shorter and extremely non-exponential. This behavior is inconsistent with simple homogeneous kinetics schemes that use a time-independent rate constant for energy transport. Above the percolation concentration (0.60 naphthalene) the authors fitted the experimental results with a random-flight-kinetic model, incorporating correlated random walks on the percolating guest cluster. The best fit was obtained for a 'coherence length' (mean free path) of $\approx10^2$ lattice units. These results are in good agreement with previous steady-state studies on the same samples, and seem to indicate a partial coherence of the exciton transport in both pure and substitutionally disordered crystals at these low temperatures. (62 refs.)

102923 On the use of X-ray-excited optical luminescence (XEOL) for the analysis of multisite rare-earth systems. P.Tola, A.Retournard (Interactions Moleculaires, Univ. de Nancy I, Vandouevre les Nancy, France), J.Dexpert-Ghys, M.Lemonnier, M.Pagel, J.Goulon.
Chem. Phys. (Netherlands), vol.78, no.3, p.339-45 (1 Aug. 1983).
The realization of a XEOL (X-ray-excited optical luminescence) spectrometer is reported. The aim of the paper is to show that a comparison between UV-excited emission spectra and XEOL spectra can be helpful in the assignment of some weak transitions for multiple site rare-earth compounds. The case of c-Y_2O_3 doped with Eu^{3+} cations is considered in some detail, as in the XEOL spectrum three lines to be assigned to transitions occurring at the

centrosymmetrical $Eu^{3+}(C_{3i})$ site are strongly enhanced. Additional site-selective UV-excited emission spectra are also reported supporting the discussion. (30 refs.)

102924 Dispersive singlet exciton motion in an organic glass. R.Jankowiak, H.Bassler (Fachbereich Phys. Chem., Philipps-Univ., Marburg, Germany).
Chem. Phys. (Netherlands), vol.79, no.1, p.57-67 (15 Aug. 1983).
Fluorescence spectra of both pure and coronene-doped 9,10-diphenylanthracene glasses prepared at 4.2K have been measured at 4.2K as a function of excitation energy E_{ex}. The spectroscopic properties of the guest are inferred from both fluorescence and fluorescence excitation spectra of coronene incorporated into a phenanthrene matrix. Analysis of the DPA(C) fluorescence spectra indicates that the number of new sites a DPA singlet exciton can visit during its random walk through the host matrix decreases as the excitation energy is scanned down the low-energy tail of the inhomogeneously broadened $S_0 \rightarrow S_1$ 0-0 transition. The effect is explained in terms of a time-distribution of hopping rates characterized by a dispersion parameter $\alpha=0.7$. The hopping rate in the $t \rightarrow 0$ limit is proportional to the square of the density of states at a given excitation energy reflecting dipolar coupling. Dispersion arises from energetic relaxation of the exciton. (31 refs.)

102925 Photoluminescence measurements of Zn-doped $Ga_{1-x}Al_xAs$ grown by metalorganic chemical vapor deposition. Z.Y.Xu, V.G.Kreismanis, C.L.Tang (School of Electrical Engng., Cornell Univ., Ithaca, NY, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4536-42 (Aug. 1983).
Investigates the photoluminescence properties of Zn-doped $Ga_{1-x}Al_xAs$ grown by metalorganic chemical vapor deposition (MOCVD). The photoluminescence spectra exhibit weak bound-exciton lines, donor-acceptor pair transitions, free-to-bound excitons, and low energy broad bands. The Zn acceptor ionization energy is determined from the free-to-bound transitions as a function of aluminum concentration x up to 0.46. Two low energy bands have been observed in Zn-doped $Ga_{1-x}Al_xAs$. One is at ~1.65 eV and is identified as due to the Zn_{Ga}-V_{As} complex. Another band has been observed at ~1.81 eV from samples with x near or beyond the crossover. It is well separated from the band edge, but its origin is not yet well understood. (36 refs.)

102926 Optical and crystallographic properties and impurity incorporation of $\alpha_xIn_{1-x}As$ ($0.44<x<0.49$) grown by liquid phase epitaxy, vapor phase epitaxy, and metal organic chemical vapor deposition. K.-H.Goetz (Inst. fur Halbleitertech., RWTH Aachen, Aachen, Germany), D.Bimberg, H.Jurgensen, J.Selders, A.V.Solomonov, G.F.Glinskii, M.Razeghi.
J. Appl. Phys. (USA), vol.54, no.8, p.4543-52 (Aug. 1983).
Optical, crystallographic, and transport properties of nominally undoped n-type and Zn doped p-type $Ga_xIn_{1-x}As/InP$ ($0.44<x<0.49$) grown by liquid phase epitaxy (LPE), vapor phase epitaxy (VPE), and metal organic chemical vapor deposition (MOCVD) have been studied and related to the different growth methods. Samples grown by LPE show in general much larger luminescence intensities than the VPE samples with similar impurity concentration and less structural and compositional inhomogeneities. Peaks related to free and bound excitons and to different impurities are found in the photoluminescence and absorption spectra of the undoped samples. The binding energy of the exciton is determined to be 2.1 ± 0.1 meV, in agreement with hydrogenic theory. A longitudinal optical (LO) phonon energy of 32 ± 0.5 meV is derived from LO-phonon replica of the exciton line. The dependence of the energy gap at $T=2$K from the solid solution composition in the range $x_{Ga}=45\%$-49% is determined yielding a bowing parameter of $C=0.475$ and a gap value of $E_g=0.811$ eV at optimum lattice match. Data on donor-acceptor pair transitions observed in the photoluminescence spectra are combined with secondary ion mass spectrometry data to identify for the first time different acceptors: C, Zn, and Si. Their binding energies are 13 ± 1, 22 ± 1, and 25 ± 1 meV, respectively. C is the dominant acceptor in the MOCVD samples, but is hardly observable in the LPE and VPE samples. Si and Zn are present in LPE, VPE, and MOCVD samples. The Zn doped p-type samples show a broad donor-Zn-acceptor pair transition band accompanied by a weak LO-phonon replica and a very weak exciton line. (32 refs.)

102927 Zeeman spectroscopy of luminescence from vanadium-doped indium phosphide. M.S.Skolnick, P.J.Dean (Royal Signals & Radar Establ., Great Malvern, England), M.J.Kane, C.Uihlein, D.J.Robbins, W.Hayes, B.Cockayne, W.R.MacEwan.
J. Phys. C (GB), vol.16, no.21, p.L767-75 (30 July 1983).
The authors have observed quite strongly-phonon-coupled photoluminescence (PL) in V-doped InP with a sharp no-phonon line near 705 meV and an excited state splitting of 1.55 meV. Detailed Zeeman data on the cold line are reported. The ground state is shown to be a pure spin triplet, $g\approx2$ and must arise from the ${V_{In}}^{3+}(d^2)$ charge state. The PL is ascribed to transitions between the $^3T_2(^3F)$-$^3A_2(^3F)$ levels of ${V_{In}}^{3+}$. A marked tetragonal anisotropy is found in the excited states of the transitions. This is tentatively attributed to an almost static Jahn-Teller effect in the $^3T_2(^3F)$ state. A similar attribution is proposed for qualitatively similar PL spectra observed by U. Kaufmann et al. (1982) in GaAs and GaP. (11 refs.)

102928 The luminescence at 0.839 eV in GaAs:Cr. A split ^5E-$^5T_2$ transition. J.Barrau, M.Brousseau (Lab. de Phys. des Solides, INSA, Toulouse, France), S.P.Austen, C.A.Bates.
J. Phys. C (GB), vol.16, no.23, p.4581-98 (20 Aug. 1983).
The luminescence at 0.839 eV in GaAs:Cr is interpreted as a split ^5E-$^5T_2$ transition within the Cr^{2+} ion. The degeneracies are removed by first- and second-order trigonal-field and spin-orbit-coupling perturbations. The parameters appearing in the effective Hamiltonians for ^5E and $^5T_2$ are all deduced from the high-resolution photoluminescence spectroscopy of Barrau and co-workers (1982); the fit of the energy levels and oscillator strengths provides a very accurate solution. The electronic and Jahn-Teller parameters are deduced. These results lead to a complete interpretation of the magnetic field Zeeman splittings of Eaves (1980), Killoran and co-workers (1980). The accuracy of the interpretation of all the experimental results represents an important improvement on previous models. In particular, the authors show how the interpretation of the ground state a ^5E (C_{3v}) is a poor approximation to the results presented. (26 refs.)

102929 The decay of infrared luminescence in II-VI compound semiconductors doped by 3d transition elements. R.Renz, H.-J.Schulz (Fritz-Haber-Inst., Max-Planck-Gesellschaft, Berlin, Germany).
J. Phys. C (GB), vol.16, no.24, p.4917-32 (30 Aug. 1983).
The decay processes of infrared emission after laser excitation have been studied in a sampling technique for several crystalline II-VI materials: ZnS and/or CdS doped by V, Cr, Co, Ni or Cu. From the exponential decay curves with time constants $0.5\leq\tau\leq50$ μs recorded at low temperatures, transition probabilities have been derived and compared with calculated electric-dipole matrix elements. Two different interactions are considered by which the parity-forbidden d-d transitions of 3d impurity ions become allowed: in a covalent model, the contribution of the wavefunctions of neighbouring ions is treated by LCAO-MO methods. In a configuration mixing model, lattice vibrations induce a mixing of 4p states of the transition-metal ion with the 3d levels. Configuration mixing appears to be the prevailing mechanism for the internal transitions considered here. The temperature dependence of the lifetime from 4 to 300K is also studied and can be interpreted by means of a configuration-coordinate model. (61 refs.)

102930 Luminescence of silver halides. I. Influence of precipitation parameters on the delayed luminescence of silver bromide microcrystals. A.de Rouck (R&D Labs., Agfa-Gevaert NV, Mortsel, Belgium).
J. Photogr. Sci. (GB), vol.31, no.4, p.170-5 (July-Aug. 1983).
The relation between delayed luminescence and photographic properties of silver halide has been investigated with monodisperse AgBr microcrystals precipitated under different reducing circumstances. According to the theories of electron and hole trapping properties of aggregates of silver atoms, the author concludes that luminescence centres activating the emission at 610 and 760 nm, are reduction centres with specific nature and function in the photographic process. (7 refs.)

102931 Luminescence of rare earth activated polymorphous perovskites $Sr_2Sr_{1/4}Gd_{1/2}\square_{1/4}WO_6(=Sr_8SrGd_2\square W_4O_{24})$. K.K.Closs, S.Kemmler-Sack (Inst. fur Anorganische Chem., Univ. Tubingen, Tubingen, Germany).
J. Solid State Chem. (USA), vol.48, no.2, p.295-9 (1 July 1983). (3 refs.)

102932 The comparison of calculated transition probabilities with luminescence characteristics of erbium (III) in fluoride glasses and in the mixed yttrium-zirconium oxide crystal. R.Reisfeld, G.Katz (Dept. of Inorganic & Analytical Chem., Hebrew Univ. of Jerusalem, Jerusalem, Israel), C.Jacoboni, R.De Pape, M.G.Drexhage, R.N.Brown, C.K.Jorgensen.
J. Solid State Chem. (USA), vol.48, no.3, p.323-32 (15 July 1983).
Fluorozirconate glasses containing 2 mole% ErF_3 were prepared by melting the binary fluorides with ammonium bifluoride under an atmosphere of carbon tetrachloride and argon at 850°C. Absorption spectra of these glasses were obtained and the Judd-Ofelt parameters were calculated. Emission spectra and lifetimes of erbium in fluorozirconate glass, in lead-gallium-zinc fluoride glass, and in yttrium-zirconium oxide crystal were measured and compared with the theoretical calculations. Laser emission lines in these materials are deduced from these measurements. It is suggested that materials doped with erbium may serve as light sources for fiber optic waveguides made from the undoped materials. (30 refs.)

102933 Effect of protonation of luminescent characteristics of xanthene dyes. V.Ya.Artyukhov, R.T.Kuznetsova, R.M.Fofonova.
J. Appl. Spectrosc. (USA), vol.37, no.4, p.1134-7 (Oct. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.4, p.576-80 (Oct. 1982).
The spectral luminescent characteristics of protonated forms of R6G are investigated. When the medium is acidified to pH=0.4, 50% of the cationic R6G molecules in an aqueous solution are protonated on one of the ethylated amino groups. In this case the longest-wave R6G band, associated with the transfer of electronic density from the two nitrogen atoms to the central carbon atom disappear, and the broad structured band associated with the transfer of electronic density from the unprotonated nitrogen, shifted in the short-wave direction relative to the cationic band, becomes the longest-wave band; hence, the R6G molecule excited into the long-wave becomes more basic than in the ground state. The authors think that further acidification of the medium leads to protonation of the second amino group. (8 refs.)

102934 Luminescence fatigue of silver chloride crystals. A.N.Latyshev, V.V.Bokarev, T.V.Voloshina, M.A.Kushnir, V.N.Raskhozhev, L.B.Antakanova.
J. Appl. Spectrosc. (USA), vol.37, no.4, p.1137-41 (Oct. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.4, p.580-5 (Oct. 1982).
Silver halides, particularly silver chloride, crystals are extremely sensitive to radiation and undergo changes when they are exposed to ultraviolet light, even at low temperatures. In this case the intensity of the steady-state luminescence is reduced. This effect is called luminescence fatigue. An investigation of luminescence fatigue in relation to temperature showed that exposure of silver chloride crystals to light gives rise to two processes with activation energies of about 0.05 and 0.01 eV. It was postulated that the movement of silver ions over the surface due to the action of light gives rise to deep electron traps. The interpretation, however, is ambiguous. The authors carried out an investigation with the aid of luminescence flash photostimulation spectra, which can be used to investigate deep electron traps. They attempted to separate the processes with different activation energies. (10 refs.)

102935 Spectral luminescence properties and the nature of the emission centers in LiF-U(VI) crystals. N.I.Aleshkevich, Yu.I.Krasilov, V.V.Syt'ko.
J. Appl. Spectrosc. (USA), vol.37, no.4, p.1141-6 (Oct. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.4, p.585-91 (Oct. 1982).
The authors have attempted to elucidate the nature of the luminescence centers in LiF-U(VI) crystals on the basis of luminescence and luminescence excitation spectra, along with measurements of the luminescence decay kinetics of the various lines, and to relate that nature to the anomalies in the spectral luminescence properties of the centers. (24 refs.)

102936 Structure of the luminescence spectra of impurity ${UO_2}^{2+}$ ions in solid solutions of halide salts. I.Ya.Kushnirenko, V.I.Sheremet.
J. Appl. Spectrosc. (USA), vol.37, no.4, p.1146-51 (Oct. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.4, p.591-7 (Oct. 1982).
The authors studied the luminescence spectra of ${UO_2}^{2+}$ impurity ions in frozen water solutions of alkali halide salts (LiCl, LiBr, KCl, KBr, etc.) in the temperature interval 1.62-77K. Their main attention is devoted to the analysis of the structure of the spectra. A comparison of the spectroscopic properties of these impurity cations in various matrices provides a means of studying more deeply the mechanisms and the nature of the interaction of the impurity with its environment, both in crystals and also in solid solutions of the alkali halide salts. (11 refs.)

102937 Influence of substrate temperature and activator concentration on the structure of optical centers in thin film luminophores. F.Z.Gil'fanov, E.L.Kvasov.
J. Appl. Spectrosc. (USA), vol.37, no.4, p.1151-3 (Oct. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.4, p.597-9 (Oct. 1982).
An important factor in determining the spectroscopic properties of impurity luminophores is the activator concentration. The work is devoted to the elucidation of the simultaneous operation of these two determing factors. The authors have studied the photoluminescence spectra of $CaF_2:Gd^{3+}$ thin films with a concentration of GdF_3 in the mixture from 0.01 to 30 wt.%, $SrF_2:Gd^{3+}$ films with GdF_3 concentration from 0.1 to 30 wt.%, deposited on substrates at various temperatures. On the basis of these studies they draw conclusions as to the existence of three concentration regions for these luminophores. (3 refs.)

102938 Optical properties of fluorite-type crystals with M_A color centers. V.A.Arkhangel'skaya, V.M.Reiterov, L.M.Trofimova, A.S.Shcheulin.
J. Appl. Spectrosc. (USA), vol.37, no.4, p.1192-4 (Oct. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.4, p.644-8 (Oct. 1982).
Singly-charged alkali ions A^+ in crystals of alkaline-earth fluorides MeF_2 (Me=Ca, Sr) cause the formation of anion vacancies in association with the

impurity ion. Such vacancies after radiation-induced or additive coloring give rise to electronic disturbed color centers of the F_A, $(F_2)_A$, and $(F_3)_A$ types, and to even more complex centers containing a larger number of vacancies. Of great interest of two adjacent anion vacancies, two electrons, and an A^+ ion located in the nearest cation site. The authors give the results of symstematic investigations of the spectral absorption and luminescence properties, quantum yield, and kinetics of the luminescence of MeF_2-A^+ crystals containing M_A centers, where Me=Ca or Sr, and $A^+=Li^+$, Na^+, or K^+. (11 refs.)

102939 Effect of hyperfine interaction on the luminescence of Pb^{2+} and Bi^{3+} centers in alkaline-earth chalcogenides. N.Yamashita, S.Asano (Dept. of Phys., Okayama Univ., Okayama, Japan).
Phys. Lett. A (Netherlands), vol.96A, no.7, p.375-8 (18 July 1983).
Emission spectra of MgS, CaO, CaS, CaSe and SrS phosphors activated with a Pb^{2+} or a Bi^{3+} ion are measured at 4.2K. By the analysis of the phonon structure of the ${}^3A_{1u} \rightarrow {}^1A_{1g}$ emission band, it is found that the hyperfine interaction provokes the zero-phonon line on the emission band for the alkaline-earth chalcogenide phosphors activated with a Pb^{2+} or a Bi^{3+} ion. (21 refs.)

102940 Vibrational fluorescence of CN^- defects in KCl excited by coupling to optically pumped *F* centers. Yihong Yang, F.Luty (Dept. of Phys., Univ. of Utah, Salt Lake City, UT, USA).
Phys. Rev. Lett. (USA), vol.51, no.5, p.419-22 (1 Aug. 1983).
Vibrational emission from molecular defects in ionic crystals has been observed for the first time, realized by dilute CN^- defects in KCl which emit a long-lifetime fluorescence at 4.8 μm. After association of *F* centers to the CN^- defects, the emission can be pumped efficiently by optical *F*-center excitation through electronic-vibrational coupling. This coupling is confirmed through Raman experiments. Relative intensity, emission spectra, and lifetime data as a function of crystal temperature are reported for the 4.8-μm emission. (8 refs.)

102941 On the time dependence of the luminescence spectrum in chalcogenide glasses. M.Suhrke (Sektion Phys., Humboldt-Univ. zu Berlin, Berlin, Germany).
Phys. Status Solidi b (Germany), vol.118, no.1, p.K79-83 (1 July 1983).
Presents a calculation of the long-time behaviour of the photoluminescence spectrum in a-As_2S_3. In this material a slow shift of the peak energy to lower energies in a wide range of times from $t \approx 10^{-8}$ to $t \approx 10^{-2}$ s is observed. The author considers a recombination model based on tunneling between localized states in the gap. In this gap states the carriers are immobile at low temperatures. The holes are bound at D−-centres with energy $E_R \gtrsim 0.5$ eV above the valence-band edge which are centres of radiative recombination (r-centre) in chalcogenide glasses. (9 refs.)

102942 On the 430 nm emission band in the NaCl:Pb^{++} system. R.Capelletti, O.Carranza Torres, J.Garcia Sole, M.Manfredi (Istituto di Fisica, Univ. degli Studi di Parma, Parma, Italy).
Phys. Status Solidi a (Germany), vol.78, no.1, p.35-9 (16 July 1983).
The temperature dependence of luminescence and of the decay times of the 430 nm emission band is studied in the NaCl:Pb^{++} system heavily doped and annealed for long time at 200°C. This emission band—that is excited at 262 or 267 nm-is found to behave very similarly to a corresponding emission band present in the $PbCl_2$ system, this fact supporting the hypothesis that the 430 nm emission is connected with a $PbCl_2$ phase growing in the NaCl matrix. The temperature dependent lifetime is explained in terms of radiationless processes thermally activated with an activation energy of 0.13 eV. (14 refs.)

102943 The luminescence of Bi^{3+} and Mn^{2+} in lanthanum magnesium borate ($LaMgB_5O_{10}$). M.Saakes, G.Blasse (Phys. Lab., State Univ., Utrecht, Netherlands).
Phys. Status Solidi a (Germany), vol.78, no.1, p.K97-9 (16 July 1983).
The authors report on the luminescence of some non-rare-earth ions in the $LaMbG_5O_{10}$ host lattice. Obvious choices for this are Bi^{3+}on La^{3+} sites and Mn^{2+} on Mg^{2+} sites. The Mn^{2+} ion acts as an efficient activator in $LaMgB_5O_{10}$. Under excitation the total light output of the luminescence is low, however, because the absorption strength of the Mn^{2+} ion is weak over the whole visible and UV region, i.e. for λ>240 nm. The Mn^{2+} ion in $LaMgB_5O_{10}$ shows a red emission. The emission spectrum consists of a band with a halfwidth of about 70 nm and a maximum at about 620 nm. These values relate to room temperature as well as liquid helium temperature. (8 refs.)

102944 Resonant two-photon absorption by exciton polaritons in evaporated CuCl films. J.K.Pribram, G.L.Koos, F.Bassani, J.P.Wolfe (Dept. of Phys. & Materials Res. Lab., Univ. of Illinois, Urbana, IL, USA).
Phys. Rev. B (USA), vol.28, no.2, p.1048-55 (15 July 1983).
Biexcitons in CuCl decay into Z_3 excitons (longitudinal or transverse) and photons (M_L or M_T luminescence). Here an intense, tunable-laser pulse is used to study this luminescence in thin CuCl films. As a function of laser frequency (3.209-3.219 eV) the luminescence line shapes in the M_L and M_T bands show absorption which the authors interpret as a resonant two-photon (laser plus luminescence) transition from the ground to biexciton state. The polariton nature of the intermediate state is explicitly considered and shown to bring about a resonant condition, greatly enhancing the absorption process. Reabsorption involving the upper and lower transverse polariton branches has been reported previously. Here they report a new transition which uses the longitudinal exciton as an intermediate state. From laser frequencies and these three reabsorption dip positions they determine a portion of the Z_3 exciton-polariton dispersion curve. (33 refs.)

102945 Radiative transitions associated with two-acceptor-one-donor complexes in epitaxial GaAs and InP. D.C.Reynolds, C.W.Litton, E.B.Smith, K.K.Bajaj (Avionics Lab., Air Force Wright Aeronaut. Labs., Wright-Patterson US Air Force Base, Dayton, OH, USA), T.C.Collins, M.H.Pilkuhn.
Phys. Rev. B (USA), vol.28, no.2, p.1117-20 (15 July 1983).
Radiative transitions on the low-energy side of the exciton-neutral-acceptor transitions are reported in good-quality epitaxially grown samples of GaAs and InP at liquid-helium temperature. These lines result from transitions within a complex involving two shallow neutral acceptors and a single neutral donor. The initial state of the system consists of two neutral acceptors each with an exciton bound to it, and a neutral donor. The exciton collapses on one of the acceptors, giving part of its radiative energy to the second acceptor-exciton system to transfer the exciton to the neutral donor. The final state, therefore, consists of two neutral acceptors and a neutral-donor-bound-exciton system. The transition energies predicted on the basis of this model agree very well with the observed energies in both GaAs and InP. (9 refs.)

102946 Comment on nonradiative-recombination kinetics in *a*-Si:H. D.J.Dunstan (Angewandte Phys., Johannes Kepler Univ., Linz, Austria).
Phys. Rev. B (USA), vol.28, no.4, p.2252-3 (15 Aug. 1983).
In a recent paper, Collins et al. (Phys. Rev. B.26, 6643, 1982) have shown that a fast process, occurring in <10, ns, is important in the nonradiative recombination of photoexcited carriers in sputtered *a*-Si:H, and so the slow process of tunneling to defects, in a time scale comparable to that of the radiative recombination, is not dominant, as previously believed from studies on glow-discharge material. The author considers the results in terms of the distant-pair model, and concludes that the fast and slow processes are in fact successive steps in the nonradiative mechanism. Also, he finds that a capture cross section for the defects comparable to that of the tail states is consistent with the data. (9 refs.)

102947 A study of recombination centres in $YAlO_3$, $EuAlO_3$, $LaAlO_3$ and Y_2O_3 using ODMR. R.L.Wood, W.Hayes (Clarendon Lab., Univ of Oxford, Oxford, England).
Radiat. Eff. (GB), vol.72, no.1-4, p.145-51 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
An ODMR study of $YAlO_2$ has been made at 1.6K using an X-ray induced luminescence band, peaking at 223 nm. The ODMR spectrum is unusual, showing the full symmetry of the crystal and also a weak exchange interaction between the recombining carriers. This behaviour is intermediate between that found for recombination of donor-acceptor pairs in semiconductors and for self-trapped excitons in strongly ionic solids. An intense luminescence band of Y_2O_3 at 364 nm does not show ODMR. Weak, sample-dependent luminescence of $EuAlO_3$ and $LaAlO_3$ in the near ultraviolet has also been studied but, again, does not show ODMR. (9 refs.)

102948 Emission of F centres in alkali halides under hydrostatic pressure. K.Asami (Inst. of Sci. & Industrial Res., Osaka Univ., Suita, Osaka, Japan), K.Iwahana, H.Ohkura, M.Ishiguro.
Radiat. Eff. (GB), vol.72, no.1-4, p.161-6 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
The effect of pressure up to 12 kbar on the luminescent properties of F centers has been measured in some potassium and cesium halides at liquid helium temperature. A decrease of the F center emission intensity and a blue shift of a peak position with pressure are observed. The former is relevant to the non-radiative transition and the latter to the observed change in lifetime with pressure. The decay time observed under pressure shows an increasing tendency with temperature. A possible mechanism is proposed. (8 refs.)

102949 Optical properties of F_A and $(F_2)_A$ centres in doped KI. A.Scacco, G.Baldacchini, U.M.Grassano, E.Polito, F.Somma (Istituto di Fisica, Univ. di Roma, Roma, Italy).
Radiat. Eff. (GB), vol.72, no.1-4, p.185-91 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
Crystals of additively coloured KI doped with lithium or sodium exhibit, after irradiation with F-light, new absorption and emission bands due to associated and perturbed centres. The defects responsible for these bands have been identified using excitation spectra and polarization measurements. F_A(I) and $(F_2)_A$ centres are found to be present in both KI:Li^+ and KI:Na^+ crystals. A weak emission in KI:Li^+ is ascribed to F_{13}(II) centres. The possibility of using these systems as laser active media is discussed. (14 refs.)

102950 Low energy photoluminescence of pure and doped LiF. R.Grasser, S.Scharmann, K.-R.Strack, G.Bruckenhaus, E.Ekpo Eno (Phys. Inst., Univ. Giessen, Giessen, Germany).
Radiat. Eff. (GB), vol.72, no.1-4, p.237-43 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
Norminally pure LiF crystals from different sources show a very weak emission in the red spectral region with the maximum at 720 nm when excited with UV light. In pure crystals this photoluminescence is measurable only under extreme excitation and registration conditions. Besides broad band and zero-phonon line spectra due to F-aggregate centres, LiF/$CaWO_4$ crystals emit strong 720 nm fluorescence bands. Additionally to this feature, the LiF/$CaWO_4$ solid system exhibits a highly structured photoluminescence on the short wavelength side of the 720 nm peak. This line spectrum is already well resolved at 77K. The red emission is connected with the presence of Ca^{2+} ions in the LiF lattice. Transmission, excitation, and emission data, together with the results of annealing experiments, strongly indicate that the measured low energy photoluminescence is due to optical transitions in Z_2-centres. (9 refs.)

102951 The resonant secondary emission of the F center in alkali halides. Y.Mori, R.Hattori, H.Ohkura (Dept. of Appl. Phys., Osaka City Univ., Osaka, Japan).
Radiat. Eff. (GB), vol.72, no.1-4, p.283-6 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
The secondary radiation after resonant excitation of F centers and the linear polarization *P* correlated to the polarization of resonant light have been measured for five alkali halides at low temperatures. In KCl, the spectrum of *P* over the whole Stoke region is divided into three successive regions; the depolarization range for the one-phonon Raman scattering, the near plateau range , and the depolarization range down to vanishing. The former two have common relevance to resonant energy and symmetries of coupled phonons. These relevances are interpreted adopting a configuration coordinate model for 2s- and 2p-like excited states. (11 refs.)

102952 Stimulated photoluminescence of CdTe. A.Cingolani, M.Ferrara, M.Lugara (Consiglio Nazionale delle Ricerche, Bari, Italy).
Solid State Commun. (USA), vol.47, no.8, p.607-9 (Aug. 1983).
Emission spectra of CdTe at low temperature under high intensity optical pumping by means of a tunable dye laser are reported. The authors show that the optical gain process is enhanced when a high exciton density is achieved by means of quasi-resonant pumping. The mechanism responsible for the amplification process is found to be the well-known exciton-exciton scattering. (11 refs.)

102953 Observation of population inversion of holes in Ge in crossed *E* and *H* fields from the spontaneous far-infrared emission. A.A.Andronov, V.I.Gavrilenko, O.F.Grishin, V.N.Murzin, Yu.N.Nozdrin, S.A.Stokliskii, A.P.Chebotarev, V.N.Shastin (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.932-5 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.339-43 (Nov. 1982).
There is growing interest in hot holes in Ge in connection with the possibility of obtaining a laser effect in crossed electric and magnetic fields at the direct optical transitions between the sub-bands of the light and heavy holes (sub-bands 2 and 1, respectively), spanning a broad range in the far infrared (300>λ>40 μ). The authors give a criterion for the occurrence of an inversion of the 2-1 transitions on the basis of the shape of the spontaneous far-infrared emission as a function of E and H, discuss the results of an experimental observation of inversion in p-Ge, and study the dependence of the degree of inversion on the geometry of the sample and its orientation with respect to the magnetic field. (14 refs.)

102954 Investigation of anodic alumina by a photoluminescence method. I. Lj.D.Zekovic, V.V.Urosevic, B.Jovanic (Inst. of Phys., Belgrade, Yugoslavia).
Thin Solid Films (Switzerland), vol.105, no.2, p.169-76 (15 July 1983).
A new investigation of anodic oxide films on aluminium was performed using a photoluminescence method. An interference effect which follows both excitation and emission of photoluminescence was used to determine the anodic film thicknesses and the anodizing rate. The measured anodizing rate of aluminium in 0.1 M oxalic acid, $j=10$ mA cm^{-2} ($\kappa=0.325$ μm min^{-1}), is in excellent agreement with the values obtained by other methods. (12 refs.)

102955 High resolution laser diagnostics for direct gap semiconductor materials. R.P.Salathe, H.H.Gilgen (Inst. of Appl. Phys., Univ. of Berne, Berne, Switzerland).
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.109-16
The laser-induced luminescence of direct gap semiconductors can be measured with high spatial (1 μm) and temporal (<1 ns) resolution. A profiling technique is described for in-situ measurements during laser processing. It allows the evaluation of temperature, carrier density and band gap energy within the focal zone. The technique has been applied to (Al,Ga)As heterostructure material subjected to highly focused CW-Kr-ion laser radiation. The measurements reveal low temperature rises (<200 deg.C) at high excitation densities (>1 MW/cm^2) and an inhomogeneous distribution of optically excited carriers for concentrations above 2×10^{17} cm^{-3}. (24 refs.)

Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals' .... See Entry 98642

Colorimetry for fluorescent materials .... See Entry 99155

Magnetic circular dichroism and anomalous fluorescence spectra of azulenothiophenes .... See Entry 100436

Contraction of, and hole burning in a phosphorescence line corresponding to the forbidden $T_1 \leftrightharpoons S_0$ transition in the spectrum of pyrene in a glassy matrix .... See Entry 100452

Streak camera study of short pulse generation in an optically pumped GaAs/(GaAl)As laser .... See Entry 100750

Saturation of interband transitions in semiconductors and the effect of optical bistability .... See Entry 100838

A new nonlinear *Q*-switch element—LiF:F_2^- crystal .... See Entry 100864

Crystal structure and electronic states of dithieno[3,2-*b*:2′,3′-*d*]thiophene .... See Entry 101683

M_A-type centers in alkaline-earth doped KCl .... See Entry 101699

F and photochromic centers in LiYF$_4$:Nd crystals .... See Entry 101794

The relation between various coupling schemes for calculating nonradiative multiphonon transition rates .... See Entry 101879

Secondary emission due to recombination of excitons near indirect band bottom. I. General feature .... See Entry 102265

Theory of the exciton bound to an isoelectronic trap in GaP .... See Entry 102266

Optical properties of fast-diffusion solid-state plasmas .... See Entry 102446

Spectroscopic properties of some Eu^{3+} doped scheelite-related rare earth sesquimolybdates and sesquitungstates .... See Entry 102903

Spectral properties of glassy tetraphosphate with high neodymium (Nd^{3+}) concentration .... See Entry 102909

Correlation of photoluminescence and symmetry studies with photoexcitation and decay processes of infrared active defects in Si .... See Entry 102910

Optical spectra of Pb^{2+} to monitor the precipitation behavior of NaCl:Cd .... See Entry 102914

The electrooptical properties of ZnSe-ZnTe heterojunctions .... See Entry 102957

Photo- and electroluminescence spectra from an n-TiO$_2$ semiconductor electrode as related to the intermediates of the photooxidation reaction of water .... See Entry 102961

The electro- and photoluminescence spectra of oxide films formed during anodic oxidation of zinc .... See Entry 102963

Thermoluminescence, fluorescence and electron paramagnetic resonance properties of synthetic hydrothermal scheelites .... See Entry 102971

Steady-state kinetic studies on the exciplex formation between indoles and n-butyl alcohol .... See Entry 103553

78.60 OTHER LUMINESCENCE SPECTRA AND RADIATIVE RECOMBINATION

(for photoconduction and photovoltaic effects, see 72.40; for photoluminescence, see 78.55)

102956 Shock-induced radiation spectra of fused quartz. K.Kondo, T.J.Ahrens (Seismological Lab., California Inst. of Technol., Pasadena, CA, USA), A.Sawaoka.
J. Appl. Phys. (USA), vol.54, no.8, p.4382-5 (Aug. 1983).
An optical multichannel analyzer is applied to observe shock-induced radiation spectra of fused quartz in the 23-31 GPa shock-pressure range. Characteristics of sample-driver interface strongly influence both intensity and profile of the observed spectra. Brightness and color temperature are determined by an integration of spectral radiance and a fit to the greybody radiation spectrum, respectively. The resultant brightness and color temperature are lower and considerably higher than those estimated by the theoretical calculation, respectively. Some broad but strong line spectra are, however, superimposed onto the continuous greybody radiation spectrum even though the influences of the interface are reduced as much as possible. The line spectra are probably caused by electroluminescence and/or triboluminescence. (18 refs.)

Irradiation effects in perovskite-type fluorides .... See Entry 101792

78.60F Electroluminescence

102957 The electrooptical properties of ZnSe-ZnTe heterojunctions. F.Firszt, H.J.Lozykowski (Inst. of Phys., Nicholas Copernicus Univ., Torun, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.1, p.9-19 (July 1983).
The electrical properties, photoluminescence and injection electroluminescence in ZnSe-ZnTe *n-p* heterojunctions have been studied. The ZnTe layer was grown on a single ZnSe(111) crystal from Zn:ZnTe solution. The prepared heterojunctions consist of a *p-s-n* structure with distributed trap centers in the boundary region. At 40K the spectrum of electroluminescence consists of two bands 2.32 eV and 1.95 eV. Photoluminescence measurements show that light generation in the diode occurs at the ZnSe side of the junction. The time-resolved spectra (TRS) measurements show the spectral peak shift to lower energies with increasing delay after the excitation pulse for the red band. This is a conspicuous characteristic of the donor-acceptor pair recombination. (48 refs.)

102958 Electroluminescence in Cu-phthalocyanine. A.Das, A.K.Tripathi (Dept. of Phys., Saugar Univ., Sagar, India).
Indian J. Pure & Appl. Phys., vol.21, no.6, p.368-9 (June 1983).
Voltage and frequency dependence of electroluminescent brightness have been studied for Cu-phthalocyanine at room temperature. The brightness varies according to the relation $B=B_0\exp(-C/V^{1/2})$ in the low-voltage region and according to $B=B_0\exp(-C/V)$ in the high-voltage region. (8 refs.)

102959 Efficiency of binderless electroluminescence in (ZnS,ZnO): Cu,Cl electroluminor. S.Bhushan (Dept. of Phys., Ravishankar Univ., Raipur, India).
Indian J. Pure & Appl. Phys., vol.21, no.6, p.370-3 (June 1983).
Efficiency of binderless electroluminescence (EL) as a function of voltage of the applied field is investigated. It is found that efficiency first increases, passes through a maximum and then decreases. A new interpretation of binderless EL in terms of Schottky-emission type of transport process is proposed. (6 refs.)

102960 A study of the electrical and luminescence characteristics of a novel Si-based thin film electroluminescent device. D.J.Robbins, D.J.DiMaria, C.Falcony, D.W.Dong (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4553-69 (Aug. 1983).
The results of electrical and luminescence measurements on a new, low voltage, DC, thin film electroluminescent device structure are presented. The devices incorporate a two-phase Si-rich-SiO$_2$/SiO$_2$ electron injector layer which provides control of current, and an active luminescent ZnS:Mn layer in which light is generated by hot electron impact excitation of the Mn^{2+} activator in high electric field. Separation of the processes of current control and light generation into different layers permits the effects of space charge and the average field distributions to be determined. The electroluminescence intensity is simply proportional to the average power dissipated in the ZnS:Mn layer when the average field is in the range 0.6-1.2 MV cm^{-1}, and when field distortion due to electron trapping in the SiO$_2$ layer is small. When the field locally in the ZnS:Mn layer exceeds ~1.7 MV cm^{-1}, lattice ionization competes with impact excitation of Mn^{2+} and the quantum efficiency falls. A simplified model assumes that in a quasi-steady-state condition the majority of the device current is carried by electrons accumulated in the satellite (*L*,*X*) valleys in the conduction band of ZnS. The results are compared with previous studies, and their general significance as regards the limiting efficiency of high field electroluminescent devices using ZnS is discussed. (45 refs.)

102961 Photo- and electroluminescence spectra from an n-TiO$_2$ semiconductor electrode as related to the intermediates of the photooxidation reaction of water. Y.Nakato, A.Tsumura, H.Tsubomura (Dept. of Chem., Osaka Univ., Osaka, Japan).
J. Phys. Chem. (USA), vol.87, no.13, p.2402-5 (23 June 1983).
Photo- and electroluminescence spectra of an n-type TiO$_2$ electrode in aqueous solutions were measured as functions of the electrode potential and the solution pH, together with the current-potential curves. The photoluminescence spectrum showed a relatively sharp band peaked at 1.47 eV. From the quenching of the photoluminescence by reductants in solution, this band was concluded to arise from an oxidative surface species, called X$_{1.47}$, acting as an intermediate of the photooxidation reaction of water. It was shown that the species X$_{1.47}$ is originally absent at an n-TiO$_2$ surface, but produced and accumulated by illumination under anodic bias. It was also suggested, from a comparison of the electroluminescence spectra in H$_2$O$_2$ solutions with those in S$_2$O$_8^{2-}$ solutions, that the species X$_{1.47}$ can be assigned to a kind of OH. radical surface adduct. (25 refs.)

102962 Excitation frequency dependence of electroluminescence spectra in ZnS: ErF$_3$, YbF$_3$ thin films. R.Nakano, H.Kawasaki, J.Sato, T.Yabumoto (Dept. of Electronics, Meiji Univ., Kawasaki, Japan).
Oyo Buturi (Japan), vol.52, no.5, p.459-61 (May 1983). In Japanese.
The emitting color changed from green to red with increasing frequency in an In$_2$O$_3$: SnO$_2$-Y$_2$O$_3$-ZnS: ErF$_3$, YbF$_3$-Y$_2$O$_3$-Al structure thin film electroluminescent device. The energy transfer process from Yb^{3+} ion to Er^{3+} ion and emission transition processes in electroluminescence are discussed. (7 refs.)

102963 The electro- and photoluminescence spectra of oxide films formed during anodic oxidation of zinc. R.Dragon (Inst. of Math. & Phys., Higher School of Engng., Opole, Poland).
Opt. Appl. (Poland), vol.13, no.1, p.47-54 (1983).
The distribution of intensity in the stationary anodic electroluminescence spectrum of zinc electrodes has been determined and compared with the photoluminescence spectrum of dried anodic zinc oxide films formed in the same electrolyte. It has been found that the anodic electroluminescence spectrum has its maximum in the green region (520 nm), whereas the photoluminescence spectrum of dried oxide films is in the yellow (580 nm). A hypothesis explaining the appearance of both spectra in different parts of the visible spectral region has been suggested. (25 refs.)

Minority carrier lifetime and luminescence efficiency of 1.3 μm InGaAsP-InP double heterostructure layers .... See Entry 100759

Impact ionization in rare earth doped CdF$_2$ crystals .... See Entry 102407

78.60H Cathodoluminescence, ionoluminescence

102964 Cathodoluminescence from deformed CaO. J.Llopis (Dept. de Fisica del Estado Solido, Univ. Complutense, Madrid, Spain), J.Piqueras.
J. Appl. Phys. (USA), vol.54, no.8, p.4570-2 (Aug. 1983).
The cathodoluminescence (CL) emission from deformed and undeformed CaO single crystals has been studied in the scanning electron microscope. Deformation enhances the emission which appears, in the CL image, localized in the deformed regions of the crystal. The CL spectrum depends on the kind of deformation applied to the crystal and is unstable under the electron beam. The results are discussed in terms of impurities and of vacancy defects generated during the plastic deformation. (13 refs.)

78.60K Thermoluminescence

102965 Thermoluminescence in borate glass containing copper. Y.Fukuda (Osaka Industrial Univ., Nakagaito, Daito, Japan), T.Okuno, N.Takeuchi.
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.437-40 (Aug. 1983).
The authors studied the possible enhancement of thermoluminescent output of borate glass with the addition of $CuCl_2$. The Cu ions acted as recombination centres and encouraging results were obtained. (5 refs.)

102966 Thermoluminescence of X- or γ-irradiated KI and KI(Ca^{2+}) crystals. E.Rzepka, J.L.Doualan, L.Taurel (Lab. de Phys. Cristalline, Univ. de Paris Sud, Orsay, France).
J. Phys. C (GB), vol.16, no.24, p.4769-77 (30 Aug. 1983).
The thermal glow peaks obtained in undoped KI and KI:Ca^{2+}, when they are X- or γ-irradiated in the temperature range 100-300K, arise from the recombination of isolated F centres and the products of decomposition of either polyiodide ions or I_2 crystalline aggregates induced by the ionising radiations. The structure of the traps of interstitial atoms was determined by Raman light scattering studies. All the results confirm that the emission of light involves recombination of F centres and the transient interstitials released from their traps, probably located near the F centres in the case of KI:Ca^{2+}. No direct recombination occurs between interstitial atoms and potassium colloids, but it does not occur via the evaporated F centres from the colloids. (23 refs.)

102967 Thermoluminescence of mixed yttrium-lutetium scandade crystals doped with neodymium. V.A.Antonov, P.A.Arsenev, Kh.S.Bagdasarov, D.I.Korolev, A.M.Kevorkov (Inst. of Energetics, Moscow, USSR), W.Jelenski, A.Niklas, J.Wiechula.
Opt. Appl. (Poland), vol.13, no.1, p.69-73 (1983).
Deals with the effect of lutetium, yttrium and neodymium on the thermoluminescence (TL) of the neodymium-doped mixed yttrium-lutetium scandades after X-ray excitation at the liquid nitrogen temperature (LNT). Single crystals were grown by the method of optical zones in an air atmosphere. The stoichiometric composition of the investigated samples was the following: $Lu_{0.4}Y_{0.55}Nd_{0.05}ScO_3$, $Lu_{0.4}Y_{0.59}Nd_{0.01}ScO_3$ and $Lu_{0.4}Y_{0.595}Nd_{0.595}ScO_3$. The sample containing the greatest amount of neodymium shows only one maximum at temperature of 210K; characteristic of all the samples containing Nd^{3+}-ions. Due to the overlapping with the other maxima, the position of the maximum ascribed to the presence of Nd^{3+}-ions can be slightly changed for samples with different chemical composition. The TL curves for remaining samples display also the maxima characteristic of pure $LuScO_3$ and $YScO_3$. Increasing amounts of Lu^{3+}-ions leads to the appearance of the TL maximum in the vicinity of 170K, i.e. at the temperature at which there occurs the strongest maximum of TL for pure $LuScO_3$ crystals. With the increasing content of neodymium, the location of the high-temperature TL peak ascribed to the presence of Nd changes from 230K to 210K. (8 refs.)

102968 Vacuum-UV absorption and thermoluminescence of X-rayed quartz crystals. H.J.Bernhardt.
Phys. Status Solidi a (Germany), vol.78, no.1, p.61-7 (16 July 1983).
The connection is investigated between the thermoluminescence centres and the X-ray absorption centres which absorb in the near-edge region of synthetic quartz crystals of various defect types. (9 refs.)

102969 Thermoluminescence of n-GaAs. C.De Blasi (Dipartimento di Fisica, Univ. di Lecce, Lecce, Italy), C.Manfredotti, G.Micocci, A.Tepore.
Phys. Status Solidi a (Germany), vol.78, no.1, p.K31-4 (16 July 1983).
The authors report for the first time thermoluminescence measurements performed on n-GaAs single crystals grown by the Bridgman-Stockbarger method. The samples are excited at room temperature by using a deuterium lamp. Several methods are available for deriving the activation energy of centres from the experimental curves. To analyse the results they have chosen the methods due to Hoogenstraaten (1958), Garlick and Gibson (1948), Chen (1969), and Grossweiner (1953). (9 refs.)

102970 On the general-order kinetics in thermoluminescence. N.Takeuch (Faculty of Technol., Kanazawa Univ., Kanazawa, Japan).
Phys. Status Solidi a (Germany), vol.78, no.1, p.K93-6 (16 July 1983).
Recently Moharil (1982) has criticized the 'general-order kinetics' reported by May and Partridge (1965). Instead, he has proposed the usefulness of the ratio A/B appearing in the Antonov-Romanovskii equation (1951) where A is the probability of retrapping and B the probability of recombination. Two special cases are obtained, i.e. when $A=B$ the second order kinetics, and when $A \ll B$ the first order kinetics. The author states that the importance of the total concentration of traps (N) cannot be disregarded. Then, it should be corrected that when $AN \gg (B-A)n$ the second order kinetics is obtained and when $AN \ll (B-A)n$ the first order kinetics is obtained. (10 refs.)

102971 Thermoluminescence, fluorescence and electron paramagnetic resonance properties of synthetic hydrothermal scheelites. R.Caruba (Lab. de Geologie-Geochimie, Univ. de Nice, Nice, France), P.Iacconi, J.F.Cottrant, G.Calas.
Phys. & Chem. Miner. (Germany), vol.9, no.5, p.223-8 (1983).
Hydrothermal scheelite was synthesized using $Na_2WO_4.2H_2O$ mixed with $CaCl_2.H_2O$, $CaSO_4.2H_2O$ or CaF_2 at different temperatures (270-720°C) and 10^8 Pa. The morphology of the crystals depends on the starting products. The observed faces include the $\{112\}$, $\{114\}$, $\{011\}$, and $\{013\}$ forms. Pure or REE doped scheelites were studied by thermoluminescence (TL), fluorescence and electron paramagnetic resonance (EPR). The main TL peaks are located near 88, 149, 216, 277, and 315K. Results obtained with EPR or optical fluorescence have been correlated with TL measurements and show that the trivalent lanthanide elements substitute for calcium ions without site distortion. The differences in TL observed between Eu and the other doping elements are related to the greater stability of Eu^{2+} caused by X-irradiation. (25 refs.)

102972 Measurements of the emission spectra of LiF during thermoluminescence. P.D.Townsend, K.Ahmed, P.J.Chandler, S.W.S.McKeever, H.J.Whitlow (School of Math. & Phys. Sci., Univ. of Sussex, Brighton, England).
Radiat. Eff. (GB), vol.72, no.1-4, p.245-57 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
Studies of the emission spectra during thermoluminescence were analysed for various specimens of LiF:Ti and LifF:Mg,Ti. These suggest that the luminescence centre is a defect complex of Ti modified, in the Mg doped crystals, by Mg in various forms. The dependence of the TL peaks on dose and LET support the suggestion that the higher temperature peaks are complexes which trap more than one charge. Red emission is observed in Mg doped crystals. (36 refs.)

102973 Thermoluminescence in systems not subject to the usual approximations for first and second order kinetics. P.W.Levy (Brookhaven Nat. Lab., Upton, NY, USA).
Radiat. Eff. (GB), vol.72, no.1-4, p.259-64 (1983). (Proceedings of the Fourth Europhysical Topical Conference on 'Lattice Defects in Ionic Crystals', Dublin, Ireland, 29 Aug.-3 Sept. 1982).
The properties of thermoluminescence (TL) glow curves have been studied in systems containing one or more glow peaks, not restricted to the assumption used to derive the usual first and second order glow peak kinetic expressions. If retrapping is negligible first order glow peaks are obtained whose peak temperature and shape are independent of other factors such as initial trapped charge concentrations. If retrapping occurs, glow peaks are obtained that are, in most cases, only approximated by first or second order kinetics. Also, in these cases, the peak temperature, shape, relative intensity and other glow curve characteristics depend strongly on initial trapped charge concentrations, recombination and retrapping cross sections and other factors. (10 refs.)

Defects induced in single thoria crystals by X and far UV irradiation ....See Entry 101793

Investigations of mechanically induced excited states on cleavage planes of ionic crystals. II. Investigations of the mechanisms of electron emission from cleaved alkali halide crystals and of the influence of surface charges ....See Entry 103037

78.65 OPTICAL PROPERTIES OF THIN FILMS

102974 Optical absorption of transition metal ions in silica coating films prepared by the sol-gel technique. S.Sakka, K.Kamiya (Faculty of Engng., Mie Univ., Mie, Japan), K.Makita, Y.Yamamoto.
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.395-6 (Aug. 1983).
The state of transition metal ions in SiO_2 glasses prepared by the sol-gel technique has been examined by measuring the optical absorption spectra. The concentration of Mn^{3+} and Fe^{3+} was found to be higher in glass prepared by this technique than in glass prepared by the high temperature technique. (8 refs.)

102975 Photoinduced changes in optical properties of yellow arsenic. A.I.Sazonov, R.I.Kalendarev.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.3, p.35-40 (1983). In Russian.
Presents results obtained in studying photoinduced changes in optical properties of thin evaporated films of the molecular form of arsenic—yellow arsenic (y-As). It is shown that reduction in optical gap width effect of illumination is connected with formation clusters of a new phase in the y-As matrix. These clusters, in their turn, exert an effect on the matrix. In the case of limiting illumination it has been ascertained by means of Raman spectroscopy that the photoinduced process leads to short order changes in y-As. The state that is thus formed is close in properties and structure to amorphous arsenic (a-As), obtained by passing the y-As stage. Certain discrepancies in optical properties are, most likely, due to certain deviations in the positions of atoms situated at larger than next-neighbour distances, as well as to the formation of a looser net-like structure. (16 refs.)

102976 Optical and electrical properties of RF-sputtered indium-tin oxide films. J.Szczyrbowski (Dept. of Solid State Phys., Acad. of Mining & Metallurgy, Cracow, Poland), A.Dietrich, H.Hoffmann.
Phys. Status Solidi a (Germany), vol.78, no.1, p.243-52 (16 July 1983).
The electrical and optical properties of two series of RF-sputtered In_2O_3/SnO_2 films are investigated. One series is sputtered onto substrates which are held at room temperature and the second series onto substrates heated to 300°C. The oxygen partial pressure of the sputter gas is varied from 1×10^{-3} to 0.1 Pa in both the cases. The analysis of the optical measurements shows that the films are optically inhomogeneous and that this inhomogeneity depends on both the substrate temperature and the oxygen partial pressure during the deposition. The behaviour of the absorption coefficient near the fundamental absorption edge suggests that there are three different transition energies for electrons, which depend on the oxygen pressure during the preparation. As a result of the optical measurements some information about the band structure of In_2O_3 is obtained. (14 refs.)

102977 Optical constants of amorphous hydrogenated carbon and silicon-carbon alloy films and their application in high temperature solar selective surfaces. D.R.McKenzie, N.Savvides, D.R.Mills, R.C.McPhedran (School of Phys., Univ. of Sydney, Sydney, NSW, Australia), L.C.Botten.
Sol. Energy Mater. (Netherlands), vol.9, no.1, p.113-26 (May-June 1983).
A study was made of the alloy series a-$Si_xC_{1-x}H_y$ for $1 \geq x \geq 0$ prepared by a DC magnetron glow discharge in argon/silane/acetylene mixtures. Optical constants of a-CH_y and a-$Si_xC_{1-x}H_y$ for three values of x were determined. The changes in the optical constants caused by heat treatment at 500°C in vacuum were investigated. Solar selective coatings with exceptionally low emittance and good high temperature stability were studied theoretically and experimentally using both single layer and multilayer coatings. A stagnation temperature of over 500°C with no concentration was predicted for some coatings and in preliminary experiments 480°C was attained. (26 refs.)

102978 Influence of annealing temperature on the exponential absorption edge of thin Si:H amorphous films deposited by 'glow discharge'. J.M.Berger, F.De Chelle, J.P.Ferraton, A.Donnadieu (Lab. de Spectroscopie II, Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
Thin Solid Films (Switzerland), vol.105, no.2, p.107-13 (15 July 1983). In French.
Optical measurements of the absorption edge were performed on undoped and phosphorus-doped amorphous hydrogenated silicon (a-Si:H) films prepared by glow discharge and annealed at increasing temperatures. The authors observed exponential absorption edges (Urbach tails) $\alpha=\alpha_0\exp\{(E\text{-}E_1)/E_0\}$; the parameter E_0 increases with annealing temperature and is linearly related to the optical gap E_g. An explanation of these changes is proposed based on structural modification of the material. A similar study of diffused a-Si:H thin films shows that the value of the parameter E_0 is dependent more on the roughness of the surface than on the hydrogen content. (14 refs.)

102979 The effect of shielded Coulomb interaction on light absorption in thin semiconductor films. K.H.Aharonian, E.M.Kazarian (Yerevan Polytech Inst., Yerevan, Armenian SSR).
Thin Solid Films (Switzerland), vol.105, no.2, p.149-56 (15 July 1983).
The effect of shielded Coulomb interaction on the absorption of light in thin semiconductor films is investigated theoretically. Taking into account the field of charge carriers in the media surrounding the film, the authors obtain in an explicit form the potential of shielded Coulomb interaction with a two-dimensional Debye shielding radius. An analytical expression for the factor determining the contribution of exciton effects to the optical absorption is also obtained. Plots of the dependence of the exciton factor on the shielding radius and on the energy of the created pair are given, the plots being obtained numerically. (8 refs.)

102980 The optical properties of $AgInTe_2$ thin films. R.Vaidhyanathan, S.L.Pinjare, J.Sobhanadri (Dept. of Phys., Indian Inst. of Technol., Madras, India).
Thin Solid Films (Switzerland), vol.105, no.2, p.157-62 (15 July 1983).
The optical absorption in electron-beam-evaporated $AgInTe_2$ thin films was studied in the energy range 0.5-2 eV. $AgInTe_2$ was found to be a direct gap semiconductor with a room temperature gap of 1.03 ± 0.01 eV. Another direct transition observed at 1.04 ± 0.01 eV was ascribed to an optical transition from the crystal-field-split valence band to the conduction band minimum. A third direct allowed transition from the spin-orbit-split valence band to the conduction band was identified at 1.77 ± 0.03 eV. An estimate of the p-d hybridization of the uppermost valence yields a value of about 15%. (14 refs.)

102981 Optical absorption of transition element oxide-silica coating films prepared by sol-gel method. Y.Yamamoto, K.Makita, K.Kamiya (Matsuzaka Res. Center, Central Glass Co. Ltd., Taki-gun, Japan), S.Sakka.
Yogyo-Kyokai-Shi (Japan), vol.91, no.5, p.222-9 (1983). In Japanese.
The valence and coordination of the transition element in the transition element oxide-silica coating films were examined by measuring the optical absorption spectra and compared with those found in silica glass containing a transition element oxide prepared by Schultz by flame-hydrolysis at high temperatures. The following results were obtained: (1) The maximum possible content of a transition element oxide for obtaining a homogeneous film was 10 mol.% for Cr_2O_3, 20 mol.% for Mn_2O_3, 45 mol.% for Fe_2O_3, 45 mol.% for CoO, 55 mol.% for NiO and 45 mol.% for CuO. The optical transmittance at 555 nm of the homogeneously colored 0.2-0.5 μm thick films with the strongest absorption was 81% for Cr, 68% for Mn, 63% for Fe, almost 0% for Co, 59% for Ni and 95% for Cu. (2) The valence and coordination of a transition element in the films were similar to those found in silica glass prepared at high temperatures. However, the concentration of a transition element showing a certain valence and coordination was not equal to that found in silica glass prepared at high temperatures. It was found that chromium is present as Cr^{3+} in octahedral site, manganese as Mn^{3+} in octahedral site, iron as Fe^{3+} in octahedral site, cobalt as Co^{2+} in tetrahedral site, nickel as Ni^{2+} in octahedral site and copper as Cu^{2+} in octahedral site. (11 refs.)

Ultrahigh vacuum apparatus for the optical study of thin films, in an energy range from 2 to 10.25 eV .... See Entry 99119

Determining the optical constants of high index thin films (II-VI compound thin film) with optical waveguides .... See Entry 99143

Simple and direct determination of complex refractive index and thickness of unsupported or embedded thin films by combined reflection and transmission ellipsometry at 45° angle of incidence .... See Entry 99157

New graphical method for the determination of the optical constants of thin films .... See Entry 99161

Frustrated total internal reflection spectroscopy of films with absorption gradients .... See Entry 99202

Second-harmonic generation on reflection from a monomolecular Langmuir layer .... See Entry 100845

IR laser-induced deposition of silicon thin films .... See Entry 102213

Laser-induced solid phase crystallization in amorphous silicon films .... See Entry 102214

Spin coated amorphous chalcogenide films: thermal properties .... See Entry 102217

Co (III) ions high-spin configuration in nonstoichiometric Co_3O_4 films .... See Entry 102255

Evidence for shallow bound states in PbTe .... See Entry 102313

Evidence for shallow bound states in PbTe: A reply .... See Entry 102314

Electrical and optical properties of RF-SP a-Ge:O:(H) deposited from GeO_2 .... See Entry 102382

Growth peculiarities of graded band gap GaAsSb/GaAs heterostructures and effective light modulation in the 1.06 μm wavelength region .. See Entry 102502

Characterization of fluorine-doped In_2O_3 films synthesized by spray pyrolysis .... See Entry 102542

Optical properties of a-Si and a-Si:H prepared by DC magnetron techniques .... See Entry 102836

Role of electromagnetic resonances in the surface-enhanced Raman effect .... See Entry 102881

Optical microanalysis of small semiconductor structures .... See Entry 102894

Photoluminescence measurements of Zn-doped $Ga_{1-x}Al_xAs$ grown by metalorganic chemical vapor deposition .... See Entry 102925

Resonant two-photon absorption by exciton polaritons in evaporated CuCl films .... See Entry 102944

Radiative transitions associated with two-acceptor-one-donor complexes in epitaxial GaAs and InP .... See Entry 102945

Comment on nonradiative-recombination kinetics in *a*-Si:H ... See Entry 102946

Investigation of anodic alumina by a photoluminescence method. I .... See Entry 102954

A study of the electrical and luminescence characteristics of a novel Si-based thin film electroluminescent device .... See Entry 102960

Excitation frequency dependence of electroluminescence spectra in ZnS: ErF_3, YbF_3 thin films .... See Entry 102962

The electro- and photoluminescence spectra of oxide films formed during anodic oxidation of zinc .... See Entry 102963

RF-plasma deposited amorphous hydrogenated hard carbon thin films: preparation, properties, and applications .... See Entry 103073

Spectrally selective black tungsten films .... See Entry 103728

78.70 OTHER INTERACTIONS OF MATTER WITH PARTICLES AND RADIATION

102982 Vacuum polarisation and electron screening effects on leptonic bremsstrahlung. L.Chatterjee (Dept. of Phys., Jadavpur Univ., Calcutta, India), S.Bhattacharyya, T.Roy.
Indian J. Phys. Part B, vol.57B, no.1, p.85-8 (Feb. 1983).
Bremsstrahlung radiation of high energy leptons in their passage through matter has been investigated, taking the vacuum polarisation and electron screening effects directly into account and using second order interaction in quantum electrodynamics. (8 refs.)

102983 Differential incoherent scattering cross sections of 661.6 keV gamma rays in elements derived from differential incoherent scattering cross sections in compounds. A.H.Shivananda, T.K.Umesh, S.Gopal, B.Sanjeevaiah (Dept. of Phys., Univ. of Mysore, Mysore, India).
J. Phys. B (GB), vol.16, no.15, p.2753-8 (14 Aug. 1983).
Differential incoherent scattering cross sections of 661.6 keV gamma rays in the solid compounds NaCl, $NaNO_2$, KCl, NiO, $NaNO_3$, CuCl, NaBr, $CaCO_3$, $CaCl_2$ and $ZnCl_2$ and in the liquid compounds H_2O and HCl at 30, 45 and 60° have been measured. Making use of the bonded hydrogen incoherent scattering functions of Hubbell et al. and the mixture rule, the differential incoherent scattering cross sections in C, N, O, Cl, Na, K, Ca, Br, Ni, Cu and Zn are derived, compared with the theoretical values of Hubbell et al. and discussed. (15 refs.)

102984 Evidence for the tetravalence of cerium in $CeRu_2$. E.Wuilloud, Y.Baer (Inst. de Phys., Univ. de Neuchatel, Neuchatel, Switzerland), M.B.Maple.
Phys. Lett. A (Netherlands), vol.97A, no.1-2, p.65-9 (8 Aug. 1983).
The conventional analysis of XPS core level spectra of $CeRu_2$ yields a picture of the 4f states which is difficult to reconcile with other results. The validity of this kind of interpretation urgently needs to be re-examined critically. In contrast, Bremsstrahlung isochromat spectroscopy (BIS) measurements on $CeRu_2$, reported herein, suggest that Ce is nearly tetravalent $4f^0$ configuration in this compound. (28 refs.)

102985 Calculation of the Compton profile of beryllium. M.Y.Chou, P.K.Lam, M.L.Cohen (Dept. of Phys., Univ. of California, Berkeley, CA, USA).
Phys. Rev. B (USA), vol.28, no.4, p.1696-700 (15 Aug. 1983).
A calculation of the Compton profiles of beryllium is presented. The wave functions are obtained from an ab initio calculation with the use of the pseudopotential approach within the local-density-functional approximation. The calculated anisotropic profiles are in excellent agreement with experiments. The directional profiles are also in good agreement except for a small discrepancy which can be improved by the inclusion of the effects of correlation in an approximate way. (23 refs.)

102986 Radiation of a stationary charge under instantaneous change of the gyrotropy of a medium. V.A.Davydov, V.V.Kolesov.
Sov. Phys.-Lebedev Inst. Rep. (USA), no.10, p.31-4 (1982). Translation of: *Sb. Kratk. Soobshch. Fiz. AN SSSR Fiz. Inst. P.N. Lebedeva*, no.10, p.35-9 (1982).
The authors consider the radiation of a stationary charge under an instantaneous change of the gyrotropy of a medium. They obtain the expressions for the spectral and angular distribution of the radiative energy. (7 refs.)

On the dynamics of low-temperature domains above T_c in lead phosphate .... See Entry 101993

78.70B Positron annihilation

(see also 71.65 Positron states)

102987 Positron annihilation in and compressibility of water-organic mixtures. I. The system water-tetrahydrofuran. K.Jerie, A.Baranowski, B.Rozenfeld (Inst. of Experimental Phys., Univ. of Wroclaw, Wroclaw, Poland), S.Ernst, J.Glinski.
Acta Phys. Pol. A (Poland), vol.A64, no.1, p.77-92 (July 1983).
The results of measurements of ultrasound velocity and average positronium lifetimes in aqueous tetrahydrofuran solutions were shown to reflect the peculiar behaviour of the solution structure on the organic component concentration. The results indicate the formation of clathrate-like structures in the dilute solutions under test, while at higher concentrations of the organic component tendency of water to engage in THF-H_2O complexes becomes pronounced. (44 refs.)

102988 Annihilation of positrons trapped at metal surface and possibility of occurrence of asymmetry in angular distributions of annihilation quanta under the influence of an external electric field. B.Rosenfeld, K.Jerie, W.Swiatkowski (Inst. of Experimental Phys., Wroclaw Univ., Wroclaw, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.1, p.93-105 (July 1983).
A phenomenological, quantum-mechanical model of the annihilation of the positrons trapped at a metal surface is proposed. The model takes into account effects related to the interference of the electron waves incident and reflected from the metal-vacuum boundary. Conclusions drawn from the study of the scattering of the electron wave from the trapped positron deserve special attention. They indicate that the scattering process can cause an asymmetry in the distribution of the perpendicular (to the metal surface) component of the resultant momentum of the annihilation photon pair. Such asymmetry can also manifest itself in samples which contain voids, as a result of positron drift at the void surface under the influence of the applied electric field. An attempt is made to explain, in this way, the influence of the electric current flow in some metallic samples on the behaviour of the angular distributions of the annihilation photons. (14 refs.)

102989 Positrons and solid state physics. A.A.Manuel (Dept. of Phys., Univ. of Geneva, Geneva, Switzerland).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.437-48 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Positron annihilation (PA) is used for many purposes in solid state physics. The author outlines the principles of this method and illustrate how positrons are used to study problems as different as particle diffusion through a solid, defects in crystals and amorphous materials, electron momentum distributions, Fermi surface measurements or surfaces states. (56 refs.)

102990 A positron study of Guinier-Preston zones and precipitates in Al-Zn alloys having Mg or Ge additions. G.Dlubek (Sektion Phys., Martin-Luther-Univ. Halle/Wittenberg, Halle, Germany), O.Brummer, R.Krause, A.Baranowski, B.Rozenfeld.
Phys. Status Solidi a (Germany), vol.78, no.1, p.217-28 (16 July 1983).
Positron studies on Al-Zn (3 and 6 at.%) alloys having a Mg or Ge addition with a value between 0 and 1.5 at.% are reported, utilizing measurements of the positron lifetime τ as well as of the curve-shape parameters S and the peak height h of the 2γ-angular correlation curve. The samples are aged at room temperature or time-linear heated after their quenching. Strong evidence is found that positrons are trapped in Al-Zn-Mg by defect-free GP zones containing 70 at.% Zn as well as by vacancies inside of a second type of GP zones containing Zn and Mg. With increasing Mg content of the alloy the second type of GP zones dominates more and more over the first one. The results for Al-Zn-Ge are interpreted assuming positron trapping by both, defect-free Zn-rich GP zones and incoherent Ge precipitates. Whereas the Ge addition to the Al-Zn alloys affects only weakly the dissolution temperature of Zn-rich GP zones at about 100°C, in the Al-Zn-Mg alloys new types of GP zones and precipitates are observed. The behaviour of the peak height h

at 200 to 250°C indicates the formation of semicoherent η'- and incoherent η-precipitates. Some general experiences on the use of different measuring techniques of the positron method (τ or S and h) in studying precipitation phenomena in Al alloys are reported. (32 refs.)

102991 Correlation of dielectric relaxation and positron annihilation in glass-forming liquids. B.D.Malhotra, R.A.Pethrick (Dept. of Pure & Appl. Chem., Univ. of Strathclyde, Glasgow, Scotland).
Phys. Rev. B (USA), vol.28, no.3, p.1256-62 (1 Aug. 1983).
Dielectric relaxation measurements are reported on bis[m-(m-phenoxy) phenoxyphenyl] ether from room temperature (298K) down to its glass transition temperature (213K). Combination of these data with orthopositronium annihilation measurements published earlier indicate that the higher-temperature elbow in the latter data (T_r) coincides with the temperature at which the orthopositronium lifetime τ_3 is comparable with the bipolar relaxation time. A similar correlation is observed for ortho-terphenyl. With the use of ultrasonic velocity data, it is possible in the latter system to compute a mean cavity dimension and discuss the way in which the dynamic behavior of the supercooled liquid influences the positron annihilation behavior. The implications of these observations in terms of theories in viscous liquids are discussed. (24 refs.)

Localized positron state in a simple metal ....See Entry 102325

Hydrogen in $Fe_{40}Ni_{40}P_{14}B_6$ amorphous alloys studied by magnetic aftereffect, internal friction, and positron annihilation ....See Entry 102710

78.70C X-ray scattering

About a feature of X-ray diffraction in imperfect crystals ....See Entry 101506

78.70D X-ray absorption and absorption edges

102992 On a site-selective EXAFS experiment using optical emission. J.Goulon (Interactions Moleculaires, Univ. de Nancy I, Vandouevre les Nancy, France), P.Tola, M.Lemonnier, J.Dexpert-Ghys.
Chem. Phys. (Netherlands), vol.78, no.3, p.347-56 (1 Aug. 1983).
X-ray-excited optical luminescence (XEOL) is known to offer an alternative detection scheme of EXAFS spectra. Although this secondary emission appears restricted to a rather limited number of systems, the authors show that it can afford, under appropriate circumstances, an interesting property of site selectivity. The case of a ZnO+ZnTPP mixture was chosen as an illustrative example. The relevant formulation of the phenomenon for powdered samples is developed and the requirements for site selectivity are discussed. (33 refs.)

102993 Study of variation of chemical shift using surface effects, electron-electron interaction and geometry of specimen. O.K.Harsh, Y.D.Kaushik, R.P.Sharma (Dept. of Post-graduate Studies & Res. in Phys., Feroze Gandhi Coll., Rae Bareli, India).
Indian J. Phys. Part B, vol.57B, no.1, p.76-9 (Feb. 1983).
Simple method is proposed to explain the chemical shifts in X-ray absorption edges of certain metal-compounds, which includes the effect of various interactions due to roughness of specimen. For this the authors used the collective method of electronic interactions. The calculated values are found in fair agreement with the experimental values of several workers. (17 refs.)

102994 Collective oscillations in the X-ray absorption spectrum of beryllium. O.K.Harsh, Y.D.Kaushik (Dept. of Post-graduate Studies & Res. in Phys., Feroze Gandhi Coll., Rae Bareli, India).
Indian J. Phys. Part B, vol.57B, no.1, p.89-91 (Feb. 1983).
It has been claimed that the fine structure in beryllium observed at an energy distance of 20.5 eV is due to plasma oscillations. The authors compared the transition probability obtained due to plasma oscillations in solids to that obtained by Kronig-Hayasi theory. It has been found that the transition probability for plasma oscillations in Be is greater than what Kronig-Hayasi theory predicts. (12 refs.)

102995 EXAFS study of bromomanganate ions in molten salts. E.D.Crozier, N.Alberding (Phys. Dept., Simon Fraser Univ., Burnaby, British Columbia, Canada), B.R.Sundheim.
J. Chem. Phys. (USA), vol.79, no.2, p.939-43 (15 July 1983).
Extended X-ray absorption fine structure spectra measurements were made on molten $(Bu_4N)MnBr_3$ to determine its coordination geometry which has remained in doubt because of its disproportionated structure in the solid form. Comparison with results on solid and molten $(Bu_4N)_2MnBr_4$ imply a Br to Mn coordination in $(Bu_4N)MnBr_3$ of 3.14 ± 0.36 at an average distance of 2.46 ± 0.03 Å. It is concluded that the nominal $MnBr_3$ moiety is, in fact, trigonal—a species previously unknown in liquids. The EXAFS of $(Bu_4N)_2MnBr_4$ give a Br-Mn bond length of 2.50 ± 0.02 Å when small corrections for an asymmetric pair distribution are included. The variation of the disorder parameter with temperature is in accord with measured asymmetric stretch frequencies of the $MnBr^{=}$ anion. No abrupt change in the disorder parameter of bond length occurs at the melting point. The near edge absorption spectra of both compounds are unexpectedly similar considering the difference in coordination numbers. (24 refs.)

102996 Extended X-ray absorption fine structure (EXAFS) of highly dispersed rhodium catalysts. G.H.Via, G.Meitzner, F.W.Lytle, J.H.Sinfelt (Exxon Res. & Engng. Co., Linden, NJ, USA).
J. Chem. Phys. (USA), vol.79, no.3, p.1527-9 (1 Aug. 1983).
An investigation was conducted of the extended X-ray absorption fine structure (EXAFS) associated with the K-absorption edge of the rhodium in two catalysts, Rh/SiO_2 and Rh/Al_2O, which contained 1 and 0.5 wt.% rhodium, respectively. Hydrogen chemisorption data indicated that the rhodium atoms were predominantly surface atoms in both catalysts. However, the EXAFS data indicated that the average number of nearest neighbor rhodium atoms about a given rhodium atom was much lower for the Rh/Al_2O_3 catalyst than for the Rh/SiO_2 catalyst, 1.5 compared to 9. These values compare with a value of 12 for metallic rhodium. Although the detection of at least some Rh-Rh coordination for the Rh/Al_2O_3 catalyst indicates that the rhodium is not present exclusively as single atoms bound to the alumina, the EXAFS data do not exclude the possibility that rhodium in this form could be present along with rhodium clusters. (17 refs.)

102997 An extended X-ray absorption fine structure spectroscopy study of a highly dispersed Rh/Al_2O_3 catalyst: The influence of CO chemisorption on the topology of rhodium. H.F.J.Van't Blik, J.B.A.D.van Zon, T.Hulzinga, J.C.Vis, D.C.Koningsberger, R.Prins (Lab. for Inorganic Chem., Eindhoven Univ. of Technol., Eindhoven, Netherlands).
J. Phys. Chem. (USA), vol.87, no.13, p.2264-7 (23 June 1983).
The X-ray absorption spectrum of the Rh K edge of a highly dispersed reduced 0.57 wt.% $Rh/\gamma\text{-}Al_2O_3$ catalyst shows EXAFS oscillations due to rhodium-rhodium nearest neighbors, which proves the existence of rhodium metal crystallites. Adsorption of CO at room temperature on the reduced catalyst significantly decreases the amplitude of these EXAFS oscillations. This implies that CO adsorption on very small rhodium crystallites leads to a disruption of a significant number of the metal-metal bonds. (23 refs.)

102998 A study of the chemical shifts in X-ray absorption spectra and the sublattice distortion in some ternary chalcopyrite compounds of the type $CuMS_2$. A.P.Deshpande, V.B.Sapre, C.Mande.
Phys. Status Solidi b (Germany), vol.118, no.1, p.K39-42 (1 July 1983).
The chemical shifts in X-ray absorption spectra are found to be governed essentially by the environment of the absorbing atom, more particularly on the effective charge on it. An attempt has been made to find out if there exists any relationship between the chemical shifts and the sublattice distortions in the isostructural compounds of the type $CuMS_2$ (M=Al, Ga, In, Tl). (11 refs.)

102999 Spectroscopic standard for tetrahedrally coordinated ferric iron: γ $LiAlO_2{:}Fe^{3+}$. G.A.Waychunas (Center for Materials Res., Stanford Univ., Stanford, CA, USA), G.R.Rossman.
Phys. & Chem. Miner. (Germany), vol.9, no.5, p.212-15 (1983).
γ $LiAlO_2$ doped with Fe^{3+} in the tetrahedral site has been examined by extended X-ray absorption fine structure (EXAFS) analysis, and Mossbauer and optical spectroscopy. The isomer shift (IS) is −0.026 mm/s (Fe-Pd); the quadrupole splitting (QS) is 0.62 mm/s. Anisotropic optical absorption is prominent at ~391, 452, and 463 nm. The K-edge absorption spectrum shows a prominent absorption near 7.113 eV typical of tetrahedrally coordinated Fe^{3+}. (14 refs.)

103000 X-ray spectroscopic investigations of lead chloride, $PbCl_2$. C.Sugiura, Shun-ichi Nakai (Dept. of Appl. Phys., Utsunomiya Univ., Utsunomiya, Japan).
Phys. Rev. B (USA), vol.28, no.2, p.1088-92 (15 July 1983).
The Cl $K\beta$ emission and Cl K absorption spectra and the Pb M_V absorption spectrum from $PbCl_2$ have been obtained with a 50-cm bent-quartz-crystal vacuum spectrograph. The Cl $K\beta$ emission spectrum consists of a broad band. The Cl K absorption spectrum has two well-separated peaks just above the K edge. The first peak is regarded as the transition to the conduction-band minimum having p character, the second peak as the transition to the higher-lying p-like conduction band. The Cl $K\beta$ emission and Cl K absorption spectra of $PbCl_2$ are compared with the Cl $K\beta$ emission and Cl K absorption spectra of $BaCl_2$ reported previously, and interesting differences between them have been found. These differences are explained in terms of the ionicity and energy-band structures The Pb M_v absorption spectrum consists of two different kinds of structures: the two small peaks near the threshold and the intense broad absorption extending to the higher-energy region. The former peaks are ascribed to the transitions to the p-like conduction bands which arise from the $6p$ and $7p$ states of the Pb^{2+} ion, and the latter absorption is attributed to the $3d_{5/2}\rightarrow\epsilon f$ continuum transitions. (25 refs.)

Size effect of powdered sample on EXAFS amplitude ....See Entry 99244

X-ray spectroscopic studies of copper compounds and complexes in aqueous solution and polycrystalline form .... See Entry 100414

Correlation of electron binding energy with the chemical shifts ....See Entry 101618

Configuration mixing in the groundstate of Ce ....See Entry 102294

78.70E X-ray emission threshold and fluorescence

103001 Parametric X-rays from ultrarelativistic electrons in a crystal: theory and possibilities of practical utilization. V.G.Baryshevsky, I.D.Feranchuk (Dept. of Phys., Byelorussian State Univ., Minsk, Byelorussian SSR).
J. Phys. (France), vol.44, no.8, p.913-22 (Aug. 1983).
The detailed theory of parametric X-rays from charged particles in a crystal is considered. It is shown that this radiation is due to the diffraction of the particle's electromagnetic field. Some features of the parametric X-ray allows us to separate this radiation from other radiation types. Methods of the experimental investigation and uses of parametric X-rays are discussed. (25 refs.)

Core-level reflectance spectroscopy of black phosphorus single crystals ....See Entry 102297

X-ray spectroscopic investigations of lead chloride, $PbCl_2$ .....See Entry 103000

78.70G Microwave and radiofrequency interactions

(exc. resonances)

103002 Microwave absorption of magnetic dielectrics. S.Yamaguchi (Yamaguchi-Lab., Tokyo, Japan).
Mater. Chem. & Phys. (Switzerland), vol.8, no.6, p.579-82 (June 1983). In German.
A simulation is made for demonstrating that a magnetic dielectric emulsion prepared by the tribophysical procedure is able to absorb microwaves with a wavelength of about one mm. In this emulsion the iron alloy and the barium titanate particles are evenly dispersed. This emulsion is compared to a closed electric circuit consisting of solenoid and condenser. (3 refs.)

103003 Submillimeter transmission spectra of mosaic samples. A.A.Volkov, G.V.Kozlov, S.P.Lebedev.
Opt. & Spectrosc. (USA), vol.54, no.1, p.61-3 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.107-10 (Jan. 1983).
The effect of the spacing between the units, the orientation of the electric wave field vector relative to the interval line, and the dielectric parameters of the units on the transmission spectra of mosaic samples was investigated by the method of submillimeter LOV spectroscopy. The typical characteristics of distortion of the spectra by parasitic radiation passing through the gaps were evaluated. (5 refs.)

103004 Microwave absorption in amorphous chalcogenide semiconductors. K.Shimakawa (Dept. of Electronics, Gifu Univ., Gifu, Japan).
Philos. Mag. B (GB), vol.48, no.1, p.77-85 (July 1983).
Although the AC conductivity of amorphous chalcogenides in the radio frequency region has been well interpreted by the combined mechanism of correlated barrier hopping (CBH) of bipolarons and single polarons based on charged defects, it is not clear whether the CBH model can be extended to the microwave region. The validity of the CBH of bipolarons with regard to both the frequency and temperature dependencies of conductivity is examined in the microwave region. It is concluded that the observed microwave optical absorption (conductivity) is well interpreted in terms of the CBH of bipolarons for glassy Se, As_2Se_3, As_2S_3, As_2Te_3, $(As_2Te_3)_{1-x}Ge_x$ and Tl_2SeAs_2Te. (22 refs.)

103005 Anomalously small dissipation of electromagnetic waves in an ionic crystal. V.B.Braginskii, V.I.Panov, A.V.Timashov (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.926-7 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.74-5 (Nov. 1982).
The study of the dissipation of electromagnetic waves in dielectric crystals permits valuable information to be obtained on the polarization mechanisms. Such mechanisms are interesting also because at the present time there is no complete theory which would permit prediction of the loss tangent tan δ of an electromagnetic wave in a crystal of known composition and structure. The authors report measurements of the quality factor (Q_e) values of disk resonators made of sapphire. (6 refs.)

Pulsed RF emission during crystallization of water and certain dielectrics .... See Entry 101921

The influence of triazaindolisine on the microwave photoconductivity of AgBr emulsion grains .... See Entry 102453

Dielectric relaxation studies in pure lutidines at different microwave frequencies .... See Entry 102809

Dielectric relaxation & molecular motion in highly viscous medium .... See Entry 102810

78.90 OTHER TOPICS IN OPTICAL PROPERTIES OF CONDENSED MATTER AND OTHER INTERACTIONS OF MATTER WITH PARTICLES AND RADIATION

On the Franck-Condon factor evaluation in harmonic approximation .... See Entry 100457

79.00 ELECTRON AND ION EMISSION BY LIQUIDS AND SOLIDS; IMPACT PHENOMENA

Vacuum Symposium Proceedings (Kobe 1982) .... See Entry 98634

79.20 IMPACT PHENOMENA

(inc. electron spectra and sputtering)

Charged beam interaction with solids .... See Entry 98675

79.20D Laser-light impact phenomena

103006 Nonlinearities of laser heating of metals. N.N.Rykalin, A.A.Uglov, I.Yu.Smurov (A.A. Baikov Inst. of Metall., Acad. of Sci., Moscow, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.970-2 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.377-81 (Nov. 1982).
Three-dimensional problems of the laser heating of metals with partial allowance for nonlinearities has been examined. Simultaneous allowance has been made for all nonlinearities (the absorptivity, the thermal conductivity, and volume heat capacity), which are inherent to the process of laser heating of metals. It has been shown that the combined effect of the nonlinearities leads, in a number of cases, to substantially new results. The authors examine the heating of a semi-infinite body by a moving laser beam. The calculations that have been carried out showed that, during the laser heating of molybdenum and of tungsten, one cannot select constant values of the absorptivity and of the thermophysical coefficients such that the linear model describes the heating process in an acceptable way over the entire temperature range from the initial temperature to the melting temperature, since the discrepancies will be large either at low or at high temperatures. (6 refs.)

103007 Calculation of heating of metals by continuous laser radiation in an oxidizing atmosphere. A.A.Uglov, I.Yu.Smurov, A.A.Volkov (A.A. Baikov Inst. of Metall., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.154-6 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.289-94 (Feb. 1983).
A study is made of a nonsteady problem of heating of metals by continuous laser radiation allowing for a chemical reaction on the surface of a metal plate. The dependence of the absorptivity of the target on the thickness of the oxide film formed on the metal surface is also allowed for. Approximate analytic expressions are obtained for the dependences of the metal temperature on time and on the oxide film thickness, and also for the time dependence of this thickness during heating. It is shown that it is essential to allow for the nonlinearity of the process in calculation of the heating of metals by laser radiation on oxidizing atmosphere. (15 refs.)

103008 Temperature dependence of the absorptivity of aluminum targets at the 10.6 μ wavelength. V.I.Konov, V.N.Tokarev (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.177-80 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.327-31 (Feb. 1983).
The temperature dependence of the absorptivity $A(T)$ of aluminum targets was determined experimentally at the 10.6 μ wavelength in the temperature range $20 \leq T \leq 780°C$. An abrupt change in $A(T)$ was observed on passing through the melting point. It is found that when the initial value of $A(T)$ (at room temperature), which depended on the state or the surface, decreased, the slope dA/dT also decreased. The experimental data were compared with calculations of $A(T)$ allowing for a slightly anomalous skin effect for aluminum under these conditions. (12 refs.)

103009 Ion and electron spectroscopy during pulsed laser irradiation of silicon. J.P.Long, R.T.Williams, T.R.Royt, J.C.Rife, M.N.Kabler (Naval Res. Lab., Washington, DC, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.89-95
Ion mass spectrometry, charged particle yields, and kinetic energy distributions of electrons and ions are used to characterize silicon wafers and vacuum-cleaved silicon surfaces under conditions related to laser annealing. The authors find that alkali metals dominate the positive ion emission from chemically-cleaned wafers, a mass-72 peak tentatively identified as Si_2O^+ comprises the main ion emission from the cleaved surface, and ion and electron temperatures can be derived from the energy distribution curves, although the Si_2O^+ emission implies more than a simple thermal evaporation process. (9 refs.)

Using optical fibers in laser processing .... See Entry 101764

Time-resolved reflectivity measurements in silicon [with reply] .... See Entry 102839

79.20F Electron impact: Auger emission

103010 Auger lifetimes for excitons bound to deep impurities in semiconductors. M.Jaros, F.A.Riddoch, Lu Da Lian (Dept. of Theoretical Phys., Univ. of Newcastle upon Tyne, Newcastle upon Tyne, England).
J. Phys. C (GB), vol.16, no.21, p.L733-9 (30 July 1983).
It is shown that the Auger transition probability for excitons bound to deep neutral impurities cannot be derived by extrapolating the results obtained for the series of shallow donors and acceptors. Although the probability increases with localisation over the range of binding energies characteristic of hydrogenic impurities, the breakdown of the effective mass approximation in the case of deep levels greatly reduces the Auger probability. Exceptional situations where this may not be so are also predicted. (20 refs.)

103011 Resonant electron emission in heavily oxidized lanthanum. R.Hoogewijs, H.Lievens, L.Fiermans, J.Vennik (Lab. voor Kristallografie, Rijksuniv. Gent, Gent, Belgium).
Solid State Commun. (USA), vol.47, no.8, p.591-2 (Aug. 1983).
Electron-excited 4d Auger spectra of La and heavily oxidized La have been measured. A distinct peak, appearing just above the 4d excitation threshold in heavily oxidized La, is tentatively assigned to an interatomic autoionization process accompanying the 4d→4f giant resonance excitation. The absence of a similar peak in La metal is explained as being due to the very weak coupling between the 4f level and the metal valence band. (13 refs.)

103012 The Auger spectrum of lithium metal, lithium binary and lithium ternary compounds. I.F.Ferguson, D.R.Masters, B.F.Riley, M.Turek (Springfields Nuclear Power Dev. Labs., UKAEA, Preston, England).
Vide les Couches Minces (France), vol.38, no.217, p.279-88 (May-July 1983).
The authors investigated the Auger spectrum of metallic lithium as well as that of a number of simple lithium compounds so as to assess this possibility and determine whether an Auger microprobe can be used to detect and hence map at high spatial resolution lithium. In this way, the distribution of lithium could be determined in boron carbide which has been irradiated in a nuclear reactor and in which lithium has been formed by the fission reaction: ${}_5^{10}B + {}_0^1n \rightarrow {}_3^7Li + {}_2^4He$. Binary compounds of lithium with other elements in the same period of the Periodic Table; lithium halides; lithium hydride; and lithium sulphide were selected for study as well as certain lithium ternary compounds. These ternary compounds included lithium borohydride which was chosen because of the environment in which a fission produced lithium atom may find itself; lithium tetraborate picked by way of contrast; as well as lithium carbonate, lithium hydroxide and lithium chloride monohydrate, all of which are related chemically to some of the simple binary compounds selected and which could occur either on their surfaces or on that of irradiated boron carbide as impurities. (9 refs.)

103013 A computer controlled investigation of the electron energy spectra formed under electron bombardment during the early stages of the oxidation of iron. I.F.Ferguson, B.F.Riley (Springfields Nuclear Power Dev. Labs., UKAEA, Preston, England), R.Sopizet.
Vide les Couches Minces (France), vol.38, no.217, p.295-300 (May-July 1983).
The continuing development of Auger analysis requires that the experimental data should be capable of rapid and meaningful quantification using a dedicated computer. In some instances, a comparison has been made between quantitative data obtained using Auger data collected in derivative mode d[E.N(E)]/dE, and referred to standard Auger spectra and bulk compositions obtained by either X-ray fluorescence or chemical analysis. These results show that a satisfactory, but not exact, agreement can be obtained between the Auger analyses and the bulk analyses. The authors have therefore decided to investigate whether Auger data collected in direct mode, E.N(E), can be quantified more satisfactorily than those collected in derivative mode. The particular problem undertaken was to prepare a sample of pure iron and to oxidise it so as to determine how the electron spectrum (collected in direct, E.N(E) mode) varies during the early stages of oxidation. (8 refs.)

Auger recombination effect on threshold current of InGaAsP quantum well lasers .... See Entry 100762

Metal doped fluorocarbon polymer films prepared by plasma polymerisation using an RF planar magnetron target .... See Entry 101590

$Pt_{50}Ni_{50}$ and $Pt_{78}Ni_{22}$(111) single crystal alloys: superficial composition determination by ion scattering and Auger spectroscopy .... See Entry 102142

Auger electron and characteristic energy loss spectra for electro-deposited americium-241 .... See Entry 103014

Surface analysis by XPS, AES and SIMS method in the Leybold Heraeus LHS 10 system .... See Entry 103626

79.20K Other electron impact phenomena

103014 Auger electron and characteristic energy loss spectra for electro-deposited americium-241. M.N.Varma, J.W.Baum (Safety & Environmental Protection Div., Brookhaven Nat. Lab., Upton, NY, USA).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.493-5 (1 July 1983).
Auger electron energy spectra for electro-deposited americium-241 on platinum substrate were obtained using a cylindrical mirror analyser. Characteristic energy loss spectra for this sample were also obtained at primary electron beam energies of 990 and 390 eV. From these measurements P_I, P_{II}, and P_{III} energy levels for americium-241 are determined. Auger electron energies are compared with theoretically calculated values. Minimum detectability under the present condition of sample preparation and equipment was estimated at approximately 1.2×10^{-8} g/cm^2 or 3.9×10^{-8} Ci/cm^2. Minimum detectability for plutonium-239 under similar conditions was estimated at about 7.2×10^{-10} Ci/cm^2. (2 refs.)

103015 Chemistry and physics of the surface of solid bodies. H.Ibach (KFA Julich, Julich, Germany).
Phys. Bl. (Germany), vol.39, no.7, p.190-3 (July 1983). In German.
Scatter of slow electrons (20-100 eV) from molecules adsorbed at single crystal cleavage planes allows one to discriminate between scatter from dipoles and from collisions. The mean free path of about 0.5 nm of electrons of 20-100 eV is responsible for the high surface sensitivity in examining the surfaces of solid bodies. An electron spectrometer is described with 127° condensers for energy dispersion. With it the steric arrangement of the

hydrogen atoms of ammonia molecules which were adsorbed on a (110) plane of iron was found. Also, the change from ethylene adsorbed on platinum at 90K and its transition to ethylidine was revealed on heating the specimen to 300K. A number of intermediate decomposition products from a Fischer-Tropsch synthesis on an iron single crystal, such as carbine, methylidine, methylene, formyl, methoxy, and hydroxy groups were identified. The binding between adsorbed molecules near the surface of the adsorbent solid body and their relation to changes of volume of the solid body could be measured. (8 refs.) *R.S.*

Structure of graphitic carbon on Ni(111): a surface extended-energy-loss fine-structure study ....See Entry 102133

π-electron delocalization in poly(p-phenylene), poly(p-phenylene sulfide), and poly(p-phenylene oxide) ....See Entry 102298

79.20N Atom, molecule, and ion impact

103016 Temperature-dependent ion mixing and diffusion during sputtering of thin films of $CrSi_2$ on silicon. U.Shreter, R.Fernandez, M.-A.Nicolet (California Inst. of Technol., Pasadena, CA, USA).
Appl. Phys. Lett. (USA), vol.43, no.3, p.247-9 (1 Aug. 1983).
Measurements of sputtering yields and composition profiles have been carried out using backscattering spectrometry for samples of $CrSi_2$ on Si irradiated with 200-keV Xe ions. When the $CrSi_2$ layer is thinner than the ion range, the sputtering yield ratio of Si to Cr increases from 3.5 for room-temperature irradiation to 65 at 290°C. For a thick sample, the corresponding increase is from 2.4 to 4.0 only. These changes are explained in terms of a rise in the Si surface concentration at 290°C. The driving force for this process seems to be the establishment of stoichiometric $CrSi_2$ compound. Transport of Si to the surface is by ion mixing in the thin sample and thermal diffusion through the thick layer. (11 refs.)

103017 Dose dependence in angular distributions of Ag and Au sputtered from an alloy target. M.R.Weller (A.W. Wright Nuclear Structure Lab., Yale Univ., New Haven, CT, USA).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.419-26 (1 July 1983).
The angular distributions of silver and gold atoms sputtered from a Ag-Au alloy have been measured as a function of the fluence of incident particles. The alloy was sputtered using a 100 keV $^{40}Ar^+$ beam. Initially, Ag was preferentially sputtered at all angles. However, as the target surface approached its steady-state composition, the angular distribution of the sputtered Ag became more oblique while that of the sputtered Au remained essentially unchanged. Relative to the bulk alloy composition, the steady-state sputtered material was depleted in Ag in the direction of the surface normal, but remained enriched in Ag at oblique angles. This suggests the presence on the target of a very thin surface layer (at most a few monolayers thick) which is enriched in Ag relative to the composition of the well-documented Au-enriched layer which extends to a depth comparable to the range of the sputtering ion. (20 refs.)

103018 Inelastic energy loss in solids. II. Calculation of the number of ejected electrons on the basis of the expectation value of the inelastic energy loss. I.Nagy, J.Laszlo, J.Giber (Phys. Inst., Tech. Univ. Budapest, Budapest, Hungary).
Appl. Phys. A (Germany), vol.A31, no.3, p.153-5 (July 1983).
The dependence on the bombarding energy of the number of ejected electrons from a polycrystalline Ag target is determined. Statistical methods are used in the calculation of the inelastic energy loss due to binary atomic collisions and due to the electronic stopping cross-section. The calculation is executed for the case of Se^+ bombarding ion in the 10-200 keV energy range. (6 refs.)

103019 A time dependent wave packet approach to three-dimensional gas-surface scattering. G.Drolshagen, E.J.Heller (Theoretical Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.2072-82 (15 Aug. 1983).
A time dependent wave packet approach to gas-surface scattering is presented. This semiclassical method is based on Gaussian wave functions whose average positions and momenta are those of classical trajectories. The initial states are represented as superpositions of Gaussian wave packets. These wave packets are propagated individually and after the collision, the scattering information is extracted by projecting them onto the final states in a coherent way, according to the initial expansion coefficients. The powerful new approach allows the treatment of surface imperfections as well as the inclusion of more degrees of freedom of the surface or the gas particle. The accuracy of the present semiclassical method is tested by a comparison with exact quantal calculations for He-LiF diffractive scattering and in most cases excellent agreement is found. In addition, the wave packet approach is used to calculate diffraction probabilities at high energies and to examine the interface structure of the scattered particles as a function of the size of the surface from which the scattering occurs. (46 refs.)

103020 Trapping and energy accommodation of atoms on metal surfaces. R.Brako (Rudjer Boskovic Inst., Zagreb, Yugoslavia).
Solid State Commun. (USA), vol.47, no.7, p.559-61 (Aug. 1983).
Expressions for the trapping and sticking probability and for the energy accommodation coefficient of atoms on metal surfaces are derived by using a Gaussian form for the distribution of the energy transfer. The results are in good agreement with recent numerical simulation calculations and experiments. (8 refs.)

103021 Ion survival probabilities for 3 keV He^+, Ne^+, and Ar^+ scattering from La and adsorbate covered La surfaces. R.Kumar, M.H.Mintz, J.A.Schultz, J.W.Rabalais (Dept. of Chem., Univ. of Houston, Houston, TX, USA).
Surf. Sci. (Netherlands), vol.130, no.1, p.L311-16 (July 1983).
TOF spectra of scattered neutrals and ions for 3 keV He^+, Ne^+, and Ar^+ bombardment of La and adsorbate covered La surfaces show that the scattered ion fractions are 21.1% and 10.7% for Ar^+ on clean and adsorbate covered La, respectively, and $<1\%$ for all of the other systems. These results are consistent with a model in which Auger and resonant neutralization (AN and RN) transitions govern the ion survival probability. (18 refs.)

103022 The formation of striations on oblique boundaries during sputtering. G.Carter, M.J.Nobes, G.W.Lewis (Dept. of Electronic & Electrical Engng., Univ. of Salford, Salford, England), J.L.Whitton.
Vacuum (GB), vol.33, no.7, p.373-80 (July 1983).
The results of studies of the production of striations on boundaries inclined obliquely to incident sputtering ion flux are described. It is shown that two processes probably operate, one resulting from local shadowing of the substrate from ion flux by protection layers, the other resulting from the complex nature of the sputtering process in damaged crystalline solids. (34 refs.)

103023 Sputtering erosion of stratified media and by time dependent ion bombardment. M.J.Nobes, G.Carter, G.W.Lewis (Dept. of Electronic & Electrical Engng., Univ. of Salford, Salford, England), J.L.Whitton.
Vacuum (GB), vol.33, no.7, p.381-9 (July 1983).
The theory of the evolution of surface morphology resulting from ion bombardment induced sputter erosion (and other process) is generalized to include description of spatio-temporally variable ion flux, and substrate inhomogeneity. This allows discussion of effects associated with rotated or translated ion beams and substrates and of striated or stratified substrates such as occur in polycrystals or in the neighbourhood of extended defects or impuritiesin single crystals. Geometric reconstructions of several two-dimensional surface sections are undertaken in order to illustrate the analytical methods. (32 refs.)

103024 Workshop notes and short contributions. H.H.Andersen, B.J.Jeppesen, S.Olesen, B.Stenum, T.Sorensen, H.J.Whitlow.
Vacuum (GB), vol.33, no.7, p.411-12 (July 1983).
The presence of a segregated surface layer during sputtering has recently been demonstrated for binary metal alloys in both solid and liquid phases by in situ measurements of the angular distributions of sputtered atoms. In order to investigate the influence of target temperature on surface segregation during ion bombardment, the authors have developed an apparatus which facilitates measurement of the angular distribution of sputtering atoms by a collector technique for target temperatures up to 600°C. (12 refs.)

Ranges, reflections and secondary electron emission for keV hydrogen ions incident on solid N_2 ....See Entry 101824

Channeling and optical study of thin Si crystals distorted by pressure ....See Entry 102135

$Pt_{50}Ni_{50}$ and $Pt_{78}Ni_{22}$(111) single crystal alloys: superficial composition determination by ion scattering and Auger spectroscopy ....See Entry 102142

Ion and electron spectroscopy during pulsed laser irradiation of silicon ....See Entry 103009

Surface analysis by XPS, AES and SIMS method in the Leybold Heraeus LHS 10 system ....See Entry 103626

79.40 THERMIONIC EMISSION

103025 Correlation between energy distribution of Sr^+ thermal ion and mass spectrometric thermal analysis for SrO-W system. T.Harada, M.Asano, K.Kubo.
Tech. Rep. Inst. At. Energy Kyoto Univ. (Japan), no.194, p.1-8 (Feb. 1983).
A correlation of energy distribution curves of Sr^+ thermal ions emitted from a SrO-W system with the result of mass spectrometric thermal analysis for the system has been investigated. The energy distribution curves have been obtained by the technique of electronic differentiation of retarding voltage curves in a method similar to LEED-Auger system with a four-grid optics. The curves obtained at various temperatures in the range 1570-1919K are found to be almost Maxwellian, except for 1842K where the curve is very broad. It is verified that the result at 1842K is due to the emission of Sr^+ thermal ions from the surfaces with various work functions. From the values of retarding voltages at the maximum of the energy distribution curves, changes in work functions of the surface, from where Sr^+ thermal ions are emitted are examined. The values of the work functions are widely changed with the chemical forms of the SrO-W system. (19 refs.)

103026 Assignment of emitting surfaces for thermal ions by their energy distributions. T.Harada, M.Asano, K.Kubo (Inst. of Atomic Energy, Kyoto Univ., Kyoto, Japan).
Tech. Rep. Inst. At. Energy Kyoto Univ. (Japan), no.195, p.1-10 (March 1983).
The K^+ thermal ions emitted simultaneously from bare surface and partly coated polycrystalline tungsten ribbon surface with potassium nitrate have been discriminated by the measurement of the ion energy distribution curves. These curves have been obtained by electronic differentiation of retarding voltage curves. The assignment of emitting surfaces for the K^+ thermal ions has been made by comparison of retarding voltages at maxima of the energy distribution curves for K^+ thermal ions emitted from two separate polycrystalline tungsten ribbons with a wholly bare surface and a wholly coated one with potassium nitrate. (10 refs.)

Design and operating characteristics of a retarding field energy analyzer-quadrupole mass filter for measurement of energy distribution of thermal ion ....See Entry 99231

79.60 PHOTOEMISSION AND PHOTOELECTRON SPECTRA

103027 Influence of crystalline perfection and surface species on the X-ray photoelectron spectra of natural and synthetic graphites. R.Schlogl, H.P.Boehm (Inst. fur Anorganische Chem., Univ. Munchen, Munchen, Germany).
Carbon (GB), vol.21, no.4, p.345-58 (1983).
Valence band and core level photoelectron spectra have been measured for a variety of natural and synthetic graphites. The valence band spectra confirm previous work, where the contamination influence by chemisorbed species was demonstrated. A linear correlation between the C 1*s* binding energy (b.e.) and the c_0 lattice constant as a measure of crystalline perfection was found. The line width is larger the more perfectly the graphite is crystallized, indicative of a relaxation effect. A characteristic satellite structure on the high b.e. side of the C 1*s* peak is due to the plasmon spectrum as well as to a large number of surface compounds. By comparison with b.e.s for discrete molecules, the satellites are associated with alcoholic or etheric, carbonylic and carboxylic surface oxides, and aliphatic and/or aromatic surface chlorides. The assignments are confirmed by variable-temperature XPS and by the products of thermal decomposition. Trace surface impurities of sulfur and nitrogen were found in many graphites. The relevance of these findings for XPS on graphite intercalation compounds is briefly discussed. (38 refs.)

103028 Experimental investigation of the mean free path of Pt($4f_{7/2}$)-photoelectrons. N.Wagner, O.Brummer (Martin-Luther-Univ., Halle-Wittenberg, Germany).
Exp. Tech. Phys. (Germany), vol.31, no.3, p.251-5 (1983). In German.
By means of a combined application of the saturation- and the absorption-method on a Pt/Au layer system the mean free path of Pt($4f_{7/2}$)-photoelectrons was estimated experimentally. The result is compared with theoretical values. It is also used to determine the Pt surface contamination and its removal by ion sputtering. (15 refs.)

103029 Angle-resolved photoelectron spectroscopy of the nickel magnetism below and above T_c. U.Gerhard (Phys. Inst., Univ. Frankfurt/Main, Frankfurt/Main, Germany).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.105-15 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Discusses the extraction of the exchange splitting of Ni from angle resolved UPS measurements. Results are obtained in both the ferromagnetic phase and the paramagnetic phase. The high temperature results are compared with the short range magnetic order model. (19 refs.)

103030 Photoemission studies of molecular beam epitaxially grown GaAs(001) surfaces exposed to a nitrogen plasma. S.Gourrier (Lab. d'Electronique et de Phys. Appl., Limeil Brevannes, France), L.Smit, P.Friedel, P.K.Larsen.
J. Appl. Phys. (USA), vol.54, no.7, p.3993-7 (July 1983).
GaAs(001) surfaces prepared in situ by molecular beam epitaxy (MBE) have been investigated by reflection electron diffraction, valence-band photoemission and core level photoemission after exposures to nitrogen plasmas. The nitridation leads to disordered surfaces. The Fermi level (E_F) which for the clean surface is situated at 0.4 eV above the GaAs valence-band maximum (VBM) shift as a function of the plasma exposure towards a saturation value of 1.1 eV above VBM. Strong nitrogen derived peaks are found in the valence-band spectra at energies 5 to 8 eV below E_F. As(3*d*) and Ga(3*d*) core level spectra show chemical shifts towards higher binding energies due to the nitridation. The shift is 0.7-0.8 eV for the Ga(3*d*) level. For the As(3*d*) level shifts in the range 1.4-2.2 eV are observed. The dependence of the chemical shifts and the linewidths on the plasma exposure and on subsequent heat treatments are explained by the presence of different As nitrides having different binding energies and volatilities, whereas only one Ga nitride (GaN) is formed by the nitridation. (13 refs.)

103031 Photoelectron energy distribution of Cs_3Sb. Chunghsin Lee (Thermo Electron Corp., Waltham, MA, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4578-80 (Aug. 1983).
Photoelectron energy distributions from semitransparent Cs_3Sb photocathodes have been measured using a parallel plate analyzer. Argon-ion and helium-neon laers are used as light sources. The energy spread, defined as the full width at half-maximum of the distribution, is found to depend on the incident photon energy F_λ according to the empirical relation, $\Delta E(\mathrm{eV})=0.25\ E_\lambda(\mathrm{eV})-0.39$. It is shown that the photoelectron energy distributions vary with the emitted current density. (9 refs.)

103032 Resonant photoemission in transition-metal chlorides. A.Kakizaki, K.Sugeno, T.Ishii (Inst. of Materials Sci., Univ. of Tsukuba, Ibaraki, Japan), H.Sugawara, I.Nagakura, S.Shin.
Phys. Rev. B (USA), vol.28, no.2, p.1026-35 (15 July 1983).
In the chlorides of Ni, Co, Fe, and Mn, the resonance between the excitations of valence electrons and the 3*p* electrons of the metal ions is observed over the whole parts of the valence-band spectra including ligand-derived bands as well as satellites. The trend of the systematic change in satellite−to−main-band separations in going from $NiCl_2$ to $MnCl_2$ is opposite to that in the energies of charge-transfer excitons, and this is discussed in connection with the three overlapping bands approximately with Fano line shapes. The *q* value characterizing a Fano line shape is larger for satellites and ligand-derived bands than for the 3*d* bands of the metal ions. The resonant enhancements of the ionization cross sections of the main bands increase from $NiCl_2$ to $MnCl_2$. These aspects are interpreted in terms of the hybridization of the 3*d* orbitals of the metal ions in the 3*p* orbitals of the ligand ion. The ordinary $M_{2,3}VV$ super-Coster-Kronig bands are very weak. (37 refs.)

103033 Mechanism for the valence-band photoemission in Ni: inclusion of interatomic interactions. T.Aisaka (Faculty of General Education, Tottori Univ., Tottori, Japan), T.Kato, E.Haga.
Phys. Rev. B (USA), vol.28, no.2, p.1113-16 (15 July 1983).
In relation to the valence-band photoemission in Ni, the importance of interactomic interactions is proposed, on the basis of examinations of the correlation effect in the *T*-matrix approximation. Calculated results show that, in the presence of the interatomic interaction, both the bandwidth and the satellite binding energy become smaller than those in the Hubbard model. This property in the interatomic interaction enables the authors to explain consistently the experimental result. (8 refs.)

X-ray photoelectron diffraction (XPED) measurements by using high performance angle-resolved X-ray photoelectron spectrometer (ARXPS) ....See Entry 99240

Novel spectrometer for time-angle resolved ultraviolet photoemission ....See Entry 99242

Cation valencies and surface segregation in copper ferrites under X-ray photoelectron spectroscopy conditions ....See Entry 102131

X-ray spectral study of the surface of flat glass .... See Entry 102140

Comment on 'Observation of resonant photoemission in an adsorbed molecule' ....See Entry 102166

Ion desorption from surfaces following photon excitation of core electrons in the bulk ....See Entry 102170

Chemisorption on CO of Co(0001). II. Multielectron excitations ....See Entry 102171

The adsorption of cyclic hydrocarbons on Ru(001). I. Cyclopropane ....See Entry 102175

The adsorption of cyclic hydrocarbons on Ru(001). II. Cyclohexane ....See Entry 102176

Three-dimensional energy band in graphite and lithium-intercalated graphite ....See Entry 102229

New photoelectron spectroscopic procedure for the precise location of the edges of electron energy bands ....See Entry 102235

Electronic structure of amorphous semiconductors .... See Entry 102241

Electronic structure of some binary uranium and thorium oxides and halides ... .See Entry 102251

Electronic structures of the $LaBO_3$ (B=Co, Fe, Al) perovskite oxides related to their catalysis ....See Entry 102256

Configuration mixing in the groundstate of Ce ....See Entry 102294

Effect of dopant on the physicochemical and electrical properties of organic conducting polymers ....See Entry 102361

Core- and valence-band energy-level shifts in small two-dimensional islands of gold deposited on Pt(100): the effect of step-edge, surface, and bulk atoms ....See Entry 102483

Angle-resolved photoelectron spectroscopy of II-VI compound semiconductors. III. Study of surface states of CdTe (110) ....See Entry 102485

Itinerant-5*f*-electron antiferromagnetism in uranium nitride: A temperature-dependent angle-resolved photoemission study ....See Entry 102616

Evidence for the tetravalence of cerium in $CeRu_2$ ....See Entry 102984

Surface analysis by XPS, AES and SIMS method in the Leybold Heraeus LHS 10 system ....See Entry 103626

X-ray photoelectron spectroscopy studies of copper diffusion behaviour and related degradation phenomena in thin film $CdS:Cu_2S$ solar cells ....See Entry 103698

79.70 FIELD EMISSION AND FIELD IONIZATION

103034 Charge state of ions in liquid metal field ion sources. D.R.Kingham (Dept. of Appl. Phys. & Electrical Engng., Oregon Graduate Center, Beaverton, OR, USA).
Appl. Phys. A (Germany), vol.A31, no.3, p.161-4 (July 1983).
The post-ionization model of field evaporation is shown to be consistent with observations of singly and doubly charged ions in liquid metal field ion sources. The model can be used to estimate the field strength at the apex of the Taylor cone which is found to be 1.9-2.9 V/Å for a Ga source. Experiments to test the post-ionization model and to determine the apex field strength more accurately are suggested. A possible method of obtaining $\sim\mu$A currents of highly charged ions, e.g. Zr^{4+}, Ta^{4+}, Ga^{3+}, As^{3+}, is proposed. (22 refs.)

103035 Transverse electron focusing in the presence of nonstationary emitter currents. Yu.A.Kolesnichenko.
Fiz. Nizk. Temp. (USSR), vol.9, no.7, p.753-6 (July 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
This is a theoretical study of the transverse electron focusing in the presence of nonstationary emitter currents on the assumption that the contact size *b* is larger than the skin depth δ. It is shown that if the emitter voltage varies with the frequency ω larger, than the inverse time of the electron flight across the emitter neighbourhood $\omega_0{}^{-1}\simeq b/v_F$, then there is no focusing (v_F is the Fermi velocity). For frequencies $\sqrt{\Omega\omega_0}<\omega<\omega_0$ (Ω is the Larmor frequency of electron motion) the electron transverse focusing peak amplitude essentially depends on ω. (9 refs.)

103036 Influence of an electric field on the evaporation of Fe-Si, Fe-Mn and Fe-Al melts in helium. Experimental investigation. A.V.Kaybichev, B.M.Lepinskikh.
Russ. Metall. (GB), no.4, p.56-61 (1981). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.4, p.66-70 (1981). [received: June 1983]
Dilute elements have a determining effects on the evaporation of binary melts. The effect of an electric field on iron-silicon and iron-manganese melts is similar. Their ion emission proceeds in the case of positive polarity and its contribution increases with weakening of the bonds between the particles in the melts. Ion emission of iron-aluminium melts in helium occurs for negative polarity and an increase in the voltage is required with decreasing melting temperature. It is assumed that there are changes in the evaporated particles with the melt composition. (6 refs.)

79.75 EXOELECTRON EMISSION

103037 Investigations of mechanically induced excited states on cleavage planes of ionic crystals. II. Investigations of the mechanisms of electron emission from cleaved alkali halide crystals and of the influence of surface charges. J.Wollbrandt, U.Bruckner, E.Linke (Zentralinst. fur Physikalische Chem., Akad. der Wissenschaften, Berlin, Germany).
Phys. Status Solidi a (Germany), vol.78, no.1, p.163-8 (16 July 1983).
For pt.I see ibid., vol.77, p.545 (1983). Using the apparatus for investigations of mechanically induced excited states, the electron emission from mechanically treated alkali halide crystals and their surface charge distribution is measured. While the spontaneous postemission (not depending on temperature below RT) of electrons after mechanical treatment can be explained as field emission from surface traps, the TSEE low-temperature glow peaks are ascribed to the decay of defect electron centres. A simple mechanism is suggested to understand the mechanically induced excitation process. Measurements of the locally resolved OSEE show the necessity to know the charge structure in order to interpret the emission relief properly. (15 refs.)

80.00 CROSS-DISCIPLINARY PHYSICS AND RELATED AREAS OF SCIENCE AND TECHNOLOGY

81.00 MATERIALS SCIENCE

81.10 METHODS OF CRYSTAL GROWTH AND PURIFICATION

(for physics of crystal growth, see 61.50C; for epitaxial growth methods, see 81.15)

103038 Man-made gem materials. I.Sunagawa (Tokyo Univ., Tokyo, Japan).
Solid State Phys. (Japan), vol.18, no.2, p.111-18 (Feb. 1983). In Japanese.
The general background to the manufacture of artificial gemstones including chemistry and crystallography is discussed. The Bernoulli ruby process, the flux method, hot water synthesis method and the methods used for diamonds, turquoise and lapis lazuli are reviewed. Gem materials are grouped into five categories: natural, treated, imitation, synthetic and artificial. Particular attention is given to the difference in physical properties reflecting the difference in growth conditions. (no refs.) *M.O.*

81.10B Growth from vapour

Surface variations in chemical composition of titanium disulphide single crystals ....See Entry 102128

81.10D Growth from solutions

Simulation studies of the hydrodynamics in high-temperature solutions for crystal growth. III. Flow rates in the presence of free and forced convections proceeding in opposite directions .... See Entry 101609

81.10F Growth from melts

103039 Tellurium as melting medium to prepare transition metal chalcogenides single crystals. M.Spiesser, J.Rouxel (Lab. de Phys.-Chimie des Solides, Univ. de Nantes, Nantes, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.19, p.1497-9 (30 May 1983). In French.
Tellurium is found to be an excellent melt to grow single crystals of second and third row transition metal tellurides and selenides. The procedure has been used successfully in the case of $MoTe_2$, WTe_2, $NbTe_4$, $ZrTe_5$, $HfTe_5$, $MoSe_2$, WSe_2, $TiSe_2$, $ZrSe_2$, $IrSe_2$ and $OsSe_2$. (6 refs.)

103040 Mathematical modelling of heat flow in Czochralski crystal pulling. A.B.Crowley (Dept. of Math. & Ballistics, Royal Military Coll. of Sci., Swindon, England).
IMA J. Appl. Math. (GB), vol.30, no.2, p.173-89 (March 1983).
A mathematical model of the heat flow in the holm region in crystal pulling by the Czochralski technique is developed. This is a moving boundary problem with two moving boundaries, the phase change surface and the air-liquid meniscus. Using the enthalpy method and coordinate transformation techniques, the problem is cast into a form suitable for numerical solution. A numerical scheme is outlined, and some results for the growth of germanium crystals are shown. (10 refs.)

103041 Device for shifting containers with crystallizing materials in a furnace for the growth of single crystals. W.Waclawek, B.Marciniak (Wyzszej Szkoly Pedagogicznej Czestochowie, Czestochow, Poland), T.Swierczynski.
Pomiary Autom. Kontrola (Poland), vol.29, no.1, p.27-8 (Jan. 1983). In Polish.
Describes the construction and operation principle of a device for linear shifting of mechanism elements, particularly of containers with a crystallizing material in the process of single crystal growth, this device allowing a control and readout of both the shifting speed and position. Also discussed is the usefulness of the device in the single crystal growth process by Bridgman's method. (7 refs.)

103042 The synthesis of fluor-analogues of natural asbestos by unidirectional crystallisation. M.Campbell, P.S.Rogers.
Proc. Br. Ceram. Soc. (GB), no.33, p.63-77 (May 1983). (Meeting of the Basic Science Section of the British Ceramic Society, 'Fabrication Science 3', London, England, 13-14 Dec. 1982).
Long fluor-amphibole fibres in parallel array have been successfully produced by unidirectional crystallisation of filaments drawn from the melt. These fluor-amphiboles are synthetic analogues of natural amphiboles with isothermal replacement of hydroxyl groups by fluorine, and can be compared with natural amphibole asbestos. The technique devised by Maries and Rogers consists of controlled drawing through an orifice in the base of a heated conical crucible. The synthetic fibres are well aligned but somewhat thicker than natural asbestos (about 50 μm against a few microns). In the case of fluor-richterite the maximum crystal growth is low (approximately 14 μms^{-1}) where no other crystalline phases are present. Fluor-tremolite can be produced at a much higher rate but pyroxene is also present in the microstructure. Fluor-magnesiorichterite can be produced with a water-swelling tetra-silicic mica as a second phase; although initially considered undesirable this may be useful as a means of fiberising the filaments. (14 refs.)

103043 Growth reactions of potassium titanate fibers by slow-cooling calcination method. Y.Fujiki (Nat. Inst. for Res. in Inorganic Materials, Ibaraki, Japan).
Yogyo-Kyokai-Shi (Japan), vol.91, no.4, p.189-96 (1983). In Japanese.
The growth of potassium titanate fibers was studied by a new growth technique called 'slow-cooling calcination method'. By this method, a specific composition is incongruently melted into a solid phase and liquid phase, and then is slowly cooled to a temperature region below the incongruent-melting temperature. Fibrous crystals are grown by a incongruent melt-association reaction between the solid and liquid phases during the cooling process. In the system $K_2Ti_2O_5$-$K_2Ti_6O_{13}$, a stating material having the n value between $2<n<6$ in the $K4_2.n\mathrm{TiO}_2$ formula was incongruently melted into a liquid phase and $K_2Ti_6O_{13}$ solid phase at above the incongruent-melting temperature (1114°C±15°C) of $K_2Ti_4O_9$, and then was slowly cooled to a temperature region below 1114°C. During the slow-cooling process, the incongruently melted $K_2Ti_6O_{13}$ solid phases and liquid phase again reacted to associate. This association reaction plays a very important role in the growth of potassium titanate fibers, especially $K_2Ti_4O_9$ fibers. (17 refs.)

Application of the Wanklyn model to the BaO-BaF_2-B_2O_3-Y_2O_3-Fe_2O_3 flux system .... See Entry 101608

Simulation studies of the hydrodynamics in high-temperature solutions for crystal growth. III. Flow rates in the presence of free and forced convections proceeding in opposite directions .... See Entry 101609

On a particular type of twinning in the growth of rhenium single crystals .... See Entry 101610

Ultra-high speed solidification and crystal growth in transiently molten semiconductor layers .... See Entry 101774

Influence of carbon and hydrogen segregation on the electrical properties of grain boundaries in polycrystalline silicon sheets .... See Entry 102423

81.10H Zone melting and zone refining

103044 On control of the composition of solid solutions of $Ga_{1-x}In_xSb$ and $Ga_{1-x}Al_xAs$ in the process of temperature-gradient zone refining. R.Antanavicius, K.Valacka, P.Miskinis, G.Treideris (Inst. of Semiconductor Phys., Acad. of Sci., Lithuanian SSR).
Sov. Phys.-Collect. (USA), vol.22, no.2, p.45-9 (1982). Translation of: *Litov. Fiz. Sb. (USSR),* vol.22, no.2, p.57-63 (1982).
The effect of temperature, zone composition, and depletion are analysed upon moving through the source on the composition of $Ga_{1-x}In_xSb$ and $Ga_{1-x}Al_xAs$ solid solutions as a function of the growth temperature is obtained for various initial zone compositions, as the profiles of the composition for various temperature and initial zone compositions. The theoretical findings are compared with available experimental data; good agreement is observed. Zone depletion for $Ga_{1-x}In_xSb$ appears only for large fractions of the InSb component or at low temperatures. (11 refs.)

81.10J Growth from solid phases

(inc. multiphase diffusion and recrystallisation)

103045 Synthesis of a new ramsdellite-like phase of approximate composition, $Li_2MgSn_3O_8$. C.Keller (Div. Estudios de Posgrado, Univ. Nacional Autonoma de Mexico, Mexico City, Mexico), A.R.West.
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.451-2 (Aug. 1983).
The authors have prepared a new phase, of composition close or equal to $Li_2MgSn_3O_8$, which is ramsdellite-like. Its framework has the constitution $(Mg, Sn_3)O_8$ and Li^+ ions reside in the tunnels, although their precise location is not known. The new phase was encountered during a study of compound formation in the system Li_2O-MgO-SnO_2. It was prepared by a solid state reaction, using Li_2CO_3, $Mg(NO_3)_26H_2O$ and SnO_2 in the molar ratio 1:1:3 as starting materials, in platinum crucibles in an electric muffle furnace. (10 refs.)

103046 Low temperature synthesis of binary chalcogenides. N.Yellin, L.Ben-Dor (Soreq Nuclear Res. Centre, Yavne, Israel).
Mater. Res. Bull. (USA), vol.18, no.7, p.823-7 (July 1983).
Synthesis of tellurides and selenides of Hg, Cd, Zn, Ge, Sn and Pb at temperatures considerably below the melting point of the compounds, was studied. The reaction went to completion within a few days. (19 refs.)

103047 Explosive recrystallization of ion implantation amorphous silicon layers. J.Narayan (Solid State Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA), G.R.Rozgonyi, D.Bensahel, G.Auvert, V.T.Nguyen, A.K.Rai.
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.177-84
Explosive recrystallization of amorphous layers, induced by scanned electron or CW Ar^+ laser beams, has been investigated in arsenic implanted (100) specimens. The authors have studied the microstructural changes using plan-view and cross-section electron microscopy to obtain the mechanism of explosive recrystallization phenomenon. The confinement of heat in the amorphous layers during laser irradiation and the nature of amorphous silicon determine the modes of explosive recrystallization. They indicate that, depending upon the degree of undercooling, two distinct modes of liquid-phase recrystallization are observed: one occurring at a velocity of $\sim 2\ ms^{-1}$ and the other at $\sim 10\ ms^{-1}$. Explosively recrystallized grains contain $\langle 110 \rangle$ and $\langle 1\bar{1}0 \rangle$ as surface normal and growth direction respectively. They present a model for unseeded crystallization to explain the $\langle 110 \rangle$ texture observed in diamond cubic lattices. (8 refs.)

Explosive crystallization in a-Ge and a-Si: a review .... See Entry 101559

Visualization of temperature profiles in a-Si crystallized in the explosive mode by CW laser .... See Entry 101781

Transient conductivity measurements in pulsed ion beam melted silicon .... See Entry 101823

Laser-induced solid phase crystallization in amorphous silicon films .... See Entry 102214

Reactivity in the spinel formation reaction in CuO/Al_2O_3, Fe_2O_3, Cr_2O_3 systems. [Influence of Jahn-Teller effect] .... See Entry 103491

81.15 METHODS OF THIN FILM DEPOSITION

(inc. epitaxial growth methods; see also 68.55 Thin film growth, structure, and epitaxy)

Epitaxial film transfer technique for producing single crystal Si film on an insulating substrate .... See Entry 102191

Solid-phase-epitaxial growth of ion implanted silicon using CW laser and electron beam annealing .... See Entry 102215

Comparison of photoelectrochemical properties of n-TiO_2 films obtained by different production methods .... See Entry 102506

Optical absorption of transition element oxide-silica coating films prepared by sol-gel method .... See Entry 102981

A new self-limiting process for the production of thin submicron semiconductor films .... See Entry 103346

New promise for photovoltaics .... See Entry 103682

81.15C Deposition by cathodic sputtering

103048 Method of selectively producing very thin oxide or nitride layers on silicon substrates. T.Bayer, C.Brandeis, H.Hinkel, J.Kempf (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.25, no.12, p.6637-8 (May 1983).
The production of very thin oxide or nitride layers by ion-implanting oxygen or nitrogen into silicon can be improved by additionally implanting noble gas ion, thus influencing the sputter rate and the stoichiometry of the generated layers. (no refs.)

103049 Conducting crystals. A latticework for microchips. S.Haines.
Sci. Dimension (Canada), vol.15, no.3, p.18-22 (1983).
Describes studies by the Canadian National Research Council's Chemical Physics section on thin film techniques for semiconductor deposition. The techniques of magnetron sputtering and metalorganic chemical vapor deposition (or MOCVD) are being studied in detail. The thin films are intended for applications in devices, such as solar cells. (no refs.)

103050 Silicon nitride and oxynitride films prepared by ion beam reactive sputtering. V.A.Burdovitsin (Inst. of Automatic Control Systems & Radioelectronics, Tomsk, USSR).
Thin Solid Films (Switzerland), vol.105, no.3, p.197-202 (22 July 1983).
The composition of particles sputtered from a silicon target during bombardment by nitrogen and oxygen ions was measured. Elementary processes on both the substrate and target were examined. A model of silicon nitride film formation was proposed, in which the main idea is the interaction of silicon on the substrate with the atomic nitrogen sputtered from the target. The dependence of the film properties on the oxygen concentration in N_2-O_2 mixtures was investigated. The relationship between the nitrogen and silicon concentrations in silicon nitride films, the nitrogen ion beam incidence angle and the ejection angle of the sputtered particles was revealed experimentally. In the proposed model this relationship is interpreted as a result of the difference between the angular distributions of silicon and nitrogen atoms sputtered from the target. (17 refs.)

103051 Mechanisms of reactive sputtering of titanium nitride and titanium carbide. I. Influence of process parameters on film composition. J.-E.Sundgren, B.-O.Johansson, S.-E.Karlsson (Dept. of Phys. & Measurement Technol., Linkoping Univ., Linkoping, Sweden).
Thin Solid Films (Switzerland), vol.105, no.4, p.353-66 (29 July 1983).
The reactive sputtering of titanium in mixed Ar-N_2 and Ar-CH_4 discharges was studied by measuring the compositions of both the deposited films and the layers formed on the target. The sputtering experiments were performed in a diode RF sputtering unit and the compositions were determined by means of Auger electron spectroscopy. The results show that the amount of reactive constituents incorporated into the growing films depends on whether a compound has been formed on the target. At low pressures where no such compound is formed, the incorporation of the reactive gas follows an adsorption isotherm similar to the Langmuir adsorption isotherm, and very low values of the sticking probability are observed. At higher pressures species originating from the target determine the composition of the coatings. The important process parameters were found to be the partial pressures of the reactive and inert working gases, the ion current density and the partial pressures of the reactive and inert working gases, the ion current density and the voltage applied to the target. (28 refs.)

103052 Mechanisms of reactive sputtering of titanium nitride and titanium carbide. II. Morphology and structure. J.-E.Sundgren, B.-O.Johansson, S.-E.Karlsson, H.T.G.Hentzell (Dept. of Phys. & Measurement Technol., Linkoping Univ., Linkoping, Sweden).
Thin Solid Films (Switzerland), vol.105, no.4, p.367-84 (29 July 1983).
For pt.I see ibid., vol.105, p.353-66 (1983). Titanium was reactively RF sputtered in mixed Ar-N_2 and Ar-CH_4 discharges onto substrates held at 775K. The films obtained were characterized by scanning electron microscopy and X-ray diffraction and through measurements of the microhardness and electrical resistivity. The composition of the films was determined by Auger electron spectroscopy. The measurements show that the morphology of the deposits to a large extent influences the properties of the films obtained. For TiN coatings the electrical resistivity reaches the bulk resistivity only if coatings with the full bulk density are obtained. The difference observed in the lattice parameter for TiN thin film and bulk samples is explained using a grain boundary relaxation model. It is also shown that the heat of formation of the compounds plays an important role in the formation of carbide and nitride films. A high heat of formation promotes the development of large grains and dense structures. (49 refs.)

103053 Mechanisms of reactive sputtering of titanium nitride and titanium carbide. III. Influence of substrate bias on composition and structure. J.-E.Sundgren, B.-O.Johansson, H.T.G.Hentzell, S.-E.Karlsson (Dept. of Phys. & Measurement Technol., Linkoping Univ., Linkoping, Sweden).
Thin Solid Films (Switzerland), vol.105, no.4, p.385-93 (29 July 1983).
For pt.II see ibid., vol.105, p.367-84 (1983). Films of Ti-N and Ti-C were grown by reactive RF sputtering of titanium in mixed Ar-N_2 and Ar-CH_4 discharges on negatively biased substrates. The compositions of the films were measured using Auger electron spectroscopy and their structure and morphology studied using X-ray diffraction and scanning electron microscopy respectively. The composition was found to be strongly affected by the bias voltage. An increase in bias increases both the carbon and the nitrogen contents in substoichiometric films. However, when stoichiometric TiN is formed no further change in the composition occurs. For Ti-C films an increase in the carbon-to-titanium ratio above 1.0 is possible. The structure is also affected by the bias voltage. For example the grain size of TiN has a maximum at a bias of -200 V. A possible explanation is a double influence of the ion bombardment. At low voltages, the adatom mobility is enhanced and the grain size increases but as the bias increases resputtering of species from the growing film surface becomes increasingly important and the grain size decreases. (32 refs.)

103054 An examination of the reactive sputtering of silicon nitride on to gallium arsenide. D.C.Bartle, D.C.Andrews, J.D.Grange, A.D.Trigg, D.K.Wickenden (GEC Res Lab., Hirst Res. Centre, Wembley, England).
Vacuum (GB), vol.33, no.7, p.407-10 (July 1983).
The deposition of silicon nitride thin films by the reactive sputtering of elemental silicon in a nitrogen/argon plasma has been investigated. The composition of the films has been examined using infra-red reflectance, X-ray photoelectron and Auger electron spectroscopies and spark source mass spectrometry. Oxygen has been found to be a major contaminant in these sputter deposited films, the oxygen concentration depending on the ambient gas pressure. The use of the silicon oxy-nitride films as annealing encapsulants for the activation of silicon ion implanted semi-insulating gallium arsenide has also been investigated. (12 refs.)

Vacuum technology, thin films, and sputtering. An introduction .... See Entry 98673

Surface structural damage produced in InP(100) by RF plasma or sputter deposition .... See Entry 102141

Reactively RF magnetron sputtered AlN films as gate dielectric .... See Entry 102197

(Ba,Sr)TiO_3 heteroepitaxial films .... See Entry 102201

Structure of reactively sputtered nickel nitride films .... See Entry 102211

Nonstoichiometric germanium nitride. A new insulating material for MIS microelectronics. I. The choice of the insulator and deposition .... See Entry 102515

Superconducting tunnel junctions on oxidized Zr_2Rh films .... See Entry 102578

Preparation of Co-Cr thin films by DC sputtering technique .... See Entry 102713

Effects of optical stress on the properties of sputtered amorphous silicon solar cells and thin films .... See Entry 103693

81.15G Vacuum deposition

103055 Growth of $Al_{0.3}Ga_{0.7}As$ by molecular beam epitaxy in the forbidden temperature range using As_2. L.P.Erickson, T.J.Mattord, P.W.Palmberg (Phys. Electronics Div., Perkin-Elmer, Eden Praire, MN, USA), R.Fischer, H.Morkoc.
Electron. Lett. (GB), vol.19, no.16, p.632-3 (4 Aug. 1983).
Using a thermal cracker and polycrystalline arsenic source material, dimeric arsenic is obtained and utilised to grow $Al_{0.3}Ga_{0.7}As$ layers in the temperature range of 600 to 700°C with excellent surface morphologies. It has been previously found that, with tetrameric arsenic, excellent surface morphologies are possible only below 630°C and above 690°C. Based on these observations, it is postulated that above 630°C tetrameric arsenic has a surface lifetime that is too short to provide enough coverage even when the beam flux is increased dramatically. At and above 700°C, tetrameric arsenic is cracked more effectively by the surface energy gained from the substrate leading to a good surface coverage and to good surface morphologies. (6 refs.)

103056 System grows complex single crystal materials.
Solid State Technol. (USA), vol.26, no.7, p.39-40 (July 1983).
Describes the Perkin-Elmer PHI Model 425B MBE system which employs molecular beam epitaxy to grow complex single crystal, multilayer thin film materials used in semiconductor applications. It can also be used to substrate preparation and characterization or to analyze completed films using a variety of surface analysis techniques. Auger electron spectroscopy, scanning Auger, ESCA or SIMS are among the techniques available. (no refs.)

103057 Molecular beam epitaxy and negative ions. M.Suffczynski (Inst. of Phys., Polish Acad. of Sci., Warsaw, Poland).
Vacuum (GB), vol.33, no.7, p.369-72 (July 1983).
Sticking coefficients of neutral atoms to typical semiconductor surfaces measured in molecular beam epitaxy are compiled together with binding energies of the atom negative ions. Neutral atoms which have no electron affinity have small sticking coefficients. This correlation is analysed, and reasons to explain the exceptions from it are advanced by consideration of the atomic centrifugal potential. Extended measurements of sticking coefficients of neutral atoms, particularly from the second column of the periodic table, are suggested. (43 refs.)

103058 Description of a deposition cell employing evaporation under vacuum. L.Rabardel, A.Levasseur, C.Delmas, P.Hagenmuller (Lab. de Chimie du Solide, CNRS, Talence, France).
Vide les Couches Minces (France), vol.38, no.217, p.289-94 (May-July 1983). In French.
To improve the electrolyte-negative electrode contact in 'all solid state' batteries, a compact lithium evaporation apparatus has been conceived and built. Good quality and well localised lithium layers have been obtained without thermal damage of the electrolyte. (7 refs.)

Morphological stability in epitaxy of monolithically integrated optical devices . ... See Entry 100925

Kinetics of the formation of concentrational transitions between epitaxial layers of silicon in the process of growth from a molecular beam .... See Entry 102208

The electrical conduction process in antimony trisulfide semiconducting thin films .... See Entry 102410

Auger electron spectroscopy interface study of evaporated and ion-plated silver films on steel substrates .... See Entry 103076

81.15H Chemical vapour deposition

103059 CVD of niobium germanides from partially reacted input gases. C.F.Wan, K.E.Spear (Materials Sci. & Engng. Dept., Pennsylvania State Univ., University Park, PA, USA).
CALPHAD: Comput. Coupling Phase Diagrams & Thermochem. (GB), vol.7, no.2, p.149-55 (April-June 1983).
Thermodynamic calculations using Eriksson's SOLGASMIX computer program were used to model changes in the chemical vapor deposition behavior of $NbCl_5$-$GeCl_4$-H_2 gaseous mixtures as the chemical reactions proceed from their initial stages toward their final equilibrium state. These illustrative modeling studies show the deposition behavior of this system is quite sensitive to changes in experimental variables and to partial reactions of the input gases. The deposition of single-phase Nb_3Ge at all stages of the progressive CVD reaction processes is favored by the use of higher temperatures and higher concentrations of hydrogen. (18 refs.)

103060 Growth process of silicon over SiO_2 by CVD: epitaxial lateral overgrowth technique. L.Jastrzebski, J.F.Corboy, J.T.McGinn, R.Pagliaro,Jr. (RCA Labs., Princeton, NJ, USA).
J. Electrochem. Soc. (USA), vol.130, no.7, p.1571-80 (July 1983).
The epitaxial lateral overgrowth (ELO) process of depositing single crystal silicon over a SiO_2 mask is described. A CVD technique has been developed which consists of depositing silicon in openings in a SiO_2 mask and then growing the silicon laterally over the SiO_2 film. By optimizing the HCl concentration in the gas, growth temperature, and the use of a growth procedure based on a series of growth/etch steps the nucleation of polysilicon over SiO_2 has been eliminated and monocrystalline ELO films have been grown. Low defect density ELO films have been achieved by orientating the oxide islands along the [010] direction on (100) substrates. The growth kinetics, overgrowth morphology, and defect formation in ELO films are described as a function of the growth conditions. One can conclude that optimization of the growth process has allowed the authors to grow monocrystalline, low defect density ELO films with smooth mirrorlike surfaces. (31 refs.)

103061 Density and deposition rate of chemically vapour-deposited Si_3N_4-TiN composites. T.Hirai, S.Hayashi (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).
J. Mater. Sci. (GB), vol.18, no.8, p.2401-6 (Aug. 1983).
Si_3N_4-TiN composites with an Si_3N_4 matrix and TiN dispersion were prepared at deposition temperatures of 1050 to 1450°C and total gas pressures of 1.33 to 10.7 kPa by the chemical vapour deposition of a $SiCl_4$-$TiCl_4$-NH_3-H_2 system. The density and deposition rate were measured and the formation mechanism of the composites was considered. The density of the crystalline (α or β) Si_3N_4 matrix was practically equal to the theoretical values. However, the density of the amorphous Si_3N_4 matrix was between 2.85 and 3.03 g cm^{-3}, depending on the deposition conditions. The highest growth rate of thickness for the composites was 0.47 mm h^{-1}. The deposition rate of the Si_3N_4 matrix increased with the addition of $TiCl_4$ vapour, the apparent activation energy being 68 to 84 kJ mol^{-1}. The deposition rate of the TiN dispersion exhibited a minimum at a deposition temperature of 1250 or 1350°C. (15 refs.)

103062 Apparatus for the epitaxial growth of semiconductor compounds by close-spaced vapour transport. J.M.Laroche, G.Cohen-Solal (Lab. de Phys. du Solide, CNRS-Bellevue, Meudon, France).
Rev. Phys. Appl. (France), vol.18, no.8, p.515-18 (Aug. 1983). In French.
The authors describe an apparatus which is used for the transport of a material upon a substrate, in a vessel where the pressure or the flow rate of the reactive gas are determined; the mean characteristics are the control and the stability of the temperature, the fast settlement of the thermal program and the possibility of in situ operations. Measurement accuracy and use flexibility make this apparatus well adapted to experimental research. The epitaxial growth of a semiconductor compound (CdTe) is given as an example of application. (22 refs.)

103063 Production of microstructures by laser pyrolysis. D.Bauerle (Angewandte Phys., Univ. of Linz, Linz, Austria).
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.19-28
Laser pyrolysis at short wavelengths is a powerful tool for micron-sized one-step local deposition of insulating, semiconducting and metallic materials from the gas phase. Various structures, e.g. stripes on different substrates, and rods of various lengths and diameters, have been produced. The morphology of the deposited material, the deposition rate, and the dimensions (typically 1-300 μm) of the structures were investigated quantitatively as functions of laser irradiance, local temperature, laser focus diameter, scanning velocity, and gas pressure. (20 refs.)

103064 Laser photolytic deposition of thin films. P.K.Boyer, C.A.Moore, R.Solanki, W.K.Ritchie, G.A.Roche, G.J.Collins (Dept. of Electrical Engng., Colorado State Univ., Fort Collins, CO, USA).
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.119-27
An excimer laser is used to photochemically deposit thin films of silicon dioxide, silicon nitride, aluminium oxide, and zinc oxide at low temperatures (100-350°C). Deposition rates in excess of 3000 Å/min and conformal coverage over vertical walled steps were demonstrated. The films exhibit low defect density and high breakdown voltage and have been characterized using IR spectrophotometry, AES, and C-V analysis. Device compatibility has been studied by using photodeposited films as interlayer dielectrics, diffusion masks, and passivation layers in production CMOS devices. Additionally, the authors have deposited metallic films of Al, Mo, W, and Cr over large (>5 cm^2) areas using UV photodissociation of trimethylaluminium and the refractory metal hexacarbonyls. Both shiny metallic films as well as black particulate films were obtained depending on the deposition geometry. The black films are shown to grow in columnar grains. The depositions were made at room temperature over pyrex and quartz plates as well as silicon wafers. The authors have examined the resistivity, adhesion, stress and step coverage of these films. The films exhibited resistivities at most $\sim$20 times that of the bulk materials and tensile stress no higher than 7×10^9 dynes/cm^2. (8 refs.)

103065 UC laser-initiated formation of Si_3N_4. T.F.Deutsch, D.J.Silversmith, R.W.Mountain (Lincoln Lab., MIT, Lexington, MA, USA).
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.129-34
Si_3N_4 films have been deposited on Si by using 193 nm ArF excimer laser radiation to initiate the reaction of SiH_4 and NH_3 at substrate temperatures between 200-600°C. Stoichiometric films having physical and optical properties comparable to those produced using low-pressure chemical vapor deposition (LPCVD) have been produced. The dielectric properties of the films are at present inferior to those of LPCVD material. (11 refs.)

103066 The spectroscopy and photolysis of metallo-organic precursors to III-V compounds. M.R.Aylett, J.Haigh (British Telecom Res. Labs., Ipswich, England).
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.177-82
The authors describe the deposition by light-stimulated breakdown of gallium and indium on borosilicate glass, gallium arsenide and indium phosphide substrates, from precursors whose ultraviolet (UV) spectra have recently been reported. Some preliminary work on the deposition of indium phosphide is also reported, using an indium-phosphorus complex whose UV spectrum is also given. (13 refs.)

103067 Semiconductor thin films grown by laser photolysis. J.G.Eden, J.E.Greene, J.F.Osmundsen, D.Lubben, C.C.Abele, S.Gorbatkin, H.D.Desai (Univ. of Illinois, Urbana, IL, USA).
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.185-92
Thin ($\leq$1.2 μm) Ge and Si films have been grown with rates up to 3.6 μm/hr by laser-induced chemical vapor deposition (LCVD) on a variety of substrates. Germanium films grown on amorphous SiO_2 (quartz) by photodissociating GeH_4 in He at 248 nm (KrF laser) exhibit grain sizes of 0.3-0.5 μm that increase only slightly up to the pyrolytic threshold for GeH_4 (280°C). On (100) NaCl, however, Ge films grown at a substrate temperature of 120°C are epitaxial. The activation energy for the LCVD growth of Ge films (from GeH_4) on SiO_2 is measured to be 85 ± 20 meV which suggests that germanium is arriving at the substrate in atomic form. The wavelength and intensity dependence of the initial film growth rate supports the conclusion that this process is photolytic and is initiated by the absorption of a single photon. (7 refs.)

103068 Laser stimulated growth of epitaxial GaAs. W.Roth, H.Krautle, A.Krings, H.Beneking (Inst. of Semiconductor Electronics, Aachen, Germany).
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.193-8
Stimulated growth of single crystalline GaAs has been obtained by irradiation of (100) oriented GaAs substrates inside an MOCVD reactor with a pulsed Nd-YAG laser. Process temperatures have been varied between 540°C and 360°C. In the non-irradiated areas, below 480°C substrate temperature the growth rate decreases rapidly, whereas in the irradiated part of the substrate epitaxial layers could be grown in the whole temperature range investigated. Below 450°C, the growth is reaction limited. (6 refs.)

103069 Laser induced chemical vapor deposition of hydrogenated amorphous silicon. R.Bilenchi, I.Gianinoni, M.Musci (CISE SpA, Milano, Italy), R.Murri.
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.199-205
Some results on hydrogenated amorphous silicon growth by CO_2 laser photodissociation of silane are reported. A 100 W CW CO_2 laser was used as the excitation source. The photoproduced radicals by interacting with the surface grow a film at a rate strongly depending on silane pressure, substrate temperature and laser intensity. This experimental configuration allows depositions on large areas, owing to the large number of reactant molecules involved in the photochemical process. Moreover, material can be produced with a continuously variable hydrogen content, since the substrate temperature required for obtaining depositions can be as low as room temperature and adjusted independently of the other process parameters. The film properties are similar to those of the glow discharge deposited material. The film amorphousness and the hydrogen presence either in monohydride and dihydride groups are evidenced by X-ray patterns and IR spectra. Results on the electrical and optical properties are also reported. (9 refs.)

103070 Direct writing using laser chemical vapor deposition. S.D.Allen, A.B.Trigubo, R.Y.Jan (Center for Laser Studies, Univ. of Southern California, Los Angeles, CA, USA).
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.207-14
Metal, dielectric and semiconductor films have been deposited by laser chemical vapor deposition (LCVD) using both pulsed and CW laser sources on a variety of substrates. For LCVD on substrates such as quartz, the deposition was monitored optically in both transmission and reflection using a collinear visible laser and the depositing CO_2 laser. Deposition initiation and rate were correlated with irradiation conditions, the laser generated surface temperature, and the changing optical properties of the film substrate during deposition. Single crystallites of W greater than 100 μm tall were deposited using a Kr laser on Si substrates. (14 refs.)

Morphological stability in epitaxy of monolithically integrated optical devices . ...See Entry 100925

Effects of growth temperature and substrate orientation on the entry of tellurium into epitaxial gallium arsenide films ....See Entry 102209

Effects of gas flow speed and chlorine concentration on tellurium uptake in gas-phase epitaxy of gallium arsenide ....See Entry 102210

Laser-initiated Ga-deposition on quartz substrates ....See Entry 102212

IR laser-induced deposition of silicon thin films ....See Entry 102213

Conduction parameters in chemically deposited thin silver films ....See Entry 102523

Optical constants of amorphous hydrogenated carbon and silicon-carbon alloy films and their application in high temperature solar selective surfaces ....See Entry 102977

Conducting crystals. A latticework for microchips ....See Entry 103049

Synthesis in a low power microwave discharge. II. Amorphous silicon nitride and polycrystalline silicon ....See Entry 103074

Spectrally selective black tungsten films ....See Entry 103728

81.15J Ion plating and other vapour deposition

103071 Growth of 1.3-μm double heterostructure GaInAsP/InP by liquid phase epitaxy. Wu Xiang-sheng, Yang Yi, Li Yun-ping, Tang Qiang-mei, Shui Hai-long (Shanghai Inst. of Metall., Acad. Sinica, Shanghai, China).
Chin. Phys. (USA), vol.3, no.2, p.489-92 (April-June 1983).
1.3-μm GaInAsP/InP DH wafers were prepared using the conventional two-phase solution LPE technique in the YW-1 type furnace and graphite-slider boat, under a Pd purified H_2 atmosphere, in the temperature range of 670-610°C. Before the epitaxial growth, the (100) facet of the InP substrate was etched with a pure In melt or unsaturated InP-In melt in order to remove the defect layers, then the *n*-type InP layer (Sn or Te doped), GaInAsP layer (undoped), *P*-type InP layer (Zn or Mg doped) were grown in successive order, or another *p*-type GaInAsP layer (Zn or Mg doped) was grown. After the LPE growth, the cleaved facet was stained with KOH and $K_3Fe(CN)_6$ aqueous solution and the layer thicknesses were measured by means of a scanning electron microscope. (7 refs.)

103072 The drawing of thin films of $Bi_{12}GeO_{20}$ by method of impulsive plasma evaporation. B.B.Davydov, F.Sh.Islamov.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.4, p.85-7 (1982). In Russian.
This work deals with the drawing of thin films of $Bi_{12}GeO_{20}$ by the method of impulsive plasma evaporation. Electronographic investigations of thin films have been conducted, which show that the film structure coincides with that of the initial crystal $Bi_{12}GeO_{20}$. (8 refs.)

103073 RF-plasma deposited amorphous hydrogenated hard carbon thin films: preparation, properties, and applications. A.Bubenzer, B.Dischler, G.Brandt, P.Koidl (Fraunhofer-Inst. fur Angewandte Festkorperphys., Freiburg, Germany).
J. Appl. Phys. (USA), vol.54, no.8, p.4590-5 (Aug. 1983).
The deposition of amorphous hydrogenated hard carbon (*a*-C:H) thin films from benzene vapor in a RF plasma is described. a-C:H was deposited on glass, quartz, Si, Ge, and GaAs. Negative self-bias V_B and gas pressure P are shown to be the two significant parameters for an accurate control of the deposition process. The dependence of growth rate and deposition temperature on V_B and P was determined; this gives an empirical relation for the average energy $\bar{E}$ of the ions forming the thin films. Refractive index (1.85-2.20 in the IR), optical gap (0.8-=1.8 eV) and density (1.5-1.8 g/cm^3) of *a*-C:H was measured. The optical gap varies linearly with the content of bonded hydrogen in the films. The density of *a*-C:H is proportional to the average ion energy $\bar{E}$. The authors demonstrate the application of *a*-C:H as antireflective coating on Ge for 10.6 μm (reflection $<$0.2% at 10.6 μm) and as terminating layer of an optical multilayer stack. (27 refs.)

103074 Synthesis in a low power microwave discharge. II. Amorphous silicon nitride and polycrystalline silicon. P.M.Jeffers, S.H.Bauer (Dept. of Chem., Cornell Univ., Ithaca, NY, USA).
J. Non-Cryst. Solids (Netherlands), vol.57, no.1, p.189-93 (Aug. 1983).
For pt.I see Inorg. Chem., vol.20, p.4632 (1981). The authors previously reported on the partial reduction of trimethyoxyborane by hydrogen when mixtures of these gases were passed through a low power microwave (S band) discharge. Here they describe experiments with mixtures of $SiCl_4/H_2$, SiF_4/H_2 and $SiCl_4/N_2/H_2$. Indeed, microwave discharge conditions proved to be particularly effective for producing elementary polycrystalline silicon from the tetrahalides, and amorphous Si_3N_4 from the mixtures which incorporated N_2. The mechanisms have yet to be determined. (5 refs.)

103075 Curved sheet plasma for ion plating. J.Uramoto (Inst. of Plasma, Nagoya Univ., Nagoya, Japan).
J. Vac. Soc. Jpn. (Japan), vol.26, no.6, p.551-5 (1983). In Japanese.
A simple method for producing curved sheet plasma (with large width and thin thickness) is described, in which two different shapes of permanent magnets are arranged on both sides of a cylindrical plasma column along a magnetic field. Using the curved sheet plasmas for ion plating of curved large surfaces, one can collect an ion current of high density in a very high power and gas efficiency. (2 refs.)

103076 Auger electron spectroscopy interface study of evaporated and ion-plated silver films on steel substrates. L.M.Wang, F.Z.Wang, J.H.Zhang, L.h.Zhai (Dept. of Metallic Materials Sci. & Engng., Beijing Polytech. Univ., Beijing, China), P.G.Cao.
Thin Solid Films (Switzerland), vol.105, no.4, p.319-23 (29 July 1983).
Thin silver films were deposited onto steel substrates by either evaporation or ion plating, which included not only the conventional ion plating process with a high substrate bias (-3 kV) and a resistance-heated evaporation source but also a process with low bias (-50 V) and a hollow cathode electron beam source which could provide a higher ionizing rate. The width of the interfaces and the oxygen distribution were analysed by Auger electron spectroscopy combined with the ion etching technique. Also the adhesion of the films was examined by means of a scratch test and a thermal shock test. It was found that for silver on steel, an insoluble pair of materials, only ion plating with a high substrate bias could produce a 'pseudodiffusion'-graded interface, and the excellent adhesion of the film to the substrate should be attributed to the cleaned and graded interface. (13 refs.)

103077 Thin films prepared by plasma polymerization of methylmethacrylate and their properties as an electron beam resist. L.Martinu, H.Biederman (Faculty of Math. & Phys., Charles Univ., Prague, Czechoslovakia).
Vacuum (GB), vol.33, no.5, p.253-4 (May 1983).
Plasma polymerized methyl-methacrylate (PPMMA) thin films were formed under various conditions in an AC glow discharge using a bell-jar type reactor with parallel plate electrodes. It has been found that the deposition rate increases in the frequency range from 10 to 50 kHz. The possibility of using the films as an electron beam resist has been investigated. (11 refs.)

103078 Ion energy distribution in ion plating. J.Machet, P.Saulnier, J.Ezquerra, J.Guille (Lab. de Phys. Ionique, Univ. de Limoges, Limoges, France).
Vacuum (GB), vol.33, no.5, p.279-84 (May 1983).
A very simple experimental set-up allows determination of the energy distribution of ions striking the substrates during deposition by ion plating. The ion energy is measured by the retarding field method. The results obtained for a discharge in argon agree with those predicted by the theoretical model of charge transfer. For discharges, generated during the deposition process, the energy distribution of the ions of the gas bearing the discharge and those of the deposited material, agree again with this model. The average energy of the metallic ions is higher than that of the ions of the gas bearing the discharge. For flat cathodes the distribution is the same for all the points except near the shield around the cathode up to a spacing of the order of the cathode dark space length. If the cathode is not flat this distribution is greatly modified. (12 refs.)

Vacuum technology, thin films, and sputtering. An introduction .... See Entry 98673

Metal doped fluorocarbon polymer films prepared by plasma polymerisation using an RF planar magnetron target .... See Entry 101590

Surface structural damage produced in InP(100) by RF plasma or sputter deposition .... See Entry 102141

Structure and properties of evaporated amorphous films consisting of transition metal-metalloid alloys .... See Entry 102193

Photoconductivity and dark conductivity of hydrogenated amorphous silicon .... See Entry 102455

Plasma arc coatings combat component wear .... See Entry 103405

81.15L Deposition from liquid phases (melts and solutions)

103079 Electrodeposition of Ni-B_4C dispersion coatings. N.Furukawa, T.Hayashi (Dept. of Appl. Chem., Osaka Univ., Osaka, Japan).
Bull. Univ. Osaka Prefect. Ser. A (Japan), vol.31, no.2, p.133-41 (1982).
The electrodeposition of Ni-B_4C dispersion coatings from a Watts nickel bath (1.2 M Ni) is studied to determine the factors affecting the codeposition of B_4C particles in the coatings. The influence of the concentration of dispersoids, current density, pH, and agitation on the codeposition of B_4C particles with nickel was examined at 45°C. The codeposition rate of the B_4C particles with nickel was found to increase with increasing current density. The Ni-B_4C coatings tend to become rougher than Ni-Al_2O_3 deposits. Addition of organic leveling and brightening agents to the plating bath, however, gave rise to the smooth deposits with a high value of hardness (Hv 690). (12 refs.)

103080 Electrodeposition of niobium-germanium alloys from molten fluorides. U.Cohen (Dept. of Materials Sci. & Engng., Stanford Univ., Stanford, CA, USA).
J. Electrochem. Soc. (USA), vol.130, no.7, p.1480-5 (July 1983).
Niobium-germanium alloys were obtained by electrodeposition from molten fluoride solutions containing 5 mol percent of K_2NbF_7, and various concentrations of K_2GeF_6 in the KF-LiF eutectic solvent. The molten bath temperature was typically about 750°C. Cathodes (or substrates) were made of Mo and W foils, and a Ge sheet was used as a dissolving anode. Stable growth deposits were obtained of the intermetallic compounds $NbGe_2$, Nb_3Ge_2, Nb_5Ge_3, and their phase-mixtures by varying the germanium ion concentration in the molten bath. Germanium was found to be more noble than niobium in the molten fluoride bath, thus facilitating the deposition of germanium rich alloys. The superconducting compound, Nb_3Ge, however, could not be obtained as a single-phase deposit. It was obtained only as a minor constituent in certain phase-mixtures when operating under extreme conditions. (25 refs.)

103081 Measurement of electroless plating rate by coulostatic method. N.Sato, M.Suzuki, Y.Sato (Res. & Dev. Center, Toshiba Corp., Kawasaki, Kanagawa, Japan).
J. Electrochem. Soc. (USA), vol.130, no.7, p.1485-8 (July 1983).
The copper deposition rate in a production electroless copper plating bath was measured by the coulostatic method. The effects of the substrate material and the degree of bath aging on the measured parameters were investigated. The deposition current density i_{ELP}, obtained from weight gain data of the specimen, the double layer capacity C_d, and the polarization resistance R_p measured by this method depended on the substrate material, while the proportionality constant K for conversion from R_p to i_{ELP} was almost constant. The dependence of i_{ELP}, C_d, and R_p on the substrate material was interpreted in terms of the surface roughness of the substrate. The possibility of using this method for real time monitoring of electroless deposition rates was demonstrated by these results. (15 refs.)

103082 Importance of hydrogen evolution in the development of structural imperfections during nickel electrocrystallisation. V.M.Kozlov (Togliatti Polytech. Inst., USSR).
Sov. Electrochem. (USA), vol.18, no.10, p.1203-7 (Oct. 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.10, p.1353-8 (Oct. 1982).
Electron microscopy and X-ray analysis were used to study the structure of electrolytic nickel deposits obtained from a sulfate bath as a function of cathodic current density, electrolyte pH, and the anodic component of current density when using periodic current. It is suggested that the development of twinning defects and dislocation boundaries is due to incoherent nucleation. The importance of adsorbed hydrogen in the development of structural imperfections during nickel electrocrystallization is discussed in terms of atomistic nucleation theory. (15 refs.)

103083 Investigation of the mechanism of the inhibiting action of cinnamaldehyde in the electrodeposition of a tin-bismuth alloy. A.N.Popov, K.M.Tyutina (D.I. Mendeleev Moscow Chem. Technol. Inst., Moscow, USSR).
Sov. Electrochem. (USA), vol.18, no.10, p.1250-3 (Oct. 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.10, p.1403-7 (Oct. 1982).
In a consideration of the question of the mechanism of the action of luster-forming compositions used in the electrodeposition of coatings of alloys of tin and containing the traditional 'condensation product', nonioniogenic surfactant, and formaldehyde, the elucidation of the causes of the strong inhibiting action of the original components of such compositions is of substantial interest. The present work is devoted to an investigation of the influence of the luster-forming additive N-3, containing cinnamaldehyde as the main inhibiting component, on the cathode process of electrodeposition of a tin-bismuth alloy. (12 refs.)

103084 Electrochemically prepared polythienylene films. S.Hotta, T.Hosaka, W.Shimotsuma (Central Res. Labs., Matsushita Electric Industrial Co. Ltd., Osaka, Japan).
Synth. Met. (Switzerland), vol.6, no.1, p.69-71 (June 1983).
Polythienylene films of 5-10 μm in thickness were prepared on an indium-tin oxide surface by applying a current of 2 mA cm^{-2} for 20 min in a two-electrode cell containing 0.24 M thiophene and an electrolyte in a solvent. The reaction system was held at room temperature of 5°C during the preparation of the films. Each green-black film was washed well with methanol and dried under vacuum at room temperature. X-ray diffraction patterns of the films show them to be amorphous. The densities of the films were measured by the flotation method in tetrachloromethane-xylene mixture. (2 refs.)

Morphological stability in epitaxy of monolithically integrated optical devices .... See Entry 100925

Zn incorporation in $Ga_{1-x}Al_x$ As grown by liquid phase epitaxy and its electrical properties .... See Entry 101728

Closed system LPE growth of $Cd_xHg_{1-x}Te$ .... See Entry 102200

Growth peculiarities of graded band gap GaAsSb/GaAs heterostructures and effective light modulation in the 1.06 μm wavelength region .. See Entry 102502

The solid-state reaction of copper and tin: an assessment of the value of an iron barrier layer .... See Entry 103400

The fatigue properties of mild steel with surface diffusion coatings of nickel-iron and nickel-cobalt-iron alloys .... See Entry 103401

Low cost process for ohmic contacts on GaAs/$Ga_{1-x}Al_xAs$ concentrator solar cells based on palladium and gold deposition .... See Entry 103697

81.20 OTHER METHODS OF PREPARATION OF MATERIALS

103085 An analysis of the ribbon formation process by the single roller rapid solidification technique. K.Takeshita, P.Hideo Shingu (Dept. of Mech. Engng, Fukui Univ., Fukui, Japan).
Trans. Jpn. Inst. Met. (Japan), vol.24, no.7, p.529-36 (July 1983).
The theory of flow boundary layer formation has been applied to the analysis of the process of ribbon formation by the single roller rapid solidification technique. It has hence become possible to solve simultaneously equations describing the fluid flow and heat flow, which take the viscosity change due to temperature reduction into consideration. The results of calculation by the use of finite difference method revealed quantitatively the relative importance of various process variables during the ribbon formation. Some of these results are contrary to those believed until the present from intuitive guesses. (14 refs.)

Carbon sample preparation for negative ion source .... See Entry 100167

The drawing of thin films of $Bi_{12}GeO_{20}$ by method of impulsive plasma evaporation .... See Entry 103072

81.20E Powder techniques, compaction and sintering

103086 Settling in solid-liquid systems with specific application to liquid phase sintering. A.N.Niemi, T.H.Courtney (Dept. of Metall. Engng., Michigan Technol. Univ., Houghton, MI, USA).
Acta Metall. (USA), vol.31, no.9, p.1393-401 (Sept. 1983).
The evolution of microstructure in liquid phase sintered (LPS) alloys as it occurs in a gravity environment is discussed. If the solid phase volume fraction (V_p) is initially sufficiently low, a dispersion of isolated solid particles within the liquid develops first. These isolated particles settle at a velocity approximately equal to the Stokes' velocity and, in a finite container, the settling leads to the formation of a solid skeleton when V_p reaches a critical value. One formed, a skeletal structure can continue to settle. The settling mechanism is controlled by 'extrication' of solid particles from the skeleton and their subsequent directional flow within the liquid as a result of the differing solid and liquid densities. (13 refs.)

103087 Powder metallurgy of amorphous metallic systems. G.M.Gryaznov, V.N.Lapovok, I.G.Naumenko, V.I.Serbin, L.I.Trusov.
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.973-5 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.619-23 (Nov. 1982).
The growing interest in amorphous metallic materials stems from their valuable combination properties. However, in the high-yield methods which have been developed for obtaining amorphous metals, the material is fabricated in the form of a ribbon not more than 15-20 μ thick. The problem of forming uniform bulk objects from such a ribbon has not been solved. The application of powder metallurgy could become an alternative solution in this case. This would require a technology for preparing powders of amorphous metallic alloys of various compositions; it would be desirable to control the process with the aim of preparing powders of the required grade. After certification of the powders, a technology for forming bulk objects from the powders by

pressure processing will be required. Finally, after cold or hot pressing and, possibly, sintering, a study should be made of the physical properties of the resulting bulk amorphous materials. The authors show the feasibility of such a powder technology for amorphous metallic systems. (4 refs.)

Meeting of the Basic Science Section of the British Ceramic Society, 'Fabrication Science 3' .... See Entry 98640

The influence of the addition of MgO on the surface mass transport of alumina .... See Entry 102158

Hot isostatic pressing of niobium C-103 alloy shapes .... See Entry 103088

Morphology of zinc powder which has been atomised with a rotating electrode .... See Entry 103089

Dispersion hardening—a low cost technique for improving the hot strength of copper alloys .... See Entry 103090

The beginning of the sintering of a ceramic: existing theories tried on dilatometric analyses .... See Entry 103091

The production of fine silicon carbide powder by the reaction of gaseous silicon monoxide with particulate carbon .... See Entry 103093

Powder preparation for rapid sintering by the combined suspension-solution freeze drying technique .... See Entry 103094

The effect of compaction pressure on the coarsening of open pores in fired compacts made with agglomerated powder .... See Entry 103095

Influence of powder and green compact characteristics on microstructure of sintered alpha-SiC .... See Entry 103097

Sintering of spray pyrolyzed Mg-Al spinel powder .... See Entry 103098

Densification and grain growth in hydrothermal reaction sintering of hafnia (HfO_2) .... See Entry 103100

A new composite ceramic material containing alumina: aluminalon .... See Entry 103101

Effect of wet milling and cobalt powders on the phase transformation and morphology of the cobalt .... See Entry 103102

On solution-reprecipitation processes during liquid phase sintering of WC-Co .... See Entry 103155

Superplastic forming of alumina .... See Entry 103237

Fatigue crack growth rate of Ti-6Al-4V prealloyed powder compacts .... See Entry 103320

Reflected-light microscopy for examining hard ferrites with the Amplival pol.u microscope .... See Entry 103422

Beta-alumina for sodium-sulphur batteries .... See Entry 103674

81.20G Specific metals and alloys (compacts, pseudoalloys)

103088 Hot isostatic pressing of niobium C-103 alloy shapes. M.Kibrick, E.H.Rennhack (Lockheed Missiles & Space Co., Sunnyvale, CA, USA), J.C.Runkle.
Int. J. Refract. & Hard Met. (GB), vol.2, no.2, p.71-7 (June 1983).
A study was undertaken to evaluate the properties of hot isostatically pressed (HIP) C-103 niobium alloy powder compacts. The purpose was to produce high quality near-net shapes for use in high temperature systems. Various HIP conditions, canning materials, and post-compaction vacuum annealing treatments used to achieve densities greater than 99% of theoretical are detailed along with the problems encountered; particularly detrimental reactions between the compacted powders and the canning material. Methods which minimize these reactions and facilitate can removal are discussed. Room temperature tensile and ductility data compared favourably with wrought material. Creep test data, obtained in vacuum at 3000F for the as-HIP and HIP plus vacuum annealed material and the results of optical and electron microscopy examinations are presented and discussed. (7 refs.)

103089 Morphology of zinc powder which has been atomised with a rotating electrode. M.Fiset, B.Champagne, R.Angers (Dept. de Mines et Metall., Univ. Laval, Ste-Foy, Quebec, Canada).
Scr. Metall. (USA), vol.17, no.7, p.817-22 (July 1983). In French.
An electric arc was struck between a tungsten electrode and a rotating zinc electrode to produce zinc powder in a chamber which could be evacuated and filled with either argon or helium. 99.999% zinc was used. The facets found on the zinc particles depended on the cooling rate of the zinc droplets formed in the electric arc and on the residual oxygen when the chamber had been evacuated to 6.65, 26.6 and 53.2 Pa. The residence time of the liquid droplets affected the formation of facets, because the nucleation process appeared to take place at the free surface of the droplets. (5 refs.) *R.S.*

Settling in solid-liquid systems with specific application to liquid phase sintering .... See Entry 103086

Powder metallurgy of amorphous metallic systems .... See Entry 103087

Fatigue crack growth rate of Ti-6Al-4V prealloyed powder compacts .... See Entry 103320

81.20J Dispersion-,fibre-, and platelet-reinforced metal-based composites

103090 Dispersion hardening—a low cost technique for improving the hot strength of copper alloys. L.Berglin, O.Sjoden (Swedish Inst. for Metals Res., Stockholm, Sweden).
Scand. J. Metall. (Finland), vol.12, no.4, p.184-8 (1983).
A possible way is considered of making low cost dispersion strengthened copper alloys by a powder metallurgical manufacturing process, consisting of mechanical mixing, cold isostatic pressing and hot extrusion. The properties of the extruded alloys were found to be good, in particular the recrystallization temperatures were high for one alloy reaching approximately 800°C. (15 refs.)

81.20L Ceramics and refractories

103091 The beginning of the sintering of a ceramic: existing theories tried on dilatometric analyses. J.M.Haussonne.
Ind. Ceram. (France), no.772, p.328-33 (1983). In French.
Experiments were made on $BaTiO_3$ under a stretching force of 10 grammes and rates of temperature rise from 10 to 1100°C/h, in the temperature range from 750 to 1300°C. The results indicated that different mechanisms were involved, depending on whether the temperature rise was less or more than 150°C/h. It is thought that $BaTiO_3$ cannot be considered as a simple body. The different diffusion rates of Ti^{4+}, Ba^{2+}, and O^- are thought to make an analytical approach very difficult. The formation of crystallisation nuclei at intergranular contact points after shrinkage, crystal growth, diffusion through the growing crystals and crystalline growth at their surfaces are important starting phenomena for sintering. (8 refs.) *R.S.*

103092 The stability of SiC-based ceramics containing ZrO_2 and other oxides. J.Lorenz, H.L.Lukas (Inst. fur Werkstoffwissenschaften, Max-Planck-Inst. fur Metallforschung, Stuttgart, Germany), E.E.Hucke, L.J.Gauckler.
CALPHAD: Comput. Coupling Phase Diagrams & Thermochem. (GB), vol.7, no.2, p.125-35 (April-June 1983).
Calculations of thermochemical equilibria, using the program SOLGASMIX, have defined the conditions and compositions of SiC-based ceramics in which stable ZrO_2 particles can be obtained. The results are compared with experiments. The calculation method offers the possibility of evaluating compositions and fabrication conditions for $SiC\text{-}ZrO_2$ and $SiC\text{-}ZrO_2\text{-}Al_2O_3\text{-}SiO_2$ composites. (12 refs.)

103093 The production of fine silicon carbide powder by the reaction of gaseous silicon monoxide with particulate carbon. P.Kennedy, B.North.
Proc. Br. Ceram. Soc. (GB), no.33, p.1-15 (May 1983). (Meeting of the Basic Science Section of the British Ceramic Society, 'Fabrication Science 3', London, England, 13-14 Dec. 1982).
Work on the carbothermic reduction of SiO_2 to produce SiC powder has indicated that the rate-controlling step is the generation of SiO vapour. With this in mind, a technique for producing fine beta SiC powder has been developed in which SiO vapour, generated from a separate ($Si\text{-}SiO_2$) source, is passed through a bed of particulate carbon and converts it to SiC powder. The dependence of the reaction on temperature and time has been investigated and the results suggest first order kinetics with an activation energy of about 466 kJ $mole^{-1}$. The technique has fundamental advantages over the carbothermic reduction of SiO_2 in terms of upscaling potential, product purity and raw material requirements. (11 refs.)

103094 Powder preparation for rapid sintering by the combined suspension-solution freeze drying technique. V.V.Pankov, M.Paulus, A.Dubon.
Proc. Br. Ceram. Soc. (GB), no.33, p.17-32 (May 1983). (Meeting of the Basic Science Section of the British Ceramic Society, 'Fabrication Science 3', London, England, 13-14 Dec. 1982).
The freeze-drying of liquid solutions allows the preparation of very fine and chemically very homogeneous powders and therefore a low sintering temperature. The use of this technique may be restricted by different factors, among them the most important is the nonsolubility of one of the cations. The authors show, by a comparative analysis of the sintering of spinel, $MgAl_2O_4$ from powders obtained by various techniques, that you get a similar high sintering rate if you replace the freeze-drying of a pure liquid solution by that of a suspension of one oxide or salt in the liquid solution of the other cations. (5 refs.)

103095 The effect of compaction pressure on the coarsening of open pores in fired compacts made with agglomerated powder. G.Isik, P.F.Messer.
Proc. Br. Ceram. Soc. (GB), no.33, p.39-50 (May 1983). (Meeting of the Basic Science Section of the British Ceramic Society, 'Fabrication Science 3', London, England, 13-14 Dec. 1982).
Compacts were formed over a wide range of pressure from a moist agglomerated powder mixture of clay, quartz and feldspar. They were dried and then fired at two temperatures for a number of soaking times. Their bulk densities, apparent porosities and shrinkages were determined and, most importantly, the open porosities were investigated using mercury porosimetry. It was found that increasing the compaction pressure reduced the apparent porosity and shrinkage and increased the bulk density. These effects are straightforward and expected. It was also found that the open porosity coarsened as the compacts shrank and that the coarsening was reduced by raising the compaction pressure. It is considered that this reduction occurred because of improved uniformity of porosity on a scale of size comparable to the size of the smaller of the agglomerates. (5 refs.)

103096 The preparation and properties of polycrystalline aluminium oxide fibres. J.D.Birchall.
Proc. Br. Ceram. Soc. (GB), no.33, p.51-62 (May 1983). (Meeting of the Basic Science Section of the British Ceramic Society, 'Fabrication Science 3', London, England, 13-14 Dec. 1982).
Ceramic fibres are of growing interest and importance for a variety of applications such as high temperature insulation, hot gas filtration, the reinforcement of metals etc. A discussion is presented on polycrystalline fibres of Al_2O_3 and in particular, with fibres produced by the spinning of basic aluminium salt solutions and heat treatment of the resulting gel fibres. The nature of the precursor solutions is discussed as are the phase transformations that occur in the heat treatment sequence. The physical properties of the fibre are very dependent on process history. The relationship between properties and applications is discussed. (10 refs.)

103097 Influence of powder and green compact characteristics on microstructure of sintered alpha-SiC. E.Carlstrom, A.-K.Tjernlund, L.Hermansson, R.Carlsson.
Proc. Br. Ceram. Soc. (GB), no.33, p.89-100 (May 1983). (Meeting of the Basic Science Section of the British Ceramic Society, 'Fabrication Science 3', London, England, 13-14 Dec. 1982).
A homogeneous green body is of importance for reaching high densities in the sintering of alpha-SiC. Inhomogeneities in the green body, such as large pores and agglomerates with a different density from the matrix, affect the ability to reach high final densities. Dense agglomerates tend to shrink away from the matrix, thereby causing cracks and pores. Alternative routes of powder preparation, such as spray drying, eliminate inhomogeneities and result in an improved microstructure. (10 refs.)

103098 Sintering of spray pyrolyzed Mg-Al spinel powder. S.Kanzaki (Government Industrial Res. Inst., Nagoya, Japan), T.Nishida, N.Otsuka, K.Saito, Z.Nakagawa, K.Hamano.
Yogyo-Kyokai-Shi (Japan), vol.91, no.4, p.165-70 (1983). In Japanese.
The equimolar spinel powders have been synthesized by spray-pyrolysis of the water-methanol solutions of magnesium and aluminum nitrates, and their sinterability was studied. The specific surface area and pore volume of the powder dependend on the calcination temperature and showed maximum values when calcined at 400°C. Although the primary particle size and the specific surface area of the powder calcined at 400°C were 150 Å and 120 m^2/g, respectively, the lattice parameter of the powder was 8.081 Å, suggesting that the particles are composed of the nearly perfect spinel lattice. The as-sprayed powder showed poor sinterability, but the grinding increased the sinterability to a great extent. As the methanol content in the solvent was increased, the agglomerated particles became fragile and tended to fracture more easily by compression. Consequently, the bulk density of the sintered body increased with decreasing of the ratio of water/methanol ratio in the solvent. (8 refs.)

103099 Alumina-zirconia fine powders prepared by hydrothermal oxidation. M.Yoshimura, S.Kikugawa, S.Somiya (Dept. of Materials Sci., Tokyo, Inst. of Technol., Yokohama-shi, Japan).
Yogyo-Kyokai-Shi (Japan), vol.91, no.4, p.183-8 (1983). In Japanese.
Fine powders of alumina-zirconia mixtures were prepared by hydrothermal oxidation of Al-Zr alloys which were fused in an arc image furnace. The hydrothermal oxidation of Al-Zr alloys proceeded above 500°C under 100 MPa for 3 h, and the obtained powders consisted of monoclinic zirconia, tetragonal zirconia and alpha-alumina. The average crystallite sizes of these phases were 13~24 nm, 9~12 nm, 27~35 nm, respectively, smaller than that of monoclinic zirconia or alpha-alumina (which was) prepared by hydrothermal oxidation of Zr or Al metal under the same condition. Alumina-zirconia powders prepared by this method were homogeneous mixtures of alumina and zirconia particles of which sizes were around 30 nm as determined by transmission electron micrograph (TEM) observation. (12 refs.)

103100 Densification and grain growth in hydrothermal reaction sintering of hafnia (HfO_2). H.Toraya, M.Yoshimura, S.Somiya (Dept. of Materials Sci. & Engng., Tokyo Inst. of Technol., Yokohama-shi, Japan).
Yogyo-Kyokai-Shi (Japan), vol.91, no.5, p.235-40 (1983). In Japanese.
Hydrothermal reaction sintering of hafnia (HfO_2) was studied under 100 MPa at temperatures up to 1300°C. HfO_2 formed from Hf and H_2O on heating was sintered above 900°C for 3 h. The density and crystallite size of sintered bodies increased monotonically with temperature in the range between 900°C and 1200°C, then saturated at the maximum relative density of 98%. The hydrothermal reaction sintering of HfO_2 proceeded through three stages with the following features: (1) a large increase in crystallite size was observed, while the density did not increase appreciably; (2) a large increase in density was observed, while crystallite size increased a little; (3) a small increase in density and a small variation of crystallite size were observed. The growth of crystallite size was influenced by the presence of high-temperature high-pressure water and the temperature of heat-treatment. The densification was thought to take place on the second and third stages in the hydrothermal reaction sintering mainly by pore elimination due to the effect of hot isostatic processing. Greyish sintered bodies were sometimes obtained, having a smaller crystalline size and larger density than white sintered bodies fabricated under the same experimental conditions. (16 refs.)

Meeting of the Basic Science Section of the British Ceramic Society, 'Fabrication Science 3' .... See Entry 98640

Growth reactions of potassium titanate fibers by slow-cooling calcination method .... See Entry 103043

Ce-Ta-(Al)-oxide porous glass ceramic .... See Entry 103103

Superplastic forming of alumina .... See Entry 103237

Reflected-light microscopy for examining hard ferrites with the Amplival pol.u microscope .... See Entry 103422

Beta-alumina for sodium-sulphur batteries .... See Entry 103674

81.20N Cermets, ceramic and refractory composites

103101 A new composite ceramic material containing alumina: aluminalon. D.Turpin-Launay, P.Goeuriot, F.Thevenot.
Ind. Ceram. (France), no.772, p.343-5 (1983). In French.
In an attempt to slow down crack propagation in ceramics, a material with a propensity for microcracks was dispersed in the matrix of alumina. Hexagonal boron nitride was found suitable to improve the resistance to thermal shock of alumina. At 1400°C the composite material, which is called aluminalon (α-Al_2O_3-$ON\gamma$) was found to have as good or even better toughness than at ambient temperature. Hitherto, the new material has been made by heating and compression. A more economical way of manufacture would be by sintering, if this also gives acceptable mechanical characteristics. (5 refs.) *R.S.*

103102 Effect of wet milling and cobalt powders on the phase transformation and morphology of the cobalt. E.R.Kimmel (Chem. & Metallurgical Div., GTE Products Corp., Towanda, PA, USA).
Int. J. Refract. & Hard Met. (GB), vol.2, no.2, p.84-7 (June 1983).
Studies were made to assess the effect of wet milling of WC and Co on the cobalt cubic-hexagonal transformation; the morphology of the cobalt in the milled powder; and the subsequent physical properties and microstructure of the sintered product. The cobalt phase transformation was measured via quantitative X-ray diffraction. The cobalt morphology was examined using SEM and optical metallographic techniques on silver infiltrations of the milled powder. Results indicate: (1) The extent of cubic-hexagonal transformation depends on both milling intensity and initial carbide particle size; (2) cobalt is distributed as 2-6 μm agglomerates or flakes; and (3) physical properties and microstructure of resultant sintered bars show differences attributable only to additional WC attrition from increased milling intensity. (7 refs.)

On solution-reprecipitation processes during liquid phase sintering of WC-Co .... See Entry 103155

81.20P Glasses

103103 Ce-Ta-(Al)-oxide porous glass ceramic. J.F.Bednarik, M.A.Res, R.W.White (Nat. Phys. Res. Lab., CSIR, Pretoria, S Africa).
Glass Technol. (GB), vol.24, no.3, p.122-6 (June 1983).
Substitution of the end-member oxides in the Na_2O-B_2O_3-SiO_2 ternary system was studied. Replacement of SiO_2 with a combination of CeO_2 and Ta_2O_5 ($CeO_2/Ta_2O_5=1.25$) produced glasses and ceramics which, after heat treatment, decomposed to form a leachable sodium borate phase and an insoluble glass ceramic phase. The mode of phase decomposition is sensitive to impurities to such an extent that selection of the melting crucible, e.g. sintered alumina or platinum-rhodium, leads to differences in pore size or surface area. These new materials have a specific surface area of 9-283 m^2/g and a pore radius of between 0.82 and 41.5 nm. (17 refs.)

103104 Zirconium as a raw material for special glasses. P.G.Devillebichot (Magnesium Elektron Ltd., Manchester, England).
Glass Technol. (GB), vol.24, no.3, p.139-42 (June 1983). (Symposium on Halide and other Nonoxide Glasses, Cambridge, England, 23-26 March 1982).
Recently developed glasses based on ZrF_4 have shown potential for fibre optics applications, amongst others, where a broadening of the infrared region of transparency is desired. Due to their adverse effect on optical properties, the levels of iron oxide and other transition and lanthanide metal oxides inherent in the raw material must be kept as low as possible. There are two main routes for producing ZrF_4 for use in special glasses, one involves the reaction of zirconium oxide with ammonium bifluoride and thermal decomposition of the resulting ammonium fluorozirconate and the other starts directly from the ammonium fluorozirconate: the former has been found to be the most popular. Magnesium Elektron produces a range of pure, chemically precipitated oxides of controlled particle shape and size, and has developed its G grade of oxides specifically for the glass and synthetic gemstone markets. Through co-operation between universities, research establishments, and the raw materials supplier, the most suitable product for the fibre optics market may also be identified. (6 refs.)

103105 Fluoride glasses of 3d transition metals. C.Jacoboni, A.le Bail, R.de Pape (Lab. des Fluorures et Oxyfluorures Ioniques, Faculte des Sci., Le Mans, France).
Glass Technol. (GB), vol.24, no.3, p.164-7 (June 1983). (Symposium on Halide and other Nonoxide Glasses, Cambridge, England, 23-26 March 1982).
Large vitreous areas have been found in PbF_2-MF_2-MF_3 systems (M=3d transitional element). The chemical and thermal conditions of preparation are given. These glasses exhibit interesting physical properties: good infrared transparency up to 7.5 μm for 3 mm thickness, luminescence with rare earth ions, and spin glass behaviour for high Mn^{2+}/Fe^{3+} content. Furthermore, the octahedral coordination of 3d glass former ions gives a structural originality for these glasses as compared with fluoroberyllate or fluorozirconate glasses which are built on different coordinations. (24 refs.)

Symposium on Halide and other Nonoxide Glasses .... See Entry 98625

Optical properties of fibre and bulk zirconium fluoride glass .... See Entry 100909

Chalcogenide glass optical fibres .... See Entry 100911

Fluorozirconate glasses with improved viscosity characteristics for fibre drawing .... See Entry 100912

Elastic constants and structure of the vitreous system H_2O-P_2O_5 .... See Entry 101574

Optical absorption of transition metal ions in silica coating films prepared by the sol-gel technique .... See Entry 102974

Powder metallurgy of amorphous metallic systems .... See Entry 103087

81.20S Polymers

Symposium on the Rheological Properties of Polymers. 65th Chemical Conference of the Chemical Institute of Canada .... See Entry 98641

Shear modification of polymers .... See Entry 101163

Influence of molar mass and catalysts on the kinetics of crystallization and on the orientation of poly(ethylene terephthalate) .... See Entry 101596

Evidence of strain-induced phase separation in isopropyl azodicarboxylate modified polybutadiene .... See Entry 101598

Fibrillation of the mixtures of crystallizable, amorphous and poorly crystalline polymers .... See Entry 101829

Characteristics of polynorbornene and ethylene-propylene terpolymer blends .... See Entry 101974

Annealing of ultra-oriented high density polyethylene extrudates .... See Entry 103186

Polyisobutylene model elastomers prepared using demonstrably complete end-linking reactions. I. Elongation moduli of the trifunctional and tetrafunctional networks prepared from the linear polymers .... See Entry 103198

Relationship between polymerization conditions and rheological properties for styrene-acrylonitrile copolymers .... See Entry 103201

81.20T Reinforced polymers and polymer-based composites

Fracture morphology of rubber compounds containing recycled rubber powder .... See Entry 103263

81.30 PHASE DIAGRAMS AND MICROSTRUCTURES DEVELOPED BY SOLIDIFICATION AND SOLID-SOLID PHASE TRANSFORMATIONS

(see also 61. Structure of liquids and solids 64.70 Phase equilibria, phase transitions, and critical points)

103106 Development and application of growth models for grain boundary allotriomorphs of a stoichiometric compound in ternary systems. T.Ando (Colorado School of Mines, Golden, CO, USA), G.Krauss.
Metall. Trans. A (USA), vol.14A, no.7, p.1261-9 (July 1983).
A model for the isothermal growth of grain boundary allotriomorphs of a stoichiometric phase, $(M, N)_aI_b$, with a nonsingular interface in a ternary M-N-I matrix is developed. The element I is assumed to diffuse orders of magnitude faster than element N. The growth model assumes two initial no-partition growth stages and a subsequent partition growth stage with respect to element N. Both planar and spherical film geometries of allotriomorphs are considered. Strict mass balance conditions are taken into account so that the model can be used in rigorous computer simulations. A method to correct the allotriomorph thickness for the specific volume difference of the matrix and the precipitate is also shown. The growth of cementite allotriomorphs in Fe-Cr-C austenite is computer-simulated with the developed growth model. Interfacial concentration terms were calculated by programming the Sharma-Purdy-Kirkaldy regular solution model for the Fe-Cr-C system. (25 refs.)

103107 Kinetics of nitrogen dissolution in high-chromium melts of the iron chromium system. S.V.Bezobrazov, A.G.Ponomarenko, V.I.Khyakkinen.
Russ. Metall. (GB), no.4, p.36-41 (1981). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.4, p.45-50 (1981). [received: June 1983]
A decrease in the oxygen current of liquid ferrochrome (60% Cr) from 0.20 to 0.07% increases the rate of dissolution of nitrogen in ferrochrome by more than five times. The dissolution of nitrogen is greatly reduced if the alloy contains more than 0.12-0.15% oxygen. An increase in the temperature of the metal accelerates the dissolution of nitrogen. The rate of absorption of nitrogen by ferrochrome depends on the crucible material. In a MgO crucible, this rate is higher than in an Al_2O_3 crucible. In a silica crucible, ferrochrome does not absorb nitrogen. For any oxygen content of the alloy, the rate of dissolution of nitrogen in the alloy is described by a first-order kinetic equation. (23 refs.)

103108 Effects of coherency constraints on phase equilibria. J.W.Cahn (Center for Materials Sci., NBS, Washington, DC, USA), F.C.Larche.
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.311-14
Discusses the differences between coherent and incoherent phase equilibria. Observations of what phases exist in coherent equilibrium lead to fields whose boundaries could be depicted on phase diagrams, while observations of compositions of coherently coexisting phases will show that they depend on volume fractions and thus are not easily depicted in phase diagrams. The authors suggest that the phase diagram show only coherent diagram lines that depict boundaries between fields in which there are different sets of coexisting phases. (3 refs.)

Crystallization of the metallic glass $Fe_{80}B_{12}Si_8$ .... See Entry 101567

Characterization of the current-blackening phenomena in scandia stabilized zirconia using transmission electron microscopy .... See Entry 101647

The simulation of spinodal decomposition in two dimensions: a comparison of Monte Carlo and Langevin dynamics .... See Entry 101981

Phase relationships for adsorbed layers on surfaces .... See Entry 102143

Spinodal decomposition and magnetic properties of Fe-Cr-12Co permanent magnet alloys .... See Entry 102707

81.30B Phase diagrams of metals and alloys

103109 δ-γ phase equilibria in iron-rich iron-chromium-nickel alloys at temperatures between 1200 and 1350°C. R.Mundt, H.Hoffmeister (Lab. fur Werkstoffkunde und Schweisstech., Hochschule der Bundeswehr, Hamburg, Germany).
Arch. Eisenhuettenwes. (Germany), vol.54, no.6, p.253-6 (June 1983).
The δ-γ phase equilibria of iron-rich iron-chromium-nickel alloys with 23 to 38% Cr, 7 to 22% Ni are established at temperatures from 1200 to 1350°C. The effect of chemical compositions and annealing temperatures on equilibrium δ ferrite fraction is discussed. (12 refs.)

103110 Estimation of T_0-curves from existing phase diagrams. L.Katgerman (Dept. of Metals Sci. & Technol., Delft Univ. of Technol., Delft, Netherlands).
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.444-6 (Aug. 1983).
The authors show that by application of the regular-solution approximation together with solidus and liquidus compositions from the phase diagram reliable estimations of T_0-curves can be made which can be used in the rapid solidification research to predict formation of non-equilibrium states or diffusionless solidification. (12 refs.)

103111 Phase equilibria and thermodynamic data for the Cu-S system. A.T.Dinsdale, T.G.Chart, T.I.Barry (Div. of Materials Applications, NPL, Teddington, England), J.R.Taylor.
High Temp.-High Pressures (GB), vol.14, no.6, p.633-40 (1982). [received: June 1983] (International Conference on Chemistry of Materials at High Temperatures, Harwell, Oxon., England, 7-10 Sept. 1981).
Phase diagrams of metal-sulphur systems are required for an understanding of the processes involved in the extraction of metals from sulphide ores. The techniques used for the calculation of multicomponent alloy phase diagrams from thermodynamic data of binary systems are now well established. However, for metal-sulphur systems the representation of the thermodynamic properties as a function of composition must take account of the ordering induced by the strong interactions between the component elements. A partial assessment of the Cu-S system is presented which uses a two-sublattice description for the properties of the liquid phase. The application of these results to the calculation of the Cu-Fe-S phase diagram is described briefly. (49 refs.)

103112 Precipitation in a Cu-20%Ni-8%Sn alloy and the phase diagram of the Cu-Ni rich Cu-Ni-Sn system. M.Miki, Y.Ogino (Dept. of Materials Sci., Himeji Inst. of Technol., Himeji, Japan).
J. Jpn. Inst. Met. (Japan), vol.47, no.7, p.602-10 (July 1983). In Japanese.
The precipitation sequence in a Cu-20 mass%Ni-8mm mass%Sn alloy on aging at temperatures between 623 and 723K after quenching from 1123K and the equilibrium phase diagram at 823K of the Cu-Ni rich Cu-Ni-Sn system were investigated by means of optical and electron microscopic observations, X-ray analysis and hardness measurements. The equilibrium precipitate phase in a Cu-20%Ni-8%Sn alloy was δ phase (β-Cu_3Ti type) with the lattice parameters of $a=0.451$, $b=0.538$ and $c=0.427$ nm. The precipitation sequence of the alloy is given. The values of apparent activation energy for intragranular and cellular precipitation of this alloy are 170 and 180 kJ/mol, respectively. The phase boundaries among $(\alpha+\gamma(DO_3))$, $(\alpha+\gamma+\delta)$, $(\alpha+\delta)$, $(\alpha+\delta+\theta(DO_{19}))$ and $(\alpha+\theta)$ regions at 823K in the Cu-Ni rich Cu-Ni-Sn system were determined. (32 refs.)

103113 Computer calculation of ternary phase diagrams. Seh Kwang Lee, Dong Nyung Lee.
J. Korean Inst. Met., vol.21, no.4, p.371-9 (April 1983). In Korean.
A computer program has been developed which is capable of calculating phase boundaries in a ternary system with multiple phases when binary thermodynamic data are known. The important features of the program are as follows: (1) The binary data are expressed in the form of Redlich-Kister equation or Legendre polynomial (2) The ternary free energy of mixing is calculated using three different model equations which are equivalent to Kohler, Toop and the shortest distance composition path equations. (3) The phase boundary is determined by minimizing the ternary free energy of mixing using simplex and hill-climbing methods. The calculated phase diagrams of the Co-Ni-Fe system at 873K and 1073K and of the Cr-Ni-Fe system at 1373K are discussed in comparison with the measured ones. (26 refs.)

103114 Calculation of the partial molar properties of ternary alloys from binary data using the shortest distance composition path. Dong Nyung Lee, Seh Kwang Lee (Dept. of Metallurgical Engng., Seoul Nat. Univ., Seoul, Korea).
Scr. Metall. (USA), vol.17, no.7, p.861-6 (July 1983).
Two expressions for the excess partial molar free energy of mixing in ternary solutions derived by Jacob and Fitzner (1977) and Lee (1982) based on the shortest distance composition path are not the same. The Lee equation only is consistent with the expression for the integral property derived on the basis of the same composition path. The activities in the Bi-Cd-Pb system at 773K, the Sn-Cd-Pb system at 773K, the Ag-Pb-Au system at 1200K and the As-Sn-Pb system at 1073K calculated using the Lee equation are in better agreement with the measured ones than values determined using the Kohler (1960) and the Toop (1965) equations. (17 refs.)

103115 Simple solution approaches in phase diagram evaluation. L.Kaufman (ManLabs Inc., Cambridge, MA, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.105-6
Summary form only given. A brief review of approaches to phase diagram evaluation since 1966 is presented. Includes the prediction of regular solution interaction parameters from simple models, and lattice stability via computer methods to calculate binary and ternary phase diagrams. (19 refs.)

103116 Coherent phase diagrams in the cluster variation approximation. D.De Fontaine (Dept. of Materials Sci. & Mineral Engng., Univ. of California, Berkeley, CA, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.149-62
Coherent phase diagrams are defined as pertaining to equilibria between phases which differ from one another merely by the distribution of different types of atoms on fixed crystallographic sites. Resulting ordered structures must then all be superstructures of one parent lattice, and corresponding phase diagrams are isomorphous to those of the Ising model with non-vanishing magnetic field. Rather complex phase diagrams can then be obtained from a single free energy functional by means of the cluster variation method. Calculated phase diagrams will be shown for the case of the FCC parent lattice with various positive and negative ratios of the values of second-to-first-neighbor pair interactions, this ratio being the only parameter which enters the calculation. Results will be compared to those of Monte Carlo calculations. (28 refs.)

103117 The mutual influence of magnetic and chemical ordering. G.Inden (Max-Planck-Inst. fur Eisenforschung GmbH, Dusseldorf, Germany).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.175-88
Model calculations are presented involving the mutual influence of magnetic and chemical ordering reactions in binary alloys. The critical temperatures in Fe-Si, Fe-Al and Co-Pt alloys are discussed on the basis of the model calculations. An empirical formulation of the ordering part of the specific heat capacity is used to calculate the phase equilibria in Fe-Si and Fe-Al alloys. (38 refs.)

103118 Magnetic ordering and phase separation in binary alloys with one magnetic component. J.L.Moran-Lopez (Dept. de Fisica, IPN, Mexico City, Mexico).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.189-93
Magnetic ordering and phase separation in binary alloys with one magnetic component are studied within the mean field approximation. The influence of ferromagnetic ordering on the phase separation temperature (T_{CS}) is examined in detail. In general it is found that magnetism increases T_{CS} and causes strong asymmetries in the phase diagram. In particular, it is found that in systems with only ferromagnetic interactions, the Curie temperature (T_{CM}) and T_{CS} are the same. Results for the phase diagrams and for the temperature dependence of the magnetic and spatial order parameters are presented. (7 refs.)

103119 A thermodynamic approach to the calculation of the C-Cr-Nb-Ni-W phase diagram. P.Y.Chevalier, J.N.Barbier, I.Ansara (Lab. de Thermodynamique et Physico-Chimie Metall., ENSEEG, Saint Martin D'Heres, France).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.211-16
The phase boundaries of the C-Cr-Nb-Ni-W system are calculated from the available thermodynamic properties of the limiting binary systems. The methods of calculation and the models used in the description of the ternary and quaternary systems are presented as well as the influence of tungsten on the solubility of the $M_{23}C_6$ phase in the nickel rich alloys. (9 refs.)

103120 Relationships between phase diagrams, the T_0 and T_n temperatures, cooling rates and glass forming ability. T.B.Massalski, C.G.Woychik (Dept. of Metall. Engng. & Materials Sci., Carnegie-Melon Univ., Pittsburgh, PA, USA), J.L.Murray.
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.241-7
Models are constructed of the crystallisation process competing with glass formation in alloy systems. The depression of the nucleation temperature by rapid cooling is discussed. The nucleation model is applied to a $Cu_{50}Ti_{50}$ alloy. (10 refs.)

103121 Thermodynamic factors in the extension of solid solubility in Al-based alloys. J.L.Murray (Metall. Div., NBS, Washington, DC, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.249-62
Stable and metastable equilibrium diagrams and T_0 curves are calculated for the Al-based binary systems Al-Ga, Al-Ge, Al-Fe, Al-Mg, and Al-Si. Extended solid solubilities and metastable phases have been produced by rapid solidification for each of these systems, and the calculations are compared to experimental observations. (33 refs.)

103122 Crystal chemistry of metastable alloy phases. B.C.Giessen (Dept. of Chem., Northeastern Univ., Boston, MA, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.263-4
Summary form only received. Metastable alloy phases that can be prepared by rapid liquid quenching are discussed. The phase diagram representation of metastable phases is examined. Examples of ordered and disordered metastable alloy phases are given. (15 refs.)

103123 Paraequilibrium and other restricted equilibria. M.Hillert (Div. of Phys. Metall., Royal Inst. of Technol., Stockholm, Sweden).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.295-310
After a review of the historic development of the concept of paraequilibrium in the field of alloy steels, the basic principles of restricted thermodynamic equilibrium at a migrating interface during phase transformaions are outlined. As a demonstration they are first applied to classical nucleation. In addition to the case of paraequilibrium they are then applied to adiabatic and to isochoric conditions. It is argued that a full equilibrium model, with a spike of the intensive property in front of the migrating interface may be more realistic. It is shown that the full equilibrium conditions require about twice as much undercooling or underpressure as the restricted equilibrium conditions because of the consumption of driving force in the spike. The concept of restricted equilibrium only applies to heterogeneous phase transformations. For homogeneous reactions, the same experimental conditions will give full equilibrium. (24 refs.)

Alloy Phase Diagrams. Proceedings of a Symposium .... See Entry 98652

Phase diagrams [of titanium alloys] .... See Entry 98665

Metallic glass formation diagrams .... See Entry 101589

Lattice energy functions for predictions of structural properties of alloy phases ....See Entry 101625

Phase diagram features associated with multicritical points in alloy systems ....See Entry 101904

Ab-initio calculations of phase diagrams of binary simple-metal alloys ....See Entry 101912

Cohesion, compound formation and phase diagrams from first principles ....See Entry 101913

Theory of surface effects in binary alloys ....See Entry 101914

Quantitative predictions from solid-state physics—what do phase diagram calculators want? ....See Entry 101915

Structural maps and parameters important to alloy phase stability ....See Entry 101916

The representation of thermodynamic properties in multicomponent alloys ....See Entry 102012

The sublattice model ....See Entry 102013

Mathematical representation of size and electronic factors ...See Entry 102014

A pair-wise interaction model for multi-sublattice phases ......See Entry 102015

Association model for liquid alloys ....See Entry 102016

Prediction of solid+liquid equilibrium diagrams for binary mixtures forming solid solutions with an extremum ....See Entry 102017

Computer simulation on the structure solidified by rapid cooling for Al-Pb alloys ....See Entry 103132

Metastable phases in rapidly solidified aluminum-rich Al-Fe alloys ....See Entry 103138

Phase stability in rapidly solidified iron and nickel-base alloys ....See Entry 103139

Computer simulation on the reduction of gravity segregation for Al-Pb alloys by the rapid solidification method ....See Entry 103159

81.30D Phase diagrams of other materials

103124 Thermodynamics of Na_2CO_3-$CaCO_3$-CaO slags for use in hot metal refining. P.Taskinen (Helsinki Univ. of Technol., Inst. of Process Metall., Espoo, Finland), D.Janke.
Arch. Eisenhuettenwes. (Germany), vol.54, no.5, p.175-80 (May 1983).
Measurements are made on the solubility of $CaCO_3$ and CaO in molten Na_2CO_3-$CaCO_3$ mixtures at 950-1400°C and $p_{CO_2}=1$ bar. The solution thermodynamics of Na_2CO_3-$CaCO_3$ slags are discussed for use in the refining of hot metal. (23 refs.)

103125 Calculation of quasibinary and quasiternary oxynitride systems. L.Kaufman, F.Hayes, D.Birnie (ManLabs Inc., Cambridge, MA, USA).
High Temp.-High Pressures (GB), vol.14, no.6, p.619-31 (1982). [received: June 1983] (International Conference on Chemistry of Materials at High Temperatures, Harwell, Oxon., England, 7-10 Sept. 1981).
Phase diagrams for the quasibinary systems Si_3N_4-SiO_2, Y_2O_3-Si_3N_4, Y_2O_3-SiO_2, Ce_2O_3-Si_3N_4 and Ce_2O_3-SiO_2 are recalculated to illustrate a method by which these and more complex equilibria can be elucidated from thermodynamic data. New results for the quasiternary systems SiO_2-MgO-Si_3N_4, SiO_2-Y_2O_3-Si_3N_4, and SiO_2-Ce_2O_3-Si_3N_4 are derived from these phase diagrams and presented as component pairwise equilibria and complete isothermal sections of the appropriate ternary phase diagrams. These sections are compared with experimental data from the literature, and good agreement was obtained in the cases of SiO_2-MgO-Si_3N_4 and SiO_2-Ce_2O_3-Si_3N_4. (13 refs.)

103126 Study of the PbTe-Tl_2Te system. Evidence of a phase derived from Tl_5Te_3. R.Chami, J.-C.Tedenac, G.Brun, M.Maurin (Univ. Sci. & Tech. du Languedoc, Montpellier, France).
Mater. Res. Bull. (USA), vol.18, no.7, p.803-8 (July 1983). In French.
The thallium-lead tellurium system has been investigated by thermal analysis and X-ray diffraction methods. The cross-section PbTe-Tl_2Te seems to be a quasibinary one. An intermediate phase of stoichiometry Tl_4PbTe_3 has been evidenced. This phase, which decomposes peritectically at 594°C, and its stannous homologous, has been studied by comparison with Tl_5Te_3. (10 refs.)

103127 $V_{3.2}W_{1.8}O_{13}$ and studies of the V_2O_5-WO_3-VO_2 ternary system. R.J.Cava, D.J.Kleinman, S.M.Zahurak (Bell Labs., Murray Hill, NJ, USA).
Mater. Res. Bull. (USA), vol.18, no.7, p.869-73 (July 1983).
The tungsten/vanadium ratios for the known ternary compounds in the V_2O_5-WO_3-VO_2 chemical system are characterized. The compounds $V_{2.5}W_{0.5}O_7$ and $V_2WO_{7.5}$ are the $n=m=3$ and $m=m=4$ members of a series of M-niobia like crystallographic shear structures. The authors have found the $n=m=5$ member of the series at the composition $V_{3.2}W_{18}O_{13}$, and report its crystallographic unit cell, powder X-ray diffraction pattern and range of temperature stability. (11 refs.)

103128 Phase equilibria in the Mn-Fe-O system in CO_2-H_2 mixtures. K.Terayama, M.Ikeda (Dept. of Metall., Toyama Univ., Toyama, Japan), M.Taniguchi.
Trans. Jpn. Inst. Met. (Japan), vol.24, no.7, p.514-17 (July 1983).
In order to establish the detailed phase equilibria of the Mn-Fe-O system, a manganese ferrite, $MnFe_2O_4$ was studied at several temperatures between 1153 to 1273K by varying the oxygen partial pressures. The thermogravimetric and quenching methods were adopted, and the oxygen partial pressures in an atmosphere of a CO_2-H_2 mixture were measured by means of a solid electrolyte cell which was composed of $(ZrO_2)_{0.85}(CaO)_{0.15}$. A wide nonstoichiometric range is seen in the phase of $MnFe_2O_4$, where the value of x in MnO.2(FeOx) ranges from 1.360 to 1.500 at 1153K. The solid solution, which is stable in the oxygen partial pressures between $10^{-13.2}$ to $10^{-15.8}$ Pa at 1153K, is converted into a mixture of MnO and metallic iron at much lower oxygen pressures. (14 refs.)

On the structure and properties of beryllium fluoride glasses containing CoF_2 ....See Entry 101561

Hydrogen solubility in $Pd_{100-x}Si_x$ metallic glasses and the phase diagram of Pd-Si-H glasses ....See Entry 101588

81.30F Solidification

(see also 64.70D Solid-liquid transitions)

103129 Influence of melt flow on the growth directions of columnar grains and columnar dendrites. K.Murakami, T.Fujiyama, A.Koike, T.Okamoto (Inst. of Sci. & Industrial Res., Osaka Univ., Osaka, Japan).
Acta Metall. (USA), vol.31, no.9, p.1425-32 (Sept. 1983).
Aluminum-copper alloys containing 0.5 to 3.9 mass% Cu were unidirectionally solidified in flowing melt at flow rates ranging from 4 to 40 cm/s and the deflection angle of the crystal growth direction in the upstream direction was measured as functions of the flow rate and the copper content. The mode of the crystal growth is equivalent to one in which crystals encounter a fluid flow after having grown some distance in a stagnant melt. Although deflection angles for both columnar grains and columnar dendrites composing the grain increase with increasing flow rate, they show different dependence on the flow rate and on the copper content. (20 refs.)

103130 Examination of M_7C_3 carbides in high chromium cast irons using thin foil transmission electron microscopy. J.T.H.Pearce (Dept. of Metall., West Bromwich Coll. of Commerce & Technol., Wednesbury, England).
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.428-32 (Aug. 1983).
Both as-cast and heat treated structures have been examined by thin foil transmission electron microscopy. Some initial observations are presented on the eutectic and secondary M_7C_3 carbides. (8 refs.)

103131 A schematic mechanism for striated growth of solid binary mixtures. B.Caroli, C.Caroli, B.Roulet (Ecole Normale Superieure, Univ. Paris VII, Paris, France).
J. Phys. (France), vol.44, no.8, p.945-51 (Aug. 1983).
It is shown, on the basis of a schematic model derived from that set up for the growth of plagioclase rocks by Haase et al. (1980), that the interplay between diffusional transport and two slow molecular attachment kinetics in non-linear competition is sufficient to account for the possibility of striated growth (i.e. growth of a solid binary mixture with planar periodic composition oscillations in the growth direction). (8 refs.)

103132 Computer simulation on the structure solidified by rapid cooling for Al-Pb alloys. T.Ikeda (Production Systems Engng., Toyohashi Univ. of Technol., Toyohashi, Japan), S.Nishi.
J. Jpn. Inst. Met. (Japan), vol.47, no.7, p.631-8 (July 1983). In Japanese.
The development of a software was carried out for the solidification phenomenon of rapid cooling. The computer simulation by the software can estimate the effect of the solidification by rapid cooling and the solidified structure for Al-2 to 8 mass%Pb alloys. An outline of the simulation is given. The cooling process by successive temperature steps was applied to the continuous cooling process in the solidification. The solidification and reaction process were analyzed by four proposed models. In the phase separation reaction, $L_1 \rightarrow L_2{}^2+(L_1)$, spherical liquid phases $L_2{}^s$ of CH%Pb are randomly distributed throughout the liquid phase L_1 of CL%Pb, and the liquid L_1 around the $L_1/L_2{}^s$ interface can be supercooled by ${}^i\Delta T_1$. A total amount of the liquid $L_2{}^s$ increases as the coarsening and sifting-out growth proceed. In the monotectic solidification, $L_1 \rightarrow Al+L_2{}^m+(L_1)$, the solid phase aluminium is nucleated in the liquid L_1 supercooled by ΔT_m due to rapid cooling. (13 refs.)

103133 An analysis of the solidification of a binary eutectic system in consideration of both heat and solute diffusion. K.Takeshita (Dept. of Mech. Engng., Fukui Univ., Fukui, Japan).
J. Jpn. Inst. Met. (Japan), vol.47, no.7, p.647-53 (July 1983). In Japanese.
The solidification problem of a binary eutectic alloy has been treated taking both heat and solute transport into account. A numerical solution for the freezing region is matched at two moving boundaries, through a simplex method for function minimisation, with analytical solutions obtainable for a pure solid or a pure liquid region. As the results of calculation, it is possible to obtain the amount of solute diffusing toward the pure liquid region, the temperature profiles within the regions, the velocities of two moving boundaries and the distribution of solid fraction within the freezing region. The results of calculation are compared with the experimental results of solidification using the H_2O-NH_4Cl eutectic system. (7 refs.)

103134 Microstructural origin of the skeletal ferrite morphology of austenitic stainless steel welds. J.A.Brooks (Sandia Nat. Labs., Livermore, CA, USA), J.C.Williams, A.W.Thompson.
Metall. Trans. A (USA), vol.14A, no.7, p.1271-81 (July 1983).
Scanning transmission electron microscopy (STEM) was conducted on welds exhibiting a variety of skeletal, or vermicular ferrite morphologies in addition to one lathy ferrite morphology. These ferrite morphologies result from primary ferrite solidification followed by a solid state transformation upon cooling. During cooling, a large fraction of the ferrite transforms to austenite leaving a variety of ferrite morphologies. Comparison of composition profiles and alloy partitioning showed both the skeletal and lathy ferrite structures result from a diffusion controlled solid state transformation. However, the overall measured composition profiles of the weld structure are a result of partitioning during both solidification and the subsequent solid state transformation. (31 refs.)

103135 Microstructure and mechanical properties of rapidly quenched $L1_2$ alloys in Ni-Al-X systems. A.Inoue (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan), H.Tomioka, T.Masumoto.
Metall. Trans. A (USA), vol.14A, no.7, p.1367-77 (July 1983).
Ductile $L1_2$-type γ' compounds with rather high strengths and large elongations have been found in rapidly quenched Ni-Al-X (X=Cr, Mn, Fe, Co, or Si) ternary systems. The γ' compounds consist of a metastable phase which contains numerous antiphase domains (APDs) with a size as small as about 50 to 75 nm. Further, the ductile γ' wires with circular cross section have been manufactured directly from the liquid state by an in-rotating-water spinning method. The H_v, σ_y, σ_f, and ϵ_p of the γ' wires are about 240 to 400 DPN, 390 to 590 MPa, 580 to 910 MPa, and 4 to 10 pct, respectively, for Ni-Al- (Cr, Fe, Co, or Si) systems and about 220 DPN, 260 MPa, 440 MPa, and 27 pct, respectively, for the Ni-Al-Mn system. A cold drawing causes a significant increase in σ_y and σ_f and the attained values are about 2450 MPa and 2480 MPa, respectively, for Ni-20Al-10Cr wire drawn to about 90 pct reduction in area. Around the temperatures where the antiphase boundaries (APBs) disappear on annealing, the H_v, σ_y, σ_f, and ϵ_p of the γ' wires decrease significantly accompanied with a drastic change in fracture surface morphology from a transgranular type to an intergranular type. It has been therefore inferred that the high strengths and good ductility of the melt-quenched γ' compounds are due to the structural changes to a low degree of ordered state containing a high density of APB and the suppression of grain boundary segregation. (9 refs.)

103136 Influence of solidification parameters on mechanical properties and thermal stability of Fe-Ni-B metallic glasses. U.Koster (Univ. Dortmund, Dortmund, Germany), U.Herold, H.-G.Hillenbrand.
Scr. Metall. (USA), vol.17, no.7, p.867-72 (July 1983).
Results are presented on the influence of the solidification parameter on ribbon surface topography, mechanical properties and crystallization behaviour of Fe-Ni-B glasses. The effects are considered of quenching wheel surface velocity u, melt temperature T_m and pressure conditions during casting. (15 refs.)

103137 Use of metastable phase diagrams in rapid solidification. J.H.Perepezko (Dept. of Metall. & Mineral Engng., Univ. of Wisconsin, Madison, WI, USA), W.J.Boettinger.
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.223-40
During rapid solidification, the nucleation and/or growth of a thermodynamically stable phase may be difficult. In this case the liquidus, solidus or other thermodynamic data for a metastable phase are important for the interpretation and prediction of the phases present in rapidly solidified materials. Various techniques are described to obtain information about metastable equilibrium from measured stable equilibrium data. Extrapolations of phase boundaries as functions of temperature, pressure or composition (including a new component) into regions of metastability can often be constructed directly on the equilibrium diagram. These constructions can be performed more quantitatively with analytical methods using thermodynamic modelling of the free energy functions consistent with measured data. A number of examples are considered including a discussion of metastable liquid miscibility gaps, metastable eutectic and peritectic reactions, pressure diagrams and metastability in ternary alloys to indicate the possible product phase selection. A coupling of metastable phase diagrams with a solidification kinetics analysis can contribute towards effective alloy design and processing during rapid solidification. (52 refs.)

103138 Metastable phases in rapidly solidified aluminum-rich Al-Fe alloys. D.Shechtman (Johns Hopkins Univ., Baltimore, MD, USA), L.J.Swartzendruber.
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.265-8
Aluminium-rich Al-Fe binary alloys up to and including Al_3Fe were prepared by melt spinning in order to study the metastable phase structure and its transformation following heat treatment. Transmission electron microscopy and nuclear gamma-ray resonance were utilized in the study. The rapidly solidified structure was found to contain up to three metastable phases. One of the phases, with a composition and a gamma-ray resonance spectrum appropriate for Al_6Fe, has either a globular or a cellular morphology upon quenching. (4 refs.)

103139 Phase stability in rapidly solidified iron and nickel-base alloys. J.Wood (Faculty of Technol., Materials Sci., Open Univ., Milton Keynes, Endland).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.269-75
The structure of a large range of model steels and high speed steels after rapid solidification are described in terms of the effect of processing conditions and alloy content. General lessons are deduced for these structures regarding the stability of austenite, ferrite, $\propto'$ and ϵ martensite, and excess carbon concentrations in rapidly solidified steels and these are compared with other workers' results. Some preliminary data regarding the structure of model nickel alloys are presented in order to shed light on previously described structures of nickel superalloys. (26 refs.)

Metallic glass formation diagrams .... See Entry 101589

An analysis of the ribbon formation process by the single roller rapid solidification technique .... See Entry 103085

Estimation of T_0-curves from existing phase diagrams .... See Entry 103110

Crystal chemistry of metastable alloy phases .... See Entry 103122

X-ray diffraction analysis at high temperature on two ceramic systems .... See Entry 103141

Interdendritic fluid flow normal to primary dendrite-arms in cubic alloys .... See Entry 103151

Computer simulation on the reduction of gravity segregation for Al-Pb alloys by the rapid solidification method .... See Entry 103159

Deformation behavior of a 16-8-2 GTA weld as influenced by its solidification substructure .... See Entry 103228

Role of iron sulfide in the formation of solidification cracks in welding of electrical steel .... See Entry 103395

81.30H Constant-composition solid-solid phase transformations: polymorphic, massive, and order-disorder

(see also 64.70K Solid-solid transitions)

103140 Influence of various forming treatments of the metastable austenite on the transformation behaviour of steels with high carbon content in bainite and martensite. E.Schmidtmann, D.Wirths.
Arch. Eisenhuettenwes. (Germany), vol.54, no.6, p.231-8 (June 1983).
Investigates the influence of the carbon content of high-strength steels, the austenitizing temperature and the amount of plastic deformation before transformation on the shape and size of bainite and martensite. The change of the M_s temperature and incubation times of the bainite treatment are discussed along with the influence on structure and residual austenite content. (28 refs.)

103141 X-ray diffraction analysis at high temperature on two ceramic systems. A.Benedetti, G.Fagherazzi (Istituto di Chimica Fisica, Univ. Ca Foscari, Venezia, Italy), S.Meriani.
J. Mater. Sci. (GB), vol.18, no.8, p.2510-16 (Aug. 1983).
The β-eucryptite/β-spodumene phase transition in glass fibres of a SiO_2-Al_2O_3-Li_2O-MgO-ZnO-K_2O-P_2O_5 system and the crystallization of a ZrO_2-CeO_2 solid solution have been studied in situ, at high temperature, using a special home-made thermal attachment for X-ray powder vertical diffractometers. The β-eucryptite/β-spodumene transition was observed in the temperature range between 865 and 930°C. A significant unit cell shrinkage was observed for β-eucryptite from which it is possible to conclude that the first crystallized phase is surely an eucryptite-silica solid solution. This agrees with the small thermal effect shown by DTA for this crystalline transition. With the same high temperature attachment the evolution of the average crystallite size, L_{111}, was followed as a function of the thermal treatment in a 0.84 ZrO_2-0.16 CeO_2 tetragonal structured solid solution. (18 refs.)

103142 Phase transformation and magnetic properties of Mn-Al-C permament magnets. Su-Hong Park (Dept. of Metall. Engng., Yonsei Univ., Seoul, Korea), Chan-Young, So Dong-Hi Lee.
J. Korean Inst. Met., vol.21, no.4, p.401-6 (April 1983). In Korean.
The specimens had compositions of 70 wt.% Mn, 28-29 wt.% Al and three different carbon contents (0.48 wt.%, 0.92 wt.%, 1.24 wt.%). After being solutionized at 1100°C for 3 hr, the specimens were quenched into oil maintained at room temperature and then annealed in a salt bath for the various period of time at the predetermined temperatures ranging from 400°C to 700°C. Their phase transformations and magnetic properties were investigated. The specimen with 0.48 wt.%C showed the best magnetic properties when annealed for 60 to 120 min. at 550°C. It was believed that the ϵ to τ phase transformation was overshadowed by the decomposition of τ into β-Mn and γ phase. The specimen with 1.24 wt.%C which is more than two times of carbon solubility of τ phase (0.48 wt.% C), showed the highest values of $(BH)_{max}$ when compared with the others. The reason for it is believed to be resulted from a particular morphology of carbide precipitates, i.e. repeated lamellar structures of Mn_3AlC in the τ phase. This type of structure seems to inhibit the decomposition process of τ phase to β-Mn phase in addition to the negative effct on the domain wall motion in that phase by pinning it. (10 refs.)

103143 Influence of microstructure on the alpha-gamma transformation of iron. A.Couture (Dept. of Mining & Metall., Laval Univ., Quebec, Canada), R.Angers.
Metall. Trans. A (USA), vol.14A, no.7, p.1511-12 (July 1983).
Observations about the influence of grain size on the alpha-gamma transformation of iron are reported. The observations were made on cylindrical Armco iron samples thermally cycled through the transformation between 870 and 964°C at the rate of 0.12°C per second in a DTA apparatus. (37 refs.)

103144 Ferrite formation in heterogeneous dual-phase steels. H.K.D.H.Bhadeshia (Dept. of Metall. & Materials Sci., Univ. of Cambridge, Cambridge, England).
Scr. Metall. (USA), vol.17, no.7, p.857-60 (July 1983).
Many properties of dual-phase steels depend on the volume fractions V and $(1-V)$ of ferrite (α) and martensite, respectively, in the microstructure. The desired microstructure can be obtained by the isothermal transformation of austenite (γ) in the $\alpha+\gamma$ phase field, followed by rapid cooling to ambient temperature so that any remaining γ decomposes martensitically. An investigation was made of the paraequilibrium formation of ferrite in 'banded' Fe-Mn-C steels, i.e. steels which are compositionally heterogeneous, as is usually the case in commercial practice. (4 refs.)

A model of thermo-mechanical behaviour of metals with phase changes .... See Entry 101081

Temperature dependence of lattice parameters and FCC/FCT/FCO transformations in some Mn-base metastable γ-phase alloys .... See Entry 101637

Ion mass effects on bombardment-induced disordering of γ'-Ni_3Si .... See Entry 101806

Compositional changes in Fe-Cr-Ni alloys under proton bombardment at elevated temperatures .... See Entry 101807

Effects of pulsed dual-ion irradiation on phase transformations and microstructure in Ti-modified austenitic alloy .... See Entry 101809

Theory of surface effects in binary alloys .... See Entry 101914

Phase transitions and order parameters .... See Entry 101963

Thermodynamic analysis of miscibility gap due to ordering in ternary systems .... See Entry 101975

Effect of wet milling and cobalt powders on the phase transformation and morphology of the cobalt .... See Entry 103102

Phase equilibria and thermodynamic data for the Cu-S system .... See Entry 103111

Paraequilibrium and other restricted equilibria .... See Entry 103123

Microstructural origin of the skeletal ferrite morphology of austenitic stainless steel welds .... See Entry 103134

New aspects on the appraisal of the cooling process during hardening of steel .... See Entry 103167

Flow stress of low carbon steels in the $(\gamma\rightarrow\alpha)$-transformation region .... See Entry 103208

Stress corrosion cracking susceptibility of SUS 304 stainless steel cathodically precharged with hydrogen .... See Entry 103379

81.30K Martensitic transformations

(see also 64.70K Solid-solid transitions)

103145 Thermodynamic condition for the formation of athermal martensite. D.A.Mirzaev (Lenin Komsomol Polytech. Inst., Chelyabinsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1228-30 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
It is shown that the thermodynamic condition for the formation of athermal martensite is somewhat different than that for isothermal martensite (crystals of the former appear in $\sim10^{-7}$ sec, which excludes the possibility of heat exchange in the course of the martensitic transition). The adiabatic term in the thermodynamic 'stimulus' is calculated for Fe-Ni alloys with nickel concentrations in the range 28-32 at.%. It is found that an increase in the nickel concentration reduces the adiabatic term because of a reduction in the thermal effect of the martensitic transition. (6 refs.) *A.T.*

103146 The effect of thermal cycling on the thermoelastic martensitic transformation in a Cu-Zn-Al alloy. Jian-Chun Li (Dept. of Materials Engng., Rensselaer Polytech. Inst., Troy, NY, USA), G.S.Ansell.
Metall. Trans. A (USA), vol.14A, no.7, p.1293-7 (July 1983).
The effect of thermal cycling between the M_f-A_f on the thermal hysteresis, temperature dependence, and the morphology of the martensitic transformation in a Cu-Zn-Al alloy was studied. The hysteresis behavior of the cyclic transformation, as characterized by following the change in electrical resistivity accompanying the transformation changed in two respects: First, the M_s and A_f temperature shifted to higher temperatures while the M_f and A_s temperatures remained constant. Second, the amount of martensite undergoing cyclic transformation decreased. These changes appeared to saturate at 300 cycles and could be partly recovered during room temperature aging. The morphology and mode of transformation also changed. During the first few cycles, transformation occurred in two simultaneous ways: (1) as martensite plates which are observed to grow and thicken in a continuous manner and (2) as plates which form in a 'burst' process. After 60 cycles no 'burst' type transformation occurred during cooling and plate growth and thickening was stepwise. (6 refs.)

103147 Effects of a pulsed high magnetic field on the M_s temperature and martensite morphology in an Fe-31.7 at.%Ni alloy. T.Kakeshita, K.Shimizu (Inst. of Sci. & Industrial Res., Osaka Univ., Osaka, Japan), T.Sakakibara, S.Funada, M.Date.
Scr. Metall. (USA), vol.17, no.7, p.897-900 (July 1983).
A study has been done to examine the morphology of martensites induced by a magnetic field and also to study the exact effect on M_s temperature in an Fe-Ni alloy. As a result of the study, different results have been obtained from those in Fe-Ni-C alloys, and the results are reported briefly. (6 refs.)

103148 Cooperative effects between γ'_1 and β'_1 martensites in a Cu-15.0 at.%Sn alloy. N.Kuwano, C.M.Wayman (Dept. of Metall. & Mining Engng., Univ. of Illinois, Urbana, IL, USA).
Trans. Jpn. Inst. Met. (Japan), vol.24, no.7, p.499-503 (July 1983).
Electron microscopy observations have been carried out to study some characteristics of martensites formed in a Cu-15.0 at.%Sn alloy which was subzero treated. It was found that an 18R-martensite (β'_1) is formed at the interface between the 2H-martensite (γ'_1) and the parent phase (β_1). The volume of the 18R-martensite increases upon heating. The β'_1 martensite appears to form as a result of stress-assistment from the γ'_1 martensite. The coexistence of the two martensites is believed to be a major cause of the sensitive dependence of the A_s and A_f temperatures upon the heating rate in this alloy. (11 refs.)

103149 Microstructural changes in an aged Cu-15 at.%Sn shape memory alloy. N.Kuwano, C.M.Wayman (Dept. of Metall. & Mining Engng., Univ. of Illinois, Urbana, IL, USA).
Trans. Jpn. Inst. Met. (Japan), vol.24, no.7, p.504-9 (July 1983).
Microstructural changes were studied by means of electron microscopy for a Cu-15.0 at.%Sn alloy aged at 373K or 323K. The as-quenched alloy was confirmed to consist of many small domains of an ω-like phase (designated as the s-phase) and a DO_3 matrix. It was observed that in the alloy aged at 373K another phase (designated as the L-phase) precipitates preferentially on dislocations and coarsens to larger than 0.2 μm in diameter. In the alloy aged at 323K the L-phase was formed, but then decomposed into small irregular segments upon subsequent aging. After aging below 323K for a prolonged time, both the s- and L-phases underwent alteration to a transitional phase which showed additional extra diffraction spots. The precipitation of the L-phase is believed to be responsible for the decrease in the martensite transformation temperature (M_s) upon aging. (15 refs.)

Influence of various forming treatments of the metastable austenite on the transformation behaviour of steels with high carbon content in bainite and martensite .... See Entry 103140

A peculiar austenite stabilization phenomenon in an ausaged Fe-Ni-Ti alloy .... See Entry 103187

Effects of SME cycle on the mechanical properties of the TiNi alloys .... See Entry 103219

Role of retained austenite of the deformation of an Fe-0.07 C-1.8 Mn-1.4 Si dual-phase steel .... See Entry 103234

Role of internal stress for continuous yielding of dual-phase steels .... See Entry 103236

Tempered martensite embrittlement in Fe-Mo-C and Fe-W-C steel .... See Entry 103310

81.30M Precipitation

(inc. segregation; see also 64.75 Solubility, segregation and mixing)

103150 Hydride precipitation in α/β zirconium alloys. V.Perovic (Dept. of Metall. & Materials Sci., Univ. of Toronto, Toronto, Canada), G.C.Weatherly, C.J.Simpson.
Acta Metall. (USA), vol.31, no.9, p.1381-91 (Sept. 1983).
The precipitation of δ-hydride ($ZrH_{1.5}$) in fine-grained α/β zirconium alloys has been studied. Both interphase and transgranular hydrides are observed, the mechanism of growth being dependent on the nature of the α/β interface. Macroscopic hydrides observed in the optical microscope are always composed of stacks of smaller hydride plates with habit planes close to the basal plane. The apparent habit plane of the macroscopic hydride plate is determined by the geometry of the stack. The stability of different hydride stacks is considered and the role of the texture of the alloy and of a stress (external or internal) acting on the basal planes in determining the orientation of the stacks is explained. (22 refs.)

103151 Interdendritic fluid flow normal to primary dendrite-arms in cubic alloys. K.Murakami, A.Shiraishi, T.Okamoto (Inst. of Sci. & Industrial Res., Osaka Univ., Osaka, Japan).
Acta Metall. (USA), vol.31, no.9, p.1417-24 (Sept. 1983).
The permeability of interdendritic space was measured using translucent borneol-paraffin organic binary alloys having columnar dendrites whose morphology is the same as that of metallic alloys of FCC and BCC. In the experiment, an aqueous solution containing a small amount of red ink and 25 vol.% surface active agent was allowed to flow normal to columnar dendrites and it was ascertained that the flow was uniform. The permeability was proportional to the square of the primary dendrite-arm spacing and to the cube of the fraction liquid. This relation is in good agreement with the prediction based on a model assuming the interdendritic space to be an assembly of interstices each of which has a slenderly rectangular section. (3 refs.)

103152 Discontinuous coarsening reaction in lamellar precipitated Cu-Be alloys. H.Tsubakino, R.Nozato (Dept. of Metall. Engng., Osaka Univ., Osaka, Japan).
Bull. Univ. Osaka Prefect. Ser. A (Japan), vol.31, no.2, p.183-95 (1982).
The cell growth kinetics in a discontinuous coarsening reaction associated with discontinuous precipitation in Cu-Be alloys containing 1.4 and 2.1 wt.% Be have been studied principally by quantitative metallographic measurements. After the discontinuous precipitation is nearly complete, discontinuous coarsening reaction with a much coarser interlamellar spacing begins at the original grain boundaries. The α phase in the cells produced by discontinuous precipitation is supersaturated at the initial ageing stage, but attains its equilibrium value prior to the occurrence of the discontinuous coarsening reaction. Cold work does not influence the cell growth of the discontinuous coarsening reaction. The driving force for the discontinuous coarsening reaction is the reduction in total interlamellar surface energy. Variations in growth rate and interlameller spacing of the discontinuous coarsening reactor with ageing time were discussed in relation to a continuous coarsening reaction which occurs in the cells produced by discontinuous precipitation. (20 refs.)

103153 On the precipitation of β phase from α Cu-Be solid solution. H.Tsubakino (Dept. of Metall. Engng., Osaka Univ., Osaka, Japan).
Bull. Univ. Osaka Prefect. Ser. A (Japan), vol.31, no.2, p.197-206 (1982).
The morphology and the rate of the precipitation of β phase from supersaturated α solid solution and also the coarsening rate of β precipitate particles in Cu-2.04 wt.% Be alloy have been studied in the temperature range 898 to 973K. The precipitation of β phase takes place by continuous mode. The rate of coarsening of β precipitate particles (rod-like shape) obeys the $t^{1/3}$-law (where, t is ageing time) and are controlled by volume diffusion of Be in α phase. (14 refs.)

103154 Calculation of precipitation behaviour in an alloy steel using a thermochemical data bank and the program 'SOLGASMIX'. R.Gallagher, P.J.Spencer (Lehrstuhl fur Metall., Rheinisch-Westfalisch Tech. Hochschule Aachen, Aachen, Germany).
CALPHAD: Comput. Coupling Phase Diagrams & Thermochem. (GB), vol.7, no.2, p.157-63 (April-June 1983).
The precipitates forming in an alloy steel at different carbon and nitrogen concentrations and at different temperatures have been calculated. The calculations have been carried out using the computer program SOLGASMIX in association with thermochemical values retrieved automatically from a data bank. The results provide information on the stabilities and amounts of the precipitated phases and also on the stoichiometry of the carbonitride phase $Nb(C_xN_y)$. (4 refs.)

103155 On solution-reprecipitation processes during liquid phase sintering of WC-Co. T.Schmitt, M.Schreiner, P.Ettmayer, E.Lassner, B.Lux (Inst. fur Chem. Technol. Anorganischer Stoffe, Tech. Univ. Wien, Wien, Austria).
Int. J. Refract. & Hard Met. (GB), vol.2, no.2, p.78-83 (June 1983).
Investigations were carried out on WC/Co hard metals with additions of coarse ($Mo_{0.4}W_{0.6}$) and Mo_2C powders. By means of the different solubilities of the three carbides in the Co binder, the grains could be shown to grow by a solution-reprecipitation process, phenomenologically similar to Ostwald ripening. The different etching behaviours of WC crystals with and without Mo and the analysis of the Mo and W distribution in the crystals with energy dispersive X-ray analysis supplied more information about chemical and structural changes in the crystals during the grain growth process. (31 refs.)

103156 X-ray diffraction investigation of the single-phase stage of precipitation of martensite. S.D.Prokoshkin, L.M.Kaputkina, M.L.Bernshtein, V.E.Mozzhukhin (Inst. of Steel & Alloys, Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1150-9 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
X-ray diffractometry was used to study changes in the crystal structure of quenched high-carbon steels during the single-phase stage of precipitation of martensite in the course of low-temperature tempering. Formation of the tempering martensite in crystals due to the elastic reaction of the surrounding matrix resulted in an anisotropic angular shift of the X-ray diffraction lines of the martensite, which could easily be explained by postulating the appearance of stacking faults along {112} planes. This shift was not observed in the absence of such an elastic reaction of the matrix (in the case of electrolytically isolated martensite). A tetragonal distortion of the tempering martensite lattice was solely due to the presence and an ordered distribution of carbon atoms. (22 refs.) *A.T.*

103157 Decomposition processes in Al-Zn-Mg alloys. H.Loffler (Pedagogical Univ., Halle, Germany), I.Kovacs, J.Lendvai.
J. Mater. Sci. (GB), vol.18, no.8, p.2215-40 (Aug. 1983).
Surveys the present knowledge of the mechanisms of decomposition processes in Al-Zn-Mg alloys. The various experimental observations connected with the formation and properties of the different second phase particles are described and critically analysed. The effect of different heat treatments, compositions, impurities, etc. on the different stages of the decomposition process is discussed in detail. (186 refs.)

103158 On the kinetics of discontinuous precipitation in Cu-Mg alloys. H.Tsubakino (Coll. of Engng., Univ. of Osaka Prefecture, Sakai, Japan), K.Wada, R.Nozato.
J. Jpn. Inst. Met. (Japan), vol.47, no.7, p.617-22 (July 1983). In Japanese.
The relation between the discontinuous precipitation and the continuous precipitation, and the kinetics of the discontinuous precipitation in Cu-Mg alloys containing 2.0, 2.6 and 3.2 mass%Mg have been investigated by metallographic observations and microhardness measurements. Variations in cell width and volume fraction of discontinuous precipitation cells with ageing time have been determined in the specimens aged at temperatures from 573K to 873K. The decomposition of Cu_2Mg from supersaturated solid solutions of magnesium in copper during ageing is initiated by a discontinuous precipitation and followed by a continuous precipitation. The cell growth is associated with the migration of a grain boundary. The cell growth rate decreases with ageing time progressively after the linear growth rate of cells. This decrease will be attributed to the influence of the continuous precipitation on the cell growth. The volume fraction of the discontinuous precipitation cells, f, can be represented by Johnson-Mehl type equation:$f=1-\exp(-bt^n)$, (where, t is the ageing time and b and n are constants). The value of the parameter n is 2 and independent of ageing temperature and alloy composition in the range of ageing time in which cell growth rates are constant. (14 refs.)

103159 Computer simulation on the reduction of gravity segregation for Al-Pb alloys by the rapid solidification method. T.Ikeda (Production Systems Engng., Toyohashi Univ. of Technol., Toyohashi, Japan), S.Nishi.
J. Jpn. Inst. Met. (Japan), vol.47, no.7, p.639-46 (July 1983). In Japanese.
The programme of this computer simulation was made by the introduction of new numerical calculation method on gravity segregation in the computer simulation on the structure solidified by rapid cooling for Al-Pb alloys. The control of the gravity segregation by rapid cooling and the formation process were investigated by the present computer simulation. A mechanism of the gravity segregation of Al-Pb alloys is considered as the falling phenomenon of growing L_2 liquid phase during the separation and coexisting reaction. The falling behavior of L_2 depended on density difference between L_1 and L_2 or growth of L_2 at elevated temperatures and the viscosity of L_1 at temperatures below about 1123K. The rapid solidification method could decrease the gravity segregation of high lead alloys. In low lead alloys, the method was rapid in cooling enough to prevent the gravity segregation. For cooling rates of 50K/s to 10^3K/s, the calculated condition for the prevention of the gravity segregation was in agreement with the experimental one. (11 refs.)

103160 The influence of cobalt, iron and aluminium on the precipitation of metastable phases in the Ni-Ta system. S.E.Axter, D.H.Polonis (Dept. of Mining, Univ. of Washington, Seattle, WA, USA).
Mater. Sci. & Eng. (Switzerland), vol.60, no.2, p.151-61 (Aug. 1983).
The precipitation of the $L1_2\gamma'$ phase or the $D0_{22}\gamma''$ phase in Ni-Ta alloys can be controlled by additions of either cobalt or combinations of iron and aluminium. The substitution of 27-29 at.% Co for nickel in a basic Ni-10 at.% Ta alloy leads to γ'' precipitation, whereas alloys containing 29-43 at.% Co exhibit the bimodal precipitation of both the γ'' and the γ' phases. Alloys containing more than 42.6 at.% Co exhibit only the f.c.c. γ' precipitate. Additions of iron to Ni-Ta promote the precipitation of the face-centered tetragonal γ'' phase whereas the addition of the aluminum favors γ' precipitation. Appropriate combinations of aluminum and iron permit the simultaneous precipitation of both the γ'' and the γ' metastable phases. The alloy compositions corresponding to the appearance of these phases either separately or together in the form of bimodal precipitation can be anticipated from electron theory considerations, thereby providing a basis for microstructure control and alloy design. (26 refs.)

103161 Discontinuous γ' coarsening in a Ni-Al-Mo base superalloy. A.W.Funkenbusch (United Technol. Res. Center, East Hartford, CT, USA).
Metall. Trans. A (USA), vol.14A, no.7, p.1283-92 (July 1983).
Discontinuous coarsening in a Ni-Al-Mo base superalloy was studied emphasizing the influence of grain boundary misorientation. Nucleation and growth rates were determined as a function of temperature, time, and degree of misorientation for ⟨001⟩ twist boundaries. Both nucleation and growth were controlled by grain boundary diffusion and increased with twist angle and temperature. Grain boundary diffusivities (calculated assuming reduced γ' (surface energy) as the driving force) were more than one order of magnitude greater than those reported for static boundaries of similar misorientation. Consideration of atomic jump frequencies in static and dynamic boundaries indicated that the high diffusivities cannot be attributed to motion enhanced grain boundary diffusion. Rather, the high calculated diffusivities are interpreted to indicate the presence of additional driving forces for discontinuous coarsening in the Ni-Al-Mo base superalloys. Potential sources of additional driving force are presented. (22 refs.)

103162 Ageing study of magnesium oxide precipitates in a silver matrix. A.Charai, A.Combe, C.Boulesteix, J.Cabane (Lab. de Microscopie Electronique Appliquee ERA, Centre Sci. et Tech. de St.-Jerome, Marseille, France).
Scr. Metall. (USA), vol.17, no.7, p.833-6 (July 1983).
It is shown that the evolution of a magnesium oxide precipitate happens very slowly. For a temperature less than 650°C a large number of dislocations occur. After higher temperatures and a sufficiently long thermal treatment, coherent precipitates are observed. The ageing then proceeds by Oswald ripening mechanism. This ageing cannot be explained by free magnesium in solid solution; it is necessary to consider the magnesium bound to oxygen which is less mobile but in a much greater quantity. On the one hand, there would be magnesium oxide in the form of precipitates in equilibrium with a negligible amount of magnesium in solid solution, and on the other hand, magnesium bound to oxygen in a small quantity but however sufficient to explain the coalescence. (20 refs.)

103163 Coarsening process of Co precipitates in Cu-Co alloys. Y.Seno (Kyushu Univ., Fukuoka, Japan), Y.Tomokiyo, K.Oki, T.Eguchi.
Trans. Jpn. Inst. Met. (Japan), vol.24, no.7, p.491-8 (July 1983).
Ostwald ripening of precipitate particles in Cu-Co alloys was investigated by electron microscopic observation. Radii of individual particles were directly measured from their strain contrasts in the electron microscopic images for the alloys containing 1-4 at.%Co, and the variation of the mean particle size and the distribution of the relative particle size were obtained as functions of the aging time at 873K. A systematic change in the distribution with the aging time was observed, which suggested that the observed coarsening process did not reach the steady state as assumed in the theories of LSW and Ardell. The shape of the distribution of particle size is sharp and symmetrical around the mean particle size in the early stage of aging, while it becomes broad and asymmetrical with increase in the aging time. This change in the size distribution with the aging time differs from the expectation from the rate equation for individual particle growth in the LSW theory and from the experimental results of some Ni-based alloys. (22 refs.)

103164 Electron microscopy study of microstructural changes in a Ti-1.6 at.%N alloy. D.Sundararaman, A.L.E.Terrance, V.Seetharaman, V.S.Raghunathan (Metall. Programme, Reactor Res. Centre, Kalpakkam, India).
Trans. Jpn. Inst. Met. (Japan), vol.24, no.7, p.510-13 (July 1983).
The early stages of decomposition of the supersaturated (α'') phase which was obtained on quenching a Ti-1.6 at.%N alloy have been found to be associated with characteristic microstructural features. The tetragonally ordered α' phase formed from α'' by continuous ordering, transforms to incoherent Ti_2N precipitates, on ageing in the temperature range 323-673K. While no perceptible growth of homogeneously transformed α' phase was observed in the matrix, lath boundary precipitation of α'/Ti_2N was found to take place during low temperature ageing ($T \leq 373K$). On ageing at high temperature ($T > 373K$) both matrix and lath boundary precipitation of Ti_2N occurred uniformly by the nucleation and growth process. The microstructural features observed during $\alpha' \rightarrow Ti_2N$ provide evidence for the predominance of continuous ordering at lower temperatures and the nucleation and growth process at higher temperatures. (9 refs.)

Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors .... See Entry 98632

Electron-microscopic investigation of α-planar defects formed by boron in alloys of refractory metals with the BCC lattice .... See Entry 101706

Dislocation motion in a dispersion hardened Al-Zn-Mg alloy and its plastic properties .... See Entry 101707

Precipitate dissolution by high energy collision cascades .... See Entry 101752

Theory of helium transport and clustering in materials under irradiation .... See Entry 101756

Compositional changes in Fe-Cr-Ni alloys under proton bombardment at elevated temperatures .... See Entry 101807

Effect of irradiation on phosphorus segregation .... See Entry 101816

Role of impurity precipitates in microhardness of NaCl:Sr^{2+} crystals .... See Entry 101851

Statistical modelling of isomorphous precipitation .... See Entry 101976

Small aggregates .... See Entry 101978

Some observations on oxygen precipitation/gettering in device processed Czochralski silicon .... See Entry 101982

Monotonic and alternating surface segregation profiles in binary alloys .... See Entry 101986

The effect of precipitation heat treatments on the critical temperature in Ti-rich Nb-Ti alloys .... See Entry 102547

A positron study of Guinier-Preston zones and precipitates in Al-Zn alloys having Mg or Ge additions .... See Entry 102990

Influence of an electric field on the evaporation of Fe-Si, Fe-Mn and Fe-Al melts in helium. Experimental investigation .... See Entry 103036

Precipitation in a Cu-20%Ni-8%Sn alloy and the phase diagram of the Cu-Ni rich Cu-Ni-Sn system .... See Entry 103112

Examination of M_7C_3 carbides in high chromium cast irons using thin foil transmission electron microscopy .... See Entry 103130

An analysis of the solidification of a binary eutectic system in consideration of both heat and solute diffusion .... See Entry 103133

Microstructural changes in an aged Cu-15 at.%Sn shape memory alloy .... See Entry 103149

Control of the steady creep in Ag-2.7 wt.% Al by dissolution-enhanced diffusion .... See Entry 103225

High temperature strength of SUS 316 stainless steel subjected to creep damage .... See Entry 103298

The micro-mechanisms of tempered martensite embrittlement in 4340-type steels .... See Entry 103304

Fatigue of Cu-1 pct Cd .... See Entry 103305

The influence of the $M_{23}(C,N)_6$ compound on the mechanical properties of type 422 stainless steel .... See Entry 103311

Low cycle fatigue of Ti-Mn alloys: microstructural aspects of fatigue crack growth .... See Entry 103316

81.40 TREATMENT OF MATERIALS AND ITS EFFECTS ON MICROSTRUCTURES AND PROPERTIES

103165 Ceramic materials stronger than steel. M.Lewis (Dept. of Phys., Univ. of Warwick, Coventry, England).
Elettrotecnica (Italy), vol.70, no.5, p.421-4 (May 1983). In Italian.
Ceramic materials being developed at present are so strong mechanically, and so resistant to corrosion and heat, that they will replace the conventional range, in, for example, parts of gas turbines and high speed tools for metal machining. The problems of production, types of ceramic compound with their crystallography, their applications and high-temperature stability are discussed. (no refs.) *J.S.*

103166 On the prediction of residual strength for notched laminates. G.Caprino (Istituto di Tecnologie, Univ. di Napoli, Naples, Italy).
J. Mater. Sci. (GB), vol.18, no.8, p.2269-73 (Aug. 1983).
The effectiveness of a two-parameter model based on linear elastic fracture mechanics concepts, is experimentally verified, using original results and data available from the literature. It is shown that the proposed model can be reduced to a one-parameter model, due to the constancy of the other parameter for fibre dominated laminates, irrespective of fibre and matrix materials and shape of the notch. A comparison with the well-known criteria proposed by Whitney and Nuismer (WN) shows that the WN models are useful for prediction of residual strength of notched laminates, provided the length of the notch is not too large; for large notches the two-parameter model reported seems to be more effective. (8 refs.)

81.40C Solid solution hardening, precipitation hardening, dispersion hardening

103167 New aspects on the appraisal of the cooling process during hardening of steel. K.-E.Thelning (Smedjebacken-Boxholm Stal AB, Boxholm, Sweden).
Scand. J. Metall. (Finland), vol.12, no.4, p.189-94 (1983).
When hardening tools and machine components the heat treater generally aims to obtain a martensitic structure at least in the surface layers of the steel. Hence the rate of cooling must be controlled so that the formation of ferrite, pearlite or bainite is avoided. Since the dimensions of the part have generally been decided beforehand the depth of hardness must be determined by a judicious choice of steel and cooling medium. With regard to the steel a knowledge of its hardenability is a good aid when choosing a suitable grade. For the cooling medium, however, there are not available the same good criteria concerning the cooling capacity of the medium. Hence the simple rule as usually applied; unalloyed steels are quenched in water, alloy steels in oil and high-alloy steels cooled in air. When it becomes desirable to introduce less sophisticated steel grades and more automation of the heat treating process, specialized knowledge is required, both of the hardenability of steel and the cooling capacity of cooling media. A successful final result is also due in large measure to the mutual interplay between these two factors. (9 refs.)

103168 Effects of surface and thickness of specimens on the aging in Al-Zn alloys. M.Ohta (School of Engng., Okayama Univ. of Okayama, Japan), T.Kanadani, A.Sakakibara, H.Yamada, M.Yamada.
Phys. Status Solidi a (Germany), vol.78, no.1, p.K23-6 (16 July 1983).
The effects of surfaces and grain boundaries on the ageing and reversion in Al-Zn alloys is reported. Vickers hardness and electropolishing were used to characterise soft surface layers. The results suggest that the vacancy concentration during the period of age hardening near the surface was lower than that in the interior of the specimen. (1 ref.)

Dislocation motion in a dispersion hardened Al-Zn-Mg alloy and its plastic properties .... See Entry 101707

The effect of precipitation heat treatments on the critical temperature in Ti-rich Nb-Ti alloys .... See Entry 102547

Dispersion hardening—a low cost technique for improving the hot strength of copper alloys .... See Entry 103090

Decomposition processes in Al-Zn-Mg alloys .... See Entry 103157

The influence of annealing procedure on the mechanical properties of a C-Mn and a C-Mn-V dual phase steel .... See Entry 103177

The effect of titanium on creep strength in 2.25 pct Cr-1 pct Mo steels .... See Entry 103231

Calculating the thermal and stress-strain state of complex shaped steel articles during hardening .... See Entry 103247

Influence of the cohesive strength of grain boundaries on strain and structure characteristics of fracture of dispersion-hardening copper-base alloys .... See Entry 103273

Contribution of texture to the strengthening and fracture in hot-rolled magnesium-12.7 at.% cadmium alloy .... See Entry 103278

Some problems on the practical use of a 3.5 GPa grade maraging steel .... See Entry 103286

Comparison of the plane strain crack arrest fracture toughness of 4340, 4140, and 1340 steel .... See Entry 103314

Oxide scale induced cleavage fracture in an ODS Fe-Cr-Al alloy .... See Entry 103318

Precipitation hardening in the carbonitrides of iron of the 'epsilon' type .... See Entry 103383

81.40E Cold working, work hardening; annealing, recovery and recrystallisation; textures

103169 HVEM study of recrystallisation in aluminium alloys containing second phase particles. S.Dermarkar (Aluminium Pechiney, Voreppe, France), P.Guyot, J.Pelissier.
Acta Metall. (USA), vol.31, no.9, p.1315-22 (Sept. 1983).
An investigation of the recrystallisation behavior of two Al alloys containing fine (Al-Fe) and coarse (Al-Si) particles is presented. In situ anneals in a 1

MeV electron microscope revealed different recrystallisation mechanisms in each case and allowed direct measurements of grain boundary velocities and subgrain sizes. Multiple nucleation around coarse particles is observed at 250°C for the Al-Si alloys. Conversely, small precipitates strongly pin a subgrain structure up to 400°C for the Al-Fe alloy. Grain boundary migration rates are compared to values deduced from bulk-annealed specimens for the Al-Si alloy. The stability of the subgrain structure in the Al-Fe alloy is discussed with respect to recent models. (14 refs.)

103170 Development of the recrystallization texture in tensile deformed aluminium single crystals. I HVEM observations. A.Berger, P.J.Wilbrandt, P.Haasen (Inst. fur Metallphys., Univ. Gottingen, Gottingen, Germany).
Acta Metall. (USA), vol.31, no.9, p.1433-43 (Sept. 1983).
Various stages of the recrystallization process of tensile deformed aluminium single crystals were investigated by means of HVEM and X-ray texture measurement. The deformed crystals have a simple microstructure consisting of 2 components. Samples were annealed under observation in the heating stage of the high voltage microscope. Recrystallization nuclei were observed to have orientations which were already present in the deformed microstructure. New orientations were generated by recrystallization twinning in a selection process favoring better coincidence orientations. A model for nucleation is proposed. (30 refs.)

103171 Nonlinear finite element analysis of an autofrettage process. E.T.Till, F.G.Rammerstorfer (Dept. of Sci. Computing, VOEST-ALPINE AG, Linz, Austria).
Comput. & Struct. (GB), vol.17, no.5-6, p.857-64 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
Generally metal forming processes are nonlinear problems. A method is presented to calculate stress and deformation time history and residual states of a mechanically autofrettaged thick walled cylinder. The finite-element-model and the results of the nonlinear analysis are demonstrated. (5 refs.)

103172 Influence of the annealing temperature on changes in the properties of hydrogen-phase-hardened palladium exhibiting hydride brittleness. V.A.Gol'tsov, V.A.Kirillov, S.V.Gorban', O.I.Karnaukh, V.G.Volynskaya, N.A.Tikhonov (Polytech. Inst., Donetsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1165-8 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The annealing temperature influenced the changes in the electrical and mechanical properties of hydrogen-phase-hardened palladium in the hydride brittleness state. Annealing of $PdH_{0.16}$ resulted in the reverse $\beta \rightarrow \alpha$ hydride transition as well as in considerable changes in the composition and properties of PdH_x alloys. Outgassing produced a monophase-hardened state with a high value of the strength and poor plastic properties. Recrystallization of hydrogen-phase-hardened palladium was observed above 250°C. (4 refs.)
A.T.

103173 The metallurgy of continuous-annealed drawing-quality sheet steel. P.L.Mangonon,Jr. (METS Internat., Exton, PA, USA), B.L.Bramfitt.
J. Met. (USA), vol.35, no.5, p.27-32 (May 1983).
Continuous annealing can provide products for the automotive and appliance industries which exhibit more uniform mechanical properties, better shape (flatness), and cleaner surfaces than batch annealing. Continuous annealing (CA) is especially suited for the high-strength steel grades required by the automotive industry. Because of the rapid heating cycle encountered in continuous annealing, drawing-quality steels produced on a CA line do not have properties equivalent to steels produced by batch annealing (BA). However, the latest continuous-annealing technologies, combined with proper control of chemistry, have developed products with properties approaching those obtained with BA. The metallurgical concepts of these technologies are reviewed. (18 refs.)

103174 Orientation relationships in the secondary recrystallization of pure nickel. P.Lejcek, V.Sima (Inst. of Phys., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Mater. Sci. & Eng. (Switzerland), vol.60, no.2, p.121-4 (Aug. 1983).
The preferred orientation relationship 19°, $\langle 100 \rangle$ was confirmed between the primary recrystallization texture and the large secondary grains grown during the unidirectional annealing of heavily deformed nickel. It was found that the rate of specimen movement affects the operational mode of the particular rotation axis. The twist rotation about $[\bar{1}00]$ corresponds to higher rates of specimen movement compared with the tilt rotation about the [001] axis which is effective at lower rates. The change in rotation axis might be explained by a higher value of the activation energy of migration for the twist-type grain boundary than for the tilt boundary. (10 refs.)

103175 The role of non-equilibrium grain boundary structure in strain induced grain boundary migration (recrystallization after small strains). R.Z.Valiev, V.Yu.Gertsman, O.A.Kaibyshev (Aviation Inst., Ufa, USSR).
Scr. Metall. (USA), vol.17, no.7, p.853-6 (July 1983).
The non-equilibrium GB structure plays an important role in recrystallization after small strains. Furthermore, non-equilibrium GBs must be of essential importance for recrystallization after large strains as well because in this case grain boundaries also have a non-equilibrium structure. This structure is a result of dislocations running-in during deformation and of the absorption of dislocations by the moving recrystallization front. The microstructure changes observed in a magnesium alloy during annealing after small strains are discussed. (15 refs.)

On the annealing behaviour and crystallization of the amorphous alloy $Fe_{40}Ni_{40}P_{14}B_6$ .... See Entry 101576

Dislocation wall and cell structures and long-range internal stresses in deformed metal crystals .... See Entry 101712

Particular properties of $\Sigma = 3^n$ boundaries in FCC polycrystals. I. Crystallographical parameters and grain boundary faceting during annealing .... See Entry 101718

Microstructural and microchemical comparisons of AISI 316 irradiated in HFIR and EBR-II .... See Entry 101804

Effect of cold working on the hydrogen trapping phenomena in pure iron .... See Entry 102068

Observation of voids in thin silver films by TEM .... See Entry 102202

Hydrogen in $Fe_{40}Ni_{40}P_{14}B_6$ amorphous alloys studied by magnetic aftereffect, internal friction, and positron annihilation .... See Entry 102710

Microstructure and mechanical properties of rapidly quenched $L1_2$ alloys in Ni-Al-X systems .... See Entry 103135

Hydride precipitation in α/β zirconium alloys .... See Entry 103150

The influence of prestrains on the buckling behaviour of a normalized plain carbon steel (German grade Ck45) .... See Entry 103209

On the very heterogeneous behaviour of plastic deformation during rolling of ferrite-martensite dual phase steels and on the mechanism of microcrack formation and their propagation through the material .... See Entry 103212

Relation between Bauschinger effect and work-hardening in copper single crystals .... See Entry 103221

Cyclic softening and thermally activated deformation of titanium and zirconium .... See Entry 103226

Plastic behavior of aluminum-killed steel following plane-strain deformation .... See Entry 103233

Role of retained austenite of the deformation of an Fe-0.07 C-1.8 Mn-1.4 Si dual-phase steel .... See Entry 103234

Effect of structural transformations in the cast conditions on the high-temperature ductility of nickel alloys .... See Entry 103244

Effect of the ferrite grain size on the deformation and fracture characteristics of a structural steel .... See Entry 103254

Influence of precracking load on critical stress intensity factor of mild steel .... See Entry 103276

Contribution of texture to the strengthening and fracture in hot-rolled magnesium-12.7 at.% cadmium alloy .... See Entry 103278

Some problems on the practical use of a 3.5 GPa grade maraging steel .... See Entry 103286

The transition from stage I to stage II fatigue crack propagation in copper single crystals cycled at constant strain amplitudes .... See Entry 103303

Fatigue of Cu-1 pct Cd .... See Entry 103305

Deformation and fracture of strongly textured Ti alloy sheets in uniaxial tension .... See Entry 103306

Stretch forming and fracture of strongly textured Ti alloy sheets .... See Entry 103307

Effect of prestrain on the mechanical properties of eutectoid steel .... See Entry 103309

Surface hardening or high-C steel by CO_2 laser .... See Entry 103378

81.40G Other heat and thermomechanical treatments

103176 A deconcentrated plasma arc used for reducing concentrations of stresses. A.E.Asnis, G.A.Ivashchenko (E.O. Paton Welding Inst., Acad. of Sci., Ukrainian SSR).
Autom. Weld. (GB), vol.35, no.6, p.35-7 (June 1982). Translation of: *Avtom. Svarka (USSR)*, no.6, p.51-2 (1982).
It has been established that a deconcentrated plasma arc can be used for melting the boundaries of welds without employing a filler wire to eliminate concentrations of stresses in the regions of transition from weld into parent metal. The optimum treatment conditions have been determined. (2 refs.)

103177 The influence of annealing procedure on the mechanical properties of a C-Mn and a C-Mn-V dual phase steel. A.Hansson, R.Lagneborg, A.Melander (Swedish Inst. for Metals Res., Stockholm, Sweden).
Scand. J. Metall. (Finland), vol.12, no.4, p.177-83 (1983).
A C-Mn and a C-Mn-V steel with the same chemical composition except for vanadium has been subjected to various heat treatments used in practice to produce microstructures typical of dual-phase steels. The strength-elongation relationships represented by the data from these various heat treatments were virtually indentically for the C-Mn and the C-Mn-V steel. Tempering at 250°C did not affect the strength-elongation relationship, whereas tempering at 350°C produced somewhat inferior combinations of strength and elongation. The higher strength and the accompanying deterioration of elongation is partly due to strengthening from increasing contents of martensite, partly due to work hardening of the ferrite matrix caused by increasing contents of martensite, and partly due to larger solid solution strengthening of carbon dissolved in the ferrite or possibly larger precipitation strengthening of fine carbides. The post-uniform elongation occurring between the onset of diffuse and sharp necking was found to increase with the strain rate sensitivity of the flow stress, M. (10 refs.)

103178 Diffusion of Al-Cu alloy castings in homogenization. N.Murakami, T.Owadano, T.Kobayashi (Kyushu Inst. of Technol., Fukuoka, Japan).
Bull. Kyushu Inst. Technol. (Sci. & Technol.) (Japan), no.46, p.11-17 (March 1983). In Japanese.
The authors investigated the dependency of Cu concentration on the diffusion coefficient in homogenization of Al-Cu alloy. Diffusion couples were composed of $CuAl_2$ phase alloy and solid solution of Al-Cu (0 to 4 wt.%) alloys. Diffusion coefficients were calculated by two methods, the phase boundary migration method and Matano method. The results obtained are as follows: the diffusion coefficient of Cu calculated by the phase boundary migration method decreased slightly as the Cu concentration of the solid solution increased; the diffusion coefficient of Cu calculated by the Matano method decreased very slightly as the copper concentration increased; the values of the diffusion coefficients calculated by the two methods were in good agreement when the accuracy of the results were considered. The averaged values of the diffusion coefficients were: $D = 11.3 \times 10^{-10}$ cm^2/sec at 530°C, $D = 7.0 \times 10^{-10}$ cm^2/sec at 520°C, D-4.6×10^{-10} cm^2/sec at 510°C. (9 refs.)

103179 On the accelerated ageing of CFRP. T.A.Collings, S.M.Copley (Materials & Structures Dept., Royal Aircraft Establ., Farnborough, England).
Composites (GB), vol.14, no.3, p.180-8 (July 1983). (Symposium on Environmental Effects on Fibre-Reinforced Plastics, London, England, 12-13 July 1983).
A technique is presented for the accelerated ageing of CFRP. The essential feature is a three-stage conditioning by which moisture distribution can be controlled to produce a through-thickness moisture profile that is representative of naturally aged specimens. Results are given for a range of thicknesses. Concurrent with the experimental work, a mathematical model of the diffusion process was developed and used. Correlation between experiment and theory is shown to be good. (7 refs.)

103180 Annealing behaviour of gamma-ray-induced electron traps in LEC *n*-InP. J.Koyama, J.Shirafuji, Y.Inuishi (Dept. of Electrical Engng., Osaka Univ., Osaka, Japan).
Electron. Lett. (GB), vol.19, no.16, p.609-11 (4 Aug. 1983).
The annealing behaviour of a gamma-ray-induced dominant electron trap ($E_c - 0.79$ eV) in LEC undoped *n*-InP is studied by means of the DLTS technique. The isothermal annealing experiment shows it is a first-order process with an activation energy of 0.98 eV; this value is much smaller than those found in room-temperature-irradiated *n*-GaAs. (5 refs.)

103181 Radiation induced thermomechanical shock experiments of structural materials for cryogenic applications. H.Yanagi, K.Someya, K.Miya (Nuclear Engng. Res. Lab., Ibaraki, Japan).
J. Fac. Eng. Univ. Tokyo Ser. B (Japan), vol.36, no.4, p.661-75 (Sept. 1982).
Composite materials are often used as structural materials under the pulsed magnetic fields of superconducting magnets. Since their electrical conductivi-

ties are not very small, an eddy current could be induced into them. If the eddy current is induced, it causes thermomechanical vibration and dynamic stress in those materials. A quick quench of the superconducting magnets might be another source of the thermomechanical shock to the composite materials because of transient thermal stress. To investigate the thermal shock effect on them, experiments were conducted irradiating electron-linac pulsed beams as a heat source to a sample of graphite fibre-epoxy composites. The rapid rise of temperature and corresponding thermal strains were measured as function of time. Thermal stress analysis was made by solving an equation of heat conduction and then an equation of thermal load balance based on the finite element method (FEM). The numerical analysis based on FEM agrees well with experimental data. (no refs.)

103182 Laser heat treatment: the state of the art. J.Mazumder (Univ. of Illinois, Urbana, IL, USA).
J. Met. (USA), vol.35, no.5, p.18-26 (May 1983). In German.
Highly localized, high heating and cooling rates inherent in laser processing are found to be beneficial to improve hardness, wear, and fatigue properties of many steels and cast irons. Development of reliable high-power CO_2 lasers in the past decade has made this process industrially viable, and many industries have already adopted the technique. Present research in this area involves optimization of the process, evaluation of wear and fatigue properties, and development of a transport phenomena model to predict the hardened zone profile. The state of the art of this process is reviewed. (24 refs.)

103183 Mathematical modelling of the inductional tempering of steel samples. A.N.Tikhonov, V.B.Glasko, N.I.Kulik, M.K.Trubetskov (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
J. Eng. Phys. (USA), vol.43, no.6, p.1370-4 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.6, p.955-60 (Dec. 1982).
Complete mathematical modelling of inductional tempering processes in various inductors is performed on a computer. Using regularizing algorithms, the problem of heat control and the problem of purposive control are solved. (10 refs.)

103184 Strain aging of Ti-6242 at hot-working temperatures. P.Dadras, J.F.Thomas,Jr. (Materials Sci. & Engng., Wright State Univ., Dayton, OH, USA), J.C.Moosbrugger.
Metall. Trans. A (USA), vol.14A, no.7, p.1512-16 (July 1983).
It has been shown that the development of yield drops in $(\alpha+\beta)$ Ti-6242 during upset compression at hot working temperatures follows static strain aging kinetics. Since irreversible strengthening is not observed and boundary sliding is expected to be important, the aging response is interpreted in terms of atmosphere formation around boundary dislocations. (no refs.)

103185 Physical aging in polystyrene: comparison of the changes in creep behavior with the enthalpy relaxation. Ryong-Joon Roe (Dept. of Materials Sci. & Metallurgical Engng., Univ. of Cincinnati, Cincinnati, OH, USA), G.M.Millman.
Polym. Eng. & Sci. (USA), vol.23, no.6, p.318-22 (April 1983).
Physical aging in polystyrene was studied by annealing samples isothermally (at 22°, 57°, and 93°C) for various lengths of time and measuring the changes in the enthalpy and the flexural creep property. The enthalpy decrease reached a constant value after about 10 hours of aging at 93°C, indicating an apparent attainment of equilibrium, whereas the creep behaviour continued to change with prolonged aging even after 10 hours. At room temperature it took about a year of aging to induce a measurable change in enthalpy, while the creep behaviour showed changes clearly only after hours of aging. These and other items of evidence indicate that the effect of aging on the creep behaviour of evidence cannot be interpreted solely in terms of the free volume concept. Thus the hope of being able to predict the mechanical properties of aged polymers from the measurement of specific volume or enthalpy alone is not likely to be realized. (15 refs.)

103186 Annealing of ultra-oriented high density polyethylene extrudates. A.Tsuruta, T.Kanamoto, K.Tanaka (Dept. of Chem., Sci. Univ. of Tokyo, Tokyo, Japan).
Polym. Eng. & Sci. (USA), vol.23, no.9, p.521-9 (June 1983).
The annealing characteristics of highly-oriented, high density polyethylene (HDPE) fibers extruded at 90°C to constant extrusion draw ratios (EDR) of 5.8 to 30 have been studied using small-(SAXS) and wide-angle (WAXD) X-ray diffraction, differential scanning calorimetry (DSC), thermal shrinkage and tensile tests. The thermal stability in macroscopic properties, such as transparency, sample dimension, and tensile modulus, remarkably increases with the sample EDR. However, the folded chain crystals within microfibrils sensitively reorganize on annealing at $\geq 110°C$, even when the macroscopic properties exhibit not significant changes at high EDRs. Although the EDR has a minor effect on the reorganizability of the fold chain crystals, it has a major influence on the SAXS intensity and the extended chain crystalline component detected by WAXD for both unannealed and annealed extrudates. This specific crystalline component has an improved thermal stability and enhances the thermal stability of macroscopic properties at higher EDR. (36 refs.)

103187 A peculiar austenite stabilization phenomenon in an ausaged Fe-Ni-Ti alloy. T.Tadaki, K.Asayama, T.Kakeshita, K.Shimizu (Inst. of Sci. & Industrial Res., Osaka Univ., Osaka, Japan).
Scr. Metall. (USA), vol.17, no.7, p.893-5 (July 1983).
The martensitic transformations in Fe-Ni based alloys with the addition of Ti or Al have been reported to be suppressed by appropriate austenite ageings. That is, the austenites of these alloys can be stabilized by ausageing. Besides the stabilization phenomenon of austenite, the authors are interested in how γ' precipitates formed in the ausaged Fe-Ni-Ti or -Al alloys are responsible for the changes in the crystallography of martensitic transformations, and thus have begun a study on those points. In the course of the study, a peculiar phenomenon has been found as to the austenite stabilization. This peculiar phenomenon is briefly reported. (5 refs.)

103188 Information about SRO-kinetics from isochronal annealing of electrical resistivity. D.Trattner, W.Pfeiler (Inst. fur Festkorperphys., Univ. Wein, Vienna, Austria).
Scr. Metall. (USA), vol.17, no.7, p.909-13 (July 1983).
Whereas isothermal annealing after an adequate temperature treatment has already proved to be an advantageous tool in studying SRO-kinetics, information also arises from isochronal annealing, if the various isochronal steps are carefully analysed. The authors report on experiments of isochronal annealing of α-brass and the excellent correspondence with calculations based on the Schulze-Lucke formalism, assuming that two thermal activated processes with different relaxation times simultaneously are involved in SRO-kinetics. (4 refs.)

103189 Effect of thermomagnetic processing on magnetic properties of iron and iron-silicon alloys. V.I.Efimov, M.K.Savchenko, V.I.Sen'kin, S.Kh.Yanson (Krasnoyarsk Polytech. Inst., Krasnoyarsk, USSR).
Sov. Phys. J. (USA), vol.25, no.11, p.1011-14 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.41-6 (Nov. 1982).
Results of experimental studies of the effect of cooling iron and iron-silicon alloys in a magnetic field on their magnetic properties are presented. It is shown that the magnetic properies are improved and are dependent on the prehistory of the materials and the temperature from which cooling in the field is commenced. Thermomagnetic processing creates a state within the material in which there is no stabilization of ferromagnetic domain boundaries and the contribution of irreversible shifting processes to magnetization is reduced significantly. (10 refs.)

Symposium on Environmental Effects on Fibre-Reinforced Plastics .... See Entry 98620

ESR study of the change in the local structure of As_2Se_3 caused by the action of high pressure and by annealing .... See Entry 101583

Thermal cycling and amorphous-crystalline transition in the amorphous Cu_{60}-Zr_{40} alloy system .... See Entry 101587

Microstructural and microchemical comparisons of AISI 316 irradiated in HFIR and EBR-II .... See Entry 101804

Void growth in a pulsed irradiation environment .... See Entry 101808

Effect of helium preinjection and prior thermomechanical treatment on the microstructure of type 316 SS .... See Entry 101811

Influence of helium injection schedule and prior thermomechanical treatment of the microstructure of type 316 SS .... See Entry 101812

Anomaly of the solubility of hydrogen in ferromagnetic metals near the Curie point .... See Entry 101977

Spin coated amorphous chalcogenide films: thermal properties .... See Entry 102217

The effect of precipitation heat treatments on the critical temperature in Ti-rich Nb-Ti alloys .... See Entry 102547

Magnetic susceptibility and kinetics of 'graphitization' of glass-like carbons .... See Entry 102617

Quenching of the phase transitions in MnAs and related compounds .... See Entry 102657

Improving the magnetic properties of electrical steels and magnetic cores by thermomagnetic treatment .... See Entry 102706

Influence of Sn, V, Cr, Mo, Nb and Ta admixtures on the local environment of Fe impurity atoms in α-Zr .... See Entry 102782

Effect of thermoradiation treatment on the radiation stability of glasses .... See Entry 102845

Influence of annealing temperature on the exponential absorption edge of thin Si:H amorphous films deposited by 'glow discharge' .... See Entry 102978

Nonlinearities of laser heating of metals .... See Entry 103006

Hot isostatic pressing of niobium C-103 alloy shapes .... See Entry 103088

Ce-Ta-(Al)-oxide porous glass ceramic .... See Entry 103103

δ-γ phase equilibria in iron-rich iron-chromium-nickel alloys at temperatures between 1200 and 1350°C .... See Entry 103109

Metastable phases in rapidly solidified aluminum-rich Al-Fe alloys .... See Entry 103138

The effect of thermal cycling on the thermoelastic martensitic transformation in a Cu-Zn-Al alloy .... See Entry 103146

X-ray diffraction investigation of the single-phase stage of precipitation of martensite .... See Entry 103156

Decomposition processes in Al-Zn-Mg alloys .... See Entry 103157

On the kinetics of discontinuous precipitation in Cu-Mg alloys .... See Entry 103158

Ageing study of magnesium oxide precipitates in a silver matrix .... See Entry 103162

Coarsening process of Co precipitates in Cu-Co alloys .... See Entry 103163

Electron microscopy study of microstructural changes in a Ti-1.6 at.%N alloy .... See Entry 103164

The influence of prestrains on the buckling behaviour of a normalized plain carbon steel (German grade Ck45) .... See Entry 103209

History effects in polycrystalline BCC metals and steel subjected to rapid changes in strain rate and temperature .... See Entry 103210

Water absorption of glass/epoxy laminates under bending stresses .... See Entry 103213

Effects of SME cycle on the mechanical properties of the TiNi alloys .... See Entry 103219

The cyclic stress-strain response of polycrystalline Al-Zn-Mg alloy and commercial alloys based on this system .... See Entry 103223

The effect of prior heat treatments on the structure and properties of warm-rolled AISI 52100 steel .... See Entry 103229

On the strain dependence of plastic-strain ratio of deep-drawing sheet steels .... See Entry 103235

Effects of aging treatment on the mechanical properites of cold rolled high strength low alloy steel .... See Entry 103288

Evaluation of fatigue crack growth characteristics of SCM 435 steel by ultrasonic method .... See Entry 103297

High temperature strength of SUS 316 stainless steel subjected to creep damage .... See Entry 103298

Fatigue of Cu-1 pct Cd .... See Entry 103305

Tempered martensite embrittlement in Fe-Mo-C and Fe-W-C steel .... See Entry 103310

Low cycle fatigue of Ti-Mn alloys: microstructural aspects of fatigue crack growth .... See Entry 103316

Low-cycle fatigue of the non-magnetic ageing 40G18N13F and 35Kh14G16N10FR steels at +20° and −196°C .... See Entry 103326

Intergranular corrosion of type 304 stainless steel and Alloy 600 in aqueous solutions containing SO_2 .... See Entry 103372

Precipitation hardening in the carbonitrides of iron of the 'epsilon' type .... See Entry 103383

Corrosion fracture micromechanism of cast steel .... See Entry 103388

Influence of diffusion impregnation in polymer-containing compositions on the physicomechanical properties of steels .... See Entry 103394

Acoustic emission during thermal cycling of heat-resistant steel ....See Entry 103444

X-ray photoelectron spectroscopy studies of copper diffusion behaviour and related degradation phenomena in thin film CdS:Cu_2S solar cells ....See Entry 103698

Stability of Pd/Nb_2O_5/amorphous hydrogenated silicon solar cells ....See Entry 103699

81.40J Elasticity and anelasticity

(see also 62.20D Elastic constants, 62.40 Anelasticity, internal friction, and mechanical resonances)

103190 Youngs modulus and linear expansion coefficient anomalies in 18Cr8Ni and 18Cr25Ni alloys at low temperatures. I.N.Klimenko, V.Ya.Ilichev (Physico Tech. Inst. of Low Temperatures, Acad. of Sci., Kharkov, USSR).
Cryogenics (GB), vol.23, no.9, p.492-4 (Sept. 1983).
18Cr8Ni and 18Cr25Ni alloys have been studied using γ-resonance spectroscopy. At $T<100K$ an increase in the isomeric shift to more negative values was found in 18Cr8Ni. As the region of the isomeric shift change coincides with the invar-anomaly temperature observed in this alloy, the isomeric shift behaviour was associated with an increase in electron density on the iron cores, which takes place at the $\gamma_1 \rightleftharpoons \gamma_2$ transition in γ-iron electron configurations. Differences in the isomeric shift behaviour of 18Cr8Ni and 18Cr25Ni alloys seems to be associated with the amount of the unstable γ_1 configuration, which at low temperatures transforms to γ_2; this is also confirmed by the drop in the value of the elastic modulus which occurs in these alloys over the same temperature range. (13 refs.)

103191 Temperature dependence of mechanical and thermal expansion properties of T300/5208 graphite/epoxy. M.W.Hyer, C.T.Herakovich, S.M.Milkovich, J.S.Short,Jr. (Dept. of Engng. Sci. & Mech., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
Composites (GB), vol.14, no.3, p.276-80 (July 1983). (Symposium on Environmental Effects on Fibre-Reinforced Plastics, London, England, 12-13 July 1983).
The elastic constants, ultimate strengths and thermal expansion behaviour of T300/5208 graphite/epoxy laminates of differing lay-ups have been determined in the temperature range 116 to 394K. Most of the properties exhibit nearly linear temperature dependences. However, the transverse modulus and the axial thermal expansion vary non-linearly with temperature, their values changing by an order of magnitude over the temperature range considered. (6 refs.)

103192 About one variational principle in the stress analysis of an elastic solid under irradiation taking into account the geometrical nonlinearity. A.N.Alizade, R.Yu.Amenzade.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.6, p.48-56 (1982). In Russian.
A variational theorem for the stress analysis of an anisotropic elastic solid under irradiation taking into account the geometrical nonlinearity is suggested. In the proof the dependence of the mechanical characteristics of the material and the value of volumetric expansion on the time, co-ordinates and parameters, determined by physics of phenomena, is assumed. As an example a hinged spindle's irradiation has been considered. (4 refs.)

103193 Physical characterization and molecular structure of hydrophilic polymers obtained by radiation cast-polymerization of methoxypolyethyleneglycol methacrylate monomers for biomedical applications. M.Kumakura, I.Kaetsu (Takasaki Radiation Chem. Res. Establ., Japan Atomic Energy Res. Inst., Gunma, Japan).
J. Mater. Sci. (GB), vol.18, no.8, p.2430-6 (Aug. 1983).
Hydrophilic polymers were prepared by radiation cast-polymerization of methoxypolyethyleneglycol methacrylate monomers for biomedical applications, and the relationship between physical characterization and molecular structure was studied. As the number, n, of oxyethylene units, $-(OCH_2CH_2)_n-$, in the monomers increased, the hydration ability of the polymers increased markedly until $n=4$ and after that increased moderately. The mechanical properties, such as tensile and tear strength decreased, and the elongation at break increased to a maximum and then decreased with increasing n. This appeared to be a characteristic of the polymers of methoxypolyethyleneglycol methacrylate monomers. The mechanical properties of the copolymers resulting from the copolymerization of methoxypolyethyleneglycol methacrylate with hydroxyhexyl methacrylate monomer were also studied. (13 refs.)

103194 Mechanical properties of ceramics. I. Elastic properties of ceramics. N.Soga.
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.353, p.229-36 (Feb. 1983). In Japanese.
Discusses elastic properties of ceramics, which are important factors in studying thermal stress and shock produced under high temperature environment. There are static and dynamic methods for measuring elastic constants of ceramics. A resonance method has become feasible in conjunction with a large-scale computer. While finding the Young's modulus of ceramics may be cumbersome theoretically, the Young's modulus E can be expressed by $E=3K(1-2\nu)$ as a function of the bulk modulus K and Poisson's ratio ν is 0.2 to 0.3. The modulus of elasticity at high temperatures become important in evaluating strength and shock resistance at high temperatures. The Debye temperature θ_D can be calculated from the sound velocity using the equation $\theta_D=(h/k)(3pN/4\pi M)^{1/3}(2/3\nu_e{}^3+1/3\nu_2{}^3)^{1/3}$ where h is Plank's constant, k is the Boltzmann constant, N is the Avogadro number, M is the average atomic weight and ρ is the density.

103195 The effect of Mo^{5+} ions (in the presence of Mo^{6+} ions) on the elastic moduli of molybdenum phosphate glasses. N.D.Patel, B.Bridge (Dept. of Phys., Brunel Univ., Uxbridge, England).
Phys. & Chem. Glasses (GB), vol.25, no.5, p.130-4 (Oct. 1983).
The analysis of the valency states of molybdenum ions in molybdenum phosphate glasses has been carried out by electron spin resonance and atomic absorption spectroscopy. The data covered the entire vitreous range that can be obtained by melting MoO_3 with P_2O_5 and ammonium molybdate with orthophosphoric acid in open crucibles. In both series of glasses, maximum total Mo content, the ratio of Mo^{5+} to Mo^{6+} ions, and the volume per gramme atom of oxygen, occurred at about 53 mol.% MoO_3, corresponding to a structural rearrangement of metaphosphate and pyrophosphate groupings. The elastic moduli of all the glasses increased systematically with increasing Mo^{5+} content, whilst the Poisson ratio decreased. These observations are interpreted on the argument that the crosslink density of the glasses increases when Mo^{5+} ions replace Mo^{6+} ions, and therefore with Mo^{5+} content. (8 refs.)

103196 Isochrone based mastercurves of viscoelastic functions. H.A.Schneider, H.-J.Cantow (Inst. fur Makromolekulare Chem., Univ. Freiburg, Freiburg, Germany).
Polym. Bull. (Germany), vol.9, no.8-9, p.361-8 (March 1983).
Composite curves of the viscoelastic functions may be obtained not only by the usual shift of isotherm data along the frequency axis, but also by a shift of the respective isochrones along the reciprocal temperature axis. This shift along the $1/T$ axis is equivalent to that of the isochrones of dynamic viscosity, along the slope of zero shear apparent activation energy of flow. It is demonstrated that both types of shift are related to this zero shear activation energy of flow, so that an unique shift mechanism is effective in both cases. Isochrone based mastercurves are favourable for studies on polymer blends particularly, because the problematical choice of the reference temperatures of the components is circumvented. (5 refs.)

103197 Temperature dependence of the dynamic viscoelastic response of amorphous poly(diethylene glycol terephthalate) chains. E.Riande, J.Guzman (Inst. de Plasticos y Caucho, CSIC, Madrid, Spain), M.A.Llorente.
Polym. Bull. (Germany), vol.9, no.8-9, p.369-74 (March 1983).
Experimental values of the storage $G'(\omega)$ and loss $G''(\omega)$ moduli were obtained at different temperatures for several fractions of poly(diethylene glycol terephthalate). By assuming that all the relaxation mechanisms have the same temperature dependence, free volume parameters were obtained. The qualitative analysis of the molecular weight dependence of the viscosity at zero shear rate suggests that well developed entanglements are present in the relatively low molecular weight fractions investigated. (11 refs.)

103198 Polyisobutylene model elastomers prepared using demonstrably complete end-linking reactions. I. Elongation moduli of the trifunctional and tetrafunctional networks prepared from the linear polymers. P.-H.Sung, S.-J.Pan, J.E.Mark (Dept. of Chem., Univ. of Cincinnati, Cincinnati, OH, USA), V.S.C.Chang, J.E.Lackey, J.P.Kennedy.
Polym. Bull. (Germany), vol.9, no.8-9, p.375-81 (March 1983).
Linear polyisobutylene (PIB) molecules with either hydroxyl or isopropenyl groups at the chain ends were prepared using cationic polymerizations with bifunctional initiator-chain transfer agents. Extensive spectroscopic analyses confirmed the essentially perfect difunctionality of the two types of polymers. The former polymers were end-linked using an aromatic triisocyanate, and the latter by means of a tetrafunctional silane. The resulting trifunctional and tetrafunctional model PIB networks were found to have absolutely negligible sol fractions, which demonstrates that the end-linking reactions used to prepare them were essentially complete. The networks were studied with regard to their equilibrium stress-strain isotherms in uniaxial extension at 25°C. (25 refs.)

103199 Temperature dependent uniaxial stress relaxation in polyamide 6. T.Sterzynski, M.Szostak, A.Nowak (Inst. of Machine Building Technol., Tech. Univ. of Poznan, Poznan, Poland).
Polym. Bull. (Germany), vol.9, no.8-9, p.410-16 (March 1983).
Stress relaxation phenomena in polyamide 6 are presented. Tests were carried out on the tensile testing machine Fu 10000 e, using oar-shaped samples. Dependence of uniaxial stress changes in time, temperature or initial load was observed and measured. Analytical and mechanical models of stress relaxation in polyamide 6 were developed and are presented. (4 refs.)

103200 Dynamic mechanical and thermomechanical properties of silicone-polycarbonate block copolymers. W.Maung, K.M.Chua, T.H.Ng, H.L.Williams (Dept. of Chem. Engng. & Appl. Chem., Univ. of Toronto, Toronto, Ontario, Canada).
Polym. Eng. & Sci. (USA), vol.23, no.8, p.439-45 (mid-June 1983). (Symposium on the Rheological Properties of Polymers. 65th Chemical Conference of the Chemical Institute of Canada, Toronto, Ont. Canada, 30 May-2 June 1982).
Representative random, alternating block copolymers of polydimethylsiloxane (PDMS) and bisphenol-A-polycarbonate (BPAPC) were studied by thermomechanical and dynamic mechanical techniques. Data on glass transition temperatures (T_g), heat-deflection temperatures (T_d), Vicat softening temperatures (T_s), coefficients of linear expansion (α), stress-strain, and stress relaxation for four PDMS-BPAPC block copolymers are presented. The effect of casting films from mixed n-hexane-methylene chloride solution on the thermomechanical and dynamic mechanical properties are also studied. (18 refs.)

103201 Relationship between polymerization conditions and rheological properties for styrene-acrylonitrile copolymers. A.Garcia-Rejon, C.Rangel-Nafaile (Inst. de Investigaciones en Materiales, Univ. Nacional Autonoma de Mexico, Mexico City, Mexico), L.Rios, F.Cid.
Polym. Eng. & Sci. (USA), vol.23, no.8, p.452-8 (mid-June 1983). (Symposium on the Rheological Properties of Polymers. 65th Chemical Conference of the Chemical Institute of Canada, Toronto, Ont. Canada, 30 May-2 June 1982).
Styrene-acrylonitrile (SAN) copolymers are widely used in industrial applications in the fields of appliances, automotives, housewares, medicine, and packaging. They possess most of the features of polystyrene, with improved resistance to chemical attack, stress cracking, and heat deflection, and with greater strength and toughness. Their properties depend on several factors, the most important being the composition of the feed (monomer ratio), the type and quantity of the initiator, and the solvent to monomer ratio in the feed. The authors present the results of a continuing program that studies the effect of the above-mentioned polymerization variables on the viscoelastic properties, and the way in which these variables can be adjusted in order to obtain a SAN copolymer with specific properties. (10 refs.)

103202 Measurement of the microscopic volume strain element in amorphous alloys. A.L.Taub (General Electric Corp. Res. & Dev., Schenectady, NY, USA).
Scr. Metall. (USA), vol.17, no.7, p.873-8 (July 1983).
Tensile stress relaxation tests are conducted on melt spun $Fe_{76}B_{18}Si_6$ ribbons at 498K. The equivalent shear stress and strain rates are computed from the curves. The small values of the volume strain element are difficult to reconcile with presently formulated dislocation models of deformation but the data are in accord with the free volume models for flow. (24 refs.)

103203 Rules of the change in Young's modulus of glass and carbon-reinforced plastics in relation to temperature. N.V.Skvortsova (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.6, p.844-8 (June 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.6, p.110-14 (June 1982).
An investigation was made of the change in Young's modulus of carbon- and glass-reinforced plastics in the 20-800°C temperature range with a heating rate of 10 deg/min in argon. An expression is adopted as the basis for approximating the temperature relationship of Young's modulus of reinforced plastics. (2 refs.)

103204 Elastic properties of nongradient glasses and glasses synthesized by ion-exchange diffusion above and below the glass-transition temperature. V.Ya.Livshits, D.G.Tennison, G.O.Karapetyan (Leningrad Technol. Inst. of the Cellulose & Paper Industry, Leningrad, USSR).
Sov. J. Glass Phys. & Chem. (USA), vol.8, no.4, p.285-90 (July-Aug. 1982). Translation of: *Fiz. & Khim. Stekla (USSR)*, vol.8, no.4, p.422-8 (July-Aug. 1982). [received: May 1983]
With the equimolar replacement of Li_2O by Na_2O, the propagation velocity of longitudinal and transverse ultrasonic waves regularly diminishes. The dependence of the molar energy of the chemical bond U on composition has an extremal character; the maximum value of U corresponds to minimum ionicity of the chemical bonds in a glass. Thus, the mixed-alkali effect appears in the migration of energy (phonons of ultrasonic waves) and is caused by the energetics and the character of the chemical bond in the glass. The elastic properties of gradient glasses formed by high-temperature and low-temperature ion-exchange synthesis differ one from the other. The theoretical strength of a glass after ion-exchange increases (or decreases) with an increase (or decrease) in the energy of the chemical interactions in a gradient glass modified by interdiffusion. (15 refs.)

103205 Elastic moduli, hardness and thermal expansion of CaO-P_2O_5 and MgO-P_2O_5 glasses. M.Ashizuka, T.Sakai (Kyushu Inst. of Technol., Kitakyushu-shi, Japan).
Yogyo-Kyokai-Shi (Japan), vol.91, no.4, p.176-82 (1983). In Japanese.
Density, elastic moduli, Vickers hardness and thermal expansion coefficient for CaO-P_2O_5 (47.5∼55.0 mol.% CaO) and MgO-P_2O_5 (47.5∼57.5 mol.% MgO) glasses have been studied. Mean molar volumes calculated from mean molecular weight and density were compared with ideal mixed molar volumes estimated from the molar volumes of the constituent oxides in the phosphate glasses. The relationship between these two kinds of molar volumes for CaO-P_2O_5 glasses was a linear over the entire range of composition, whereas the relationship for MgO-P_2O_5 glasses was not linear with maximum deviation at the metaphosphate composition relative to the linear line for CaO-P_2O_5 glasses. The deviation decreased with a decrease in MgO content and the curve agreed with the linear line for CaO-P_2O_5 glasses about 33 mol.% MgO. There were definite relationships between elastic moduli (bulk modulus K, Young's modulus E, shear modulus G and Poisson's ratio ν) and mean atomic volume. (11 refs.)

103206 The elastic properties of the glasses in the systems R_2O-B_2O_3-SiO_2 (R=Na and K) and Na_2O-B_2O_3. K.Takahashi, A.Osaka, R.Furuno (Dept. of Industrial Chem., School of Engng., Okayama Univ., Okayama-shi, Japan).
Yogyo-Kyokai-Shi (Japan), vol.91, no.5, p.199-205 (1983). In Japanese.
The elastic properties of the glasses in the systems $xR_2O.B_2O_3.rSiO_2$ ($0<x<1.3$; $r=1$ and 2; R=Na and K) and $yNa_2O.(1-y)B_2O_3$ have been measured by the pulse transmission method. The elastic constants of the glasses in the sodium borate systems with and without 5 mol.% MgO exhibited a maximum at the molar ratio $(MgO+Na_2O)/B_2O_3=0.5$. This composition is equivalent to that at which the fraction N_4 of the four-coordinated boron atoms in those glasses deviates from the relation $N_4=(MgO+Na_2O)/B_2O_3$. Therefore the elastic constant is expected to play a role indicating the composition with the maximum value of N_4 and the formation of non-bridging oxygens. The results in the alkali borate glasses have been applied to the borosilicate glasses in order to estimate the composition at which the N_4 becomes maximum and also to ascertain if the potassium oxide plays the same role as the sodium oxide. The log-log plot of the bulk modulus versus the mean atom-pair volume verifies the previous model of the borosilicate glasses. The effect of SiO_2 content on the elastic properties of the borosilicate glasses has also been discussed. (19 refs.)

Research on rheological models for solid polymers under large impact velocity. Identification problems See Entry 101071

Elastic constants and structure of the vitreous system H_2O-P_2O_5 See Entry 101574

Physical properties of high-pressure ethylene vinylacetate copolymers and their saponified derivatives See Entry 101600

Properties of polyisobutylene-polyurethane block copolymers. I. Macroglycols from ozonolysis of isobutylene-isoprene copolymer See Entry 101601

Thermoelastic analysis of hybrid fabric composites See Entry 101832

The hydrostatic pressure derivatives of the elastic constants of bismuth alloys See Entry 101833

A theory of yielding of amorphous polymers at low temperature—a molecular viewpoint See Entry 101841

Hydrogen in $Fe_{40}Ni_{40}P_{14}B_6$ amorphous alloys studied by magnetic aftereffect, internal friction, and positron annihilation See Entry 102710

The magnetio-elastic properties of the Invar alloy, Fe_3Pt See Entry 102721

The response of an elastomer filled with soft ferrite to mechanical and magnetic influences See Entry 102726

Dielectric and electromechanical properties of calcium-doped lead zirconate titanate See Entry 102813

Rheo-optical Fourier transform IR spectroscopy of polyurethane elastomers. I. Principle of the method and measurements at ambient temperature See Entry 102886

The influence of prestrains on the buckling behaviour of a normalized plain carbon steel (German grade Ck45) See Entry 103209

Water absorption of glass/epoxy laminates under bending stresses See Entry 103213

Characterization of elastomeric network structures using the effects of swelling on stress-strain isotherms and the extents of swelling at thermodynamic equilibrium See Entry 103239

Some mechanical properties of rigid polyurethane structural form See Entry 103240

Effect of the addition of EPM copolymers on the properties of high density polyethylene/isotactic polypropylene blends. II. Morphology and mechanical properties of extruded samples See Entry 103242

Changes in the structure and mechanical properties of 25Kh2MFA steel under the effect of programmed increasing load and irradiation See Entry 103252

Anisotropy of the physicomechanical characteristics of asbestos, glass, and carbon textolites in the 293-873K temperature range See Entry 103255

Comparison between high temperature dead-load creep and stress-relaxation deformation in iron-doped polycrystalline aluminum and magnesium oxides See Entry 103256

The hardness of PbO-ZnO-B_2O_3 glasses See Entry 103282

Environmental resistance of carbon fibre-reinforced polyether etherketone See Entry 103342

Influence of water on the relaxation properties of filled elastomers See Entry 103361

Determination of the behaviour of composite materials under dynamic conditions See Entry 103417

81.40L Deformation, plasticity and creep

(see also 62.20F Deformation and plasticity, 62.20H Creep)

103207 Temperature- and strain-rate dependence of the flow stress of ultrapure niobium single crystals in cyclic deformation. F.Ackermann, H.Mughrabi, A.Seeger (Max-Planck-Inst. fur Metallforschung, Stuttgart, Germany).
Acta Metall. (USA), vol.31, no.9, p.1353-66 (Sept. 1983).
After cyclic deformation into saturation at room temperature, the temperature dependence of the cyclic flow stress of ultrapure niobium single crystals was measured in the range 160-500K at three different plastic shear-strain rates varying from $\approx 10^{-4}\ s^{-1}$ to $\approx 10^{-2}\ s^{-1}$. The experimental data may be fitted very satisfactorily to theoretical relationships which describe the flow stress of pure BCC metals in the temperature/stress regime in which the strain rate is controlled by the formation of kink pairs on screw dislocations. The theory provides analytical expressions which are valid in well-defined ranges of stress and temperature. The evaluation of the data in the high- and low-stress regimes yields mutually consistent values for the formation enthalpy of two isolated kinks which is found to be $2H_k=0.65\pm0.02$ eV. From the low-stress data the diffusion coefficient of kinks is determined as $D_k=1.4\times10^{-6}\ m^2\ s^{-1}$ over the approximate temperature range 250-350K. The product of the density of (mobile) screw dislocations and the spacing between obstacles which are insurmountable by kinks is found to be $\approx 7\times10^4\ m^{-1}$. (50 refs.)

103208 Flow stress of low carbon steels in the ($\gamma\rightarrow\alpha$)-transformation region. R.Kaspar, A.Streisselberger, O.Pawelski.
Arch. Eisenhuettenwes. (Germany), vol.54, no.5, p.195-8 (May 1983). In German.
A plain carbon steel and a Ti-bearing HSLA steel were investigated with respect to the flow stress vs. deformation temperature relationship within the ($\gamma\rightarrow\alpha$)-transformation region. A computer-controlled hot deformation simulator (WUMSI) was employed for the experiments. In addition to the evaluated flow stress curves quantitative metallography was applied. (20 refs.)

103209 The influence of prestrains on the buckling behaviour of a normalized plain carbon steel (German grade Ck45). B.Scholtes, O.Vohringer, E.Macherauch.
Arch. Eisenhuettenwes. (Germany), vol.54, no.5, p.199-202 (May 1983). In German.
The influence of prestrain on the buckling behaviour has been investigated on normalized specimens of the German steel grade Ck45. Buckling specimens have been taken from tensile test bars subjected to different amounts of prestrain and the relevant compressive force-contraction diagrams determined. The investigations revealed that the maximum buckling stress decreases with increasing plastic strain and reaches at $\epsilon_p\approx2\%$ less than half the value of an unstrained specimen. This behaviour is attributable to the change caused by the Bauschinger effect of the deformation characteristic of the prestrained vs. the unstrained steel. Prestrained steels do not exhibit in the tensile test an exclusively elastic strain range. For this reason, the tangent modulus taken from the compressive stress-upsetting curve is always inferior to the elasticity modulus of an unstrained specimen. A comparison between experimental and theoretical buckling stresses in consideration of the true behaviour of prestrained specimens quantitatively confirms this influence of the Bauschinger effect. (17 refs.)

103210 History effects in polycrystalline BCC metals and steel subjected to rapid changes in strain rate and temperature. J.Klepaczko (Inst. of Fundamental Technol. Res., Polish Acad. of Sci., Warsaw, Poland), J.Duffy.
Arch. Mech. (Poland), vol.34, no.4, p.419-36 (1982).
A review is presented of the available experimental data on strain rate and temperature history effects for polycrystalline BCC metals and ferritic steels together with new experimental results on AISI 1020 hot rolled steel (HRS). The early experiments on steels and other BCC metals are discussed in which interrupted tests were performed at two substantially different strain rates or temperatures. These experiments revealed that a substantial difference in response exists between BCC and FCC polycrystalline metals. The review also includes results of incremental strain rate tests with large jumps in strain rate augmented by a series of experiments designed to determine strain rate history effects in steel. A literature survey on incremental tests for BCC metals and steel is also included. Experimental results for ferritic steels indicate that for low temperatures as well as for the dynamic ageing temperature region strain rate history effects are of considerable importance. (46 refs.)

103211 Necking and drawing in polymeric fibers under tension. B.D.Coleman (Dept. of Maths., Carnegie-Mellon Univ., Pittsburgh, PA, USA).
Arch. Ration. Mech. & Anal. (Germany), vol.83, no.2, p.115-37 (1983).
A constitutive relation is proposed for the dependence of the tension in a thin polymeric fiber on the variation of the stretch ratio λ along the fiber axis. When this relation is placed in the equation of balance of forces, it yields a nonlinear second-order differential equation for λ whose equilibrium solutions (for a long fiber) are known in other contexts. The solutions describe necks, bulges, drawing configurations, and periodic striations. The assumption that motions resulting from gradual changes in tension or length are homotopies formed from these equilibrium solutions is compatible with many of the observed properties of tension-induced necking and drawing in fibers of such polymers as nylon and polyethylene. (16 refs.)

103212 On the very heterogeneous behaviour of plastic deformation during rolling of ferrite-martensite dual phase steels and on the mechanism of microcrack formation and their propagation through the material. A.Berghezan, Xi Jing He (Univ. Catholique de Louvain-la-Neuve, Louvain-la-Neuve, Belgium).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.15, p.1169-74 (25 April 1983). In French.
The purpose of this work was to find out the main causes of the premature failure of certain dual ferritic-martensitic steels. In order to reveal the principal factors responsible for this shortcoming, certain of the dual steels were deformed deliberately by cold-rolling and not by traction. It was necessary during the deformation of the sheet to examine continuously a clean and virgin surface and not a dirty one which has been leveled down by the rollers of the mill. An 'artefact' was used and instead of the examination of the rolling plane surface, the side surfaces were examined, which were—before rolling—polished and slightly etched to reveal both phases. In this way, it was found that the deformation of these two-phase steels is excessively heterogeneous. This heterogeneity is entirely or principally due to the hard martensite crystals which act as very efficent obstacles to impede the flow of the ductile ferrite. However, the main interest was to detect the mechanisms of the microcrack formation and their propagation through the material. (5 refs.)

103213 Water absorption of glass/epoxy laminates under bending stresses. K.A.Kasturiarachchi, G.Pritchard (School of Chem. & Phys. Sci., Kingston Polytech., Kingston-upon-Thames, England).
Composites (GB), vol.14, no.3, p.244-50 (July 1983). (Symposium on Environmental Effects on Fibre-Reinforced Plastics, London, England, 12-13 July 1983).
The water absorption characteristics of unidirectional glass/epoxy laminates have been studied during hygrothermal ageing at 95% relative humidity and temperatures up to 80°C for periods of up to 900 days. Initial water absorption behaviour approximately followed Fick's Laws, but deviations occurred at higher temperatures (~80°C). No classical equilibrium absorption plateau was obtained at any temperature and irregular changes in specimen weight were observed after prolonged exposure at 80°C. These changes are explained in part by postulating a degradation process, involving interaction between water and the curing agent. Four-point bending stresses were applied to some specimens during hygrothermal exposure. These stresses were insufficient to have much effect on the diffusivity, but surface damage was induced between the two loading noses on the compressive face. Failure occurred after prolonged exposure to high stresses at 45°C. Pre-stressing does not affect water uptake, but post-loading already soaked laminates lowers the flexural modulus. (16 refs.)

103214 Structure of localized flow regions observed on strong deformation of Fe-Ni alloys in martensitic state. V.I.Izotov, A.P.Kozlov (Inst. of Metallography & Phys. of Metals, Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1211-13 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
An investigation was made of the structure of Fe-23% Ni-3% Mn and Fe-32% Ni alloys subjected to a series of heat and mechanical treatments. Studies carried out in the martensite state indicated that plastic flow created inhomogeneous (localized flow) regions in parts of a crystal occupied by many martensite crystallites of this kind. (2 refs.) *A.T.*

103215 Short glass fiber-natural rubber composites. V.M.Murty (Rubber Technol. Centre, Indian Inst. of Technol., Kharagpur, India).
Int. J. Polym. Mater. (GB), vol.10, no.2, p.149-58 (1983).
Effect of fiber concentration on the physical properties such as tensile strength tear strength and elongation at break, flexing resistance, heat buildup, compression set, permanent set, hardness, resilience and aging resistance of natural rubber filled with treated short glass fiber has been studied. The effect of carbon black on the physical properties and processing characteristics of the fiber-rubber composites has also been studied at different fiber concentrations. Scanning electron microscopy studies have been made in order to assess the failure criteria. (10 refs.)

103216 Strain distribution in the superplastic Pb-Sn eutectic alloy. M.M.I.Ahmed, T.G.Langdon (Dept. of Materials Sci., Univ. of Southern California, Los Angeles, CA, USA).
J. Mater. Sci. (GB), vol.18, no.8, p.2407-13 (Aug. 1983).
Experiments were conducted to investigate the distribution of strain within the gauge length for specimens of the superplastic Pb-62 wt.% Sn eutectic alloy tested at room temperature. It is shown that deformation is quasi-uniform at low strain rates in region II so that the necks are diffuse rather than localized, but failure occurs by the formation of a sharp neck at high strain rates in region III. Using a specimen grain size of 6.1 μm, the transition from region II to region III occurs at an initial strain rate in the vicinity of 10^{-4} sec^{-1}. (15 refs.)

103217 The effect of grain size on deformation twinning in a textured zinc alloy. N.Ecob, B.Ralph (Dept. of Metall. & Materials Sci., Univ. of Cambridge, Cambridge, England).
J. Mater. Sci. (GB), vol.18, no.8, p.2419-29 (Aug. 1983).
The incidence of deformation twinning in samples of a commercial rolled zinc-0.1% aluminium-0.05 wt.% magnesium alloy has been measured at room temperature as a function of strain, grain size and direction of loading relative to the rolling direction. The volume fraction of twinned material has been measured at the surface and in the bulk. It is shown that this volume fraction is a linear function of both strain and grain size in most cases. Bands of heavily twinned grains are found to form inhomogeneously across the gauge length of tensile specimens, by an autocatalytic mechanism. Several examples are given of the interaction of twins and slip bands at grain boundaries which illustrate the formation and the accommodation of twins. The smaller volume fraction of twins found at the surface compared with the bulk reflects a relaxation of Von Mises criterion. (16 refs.)

103218 Superplastic flow and failure at 773K in the aluminium-calcium eutectic alloy. G.Piatti (Materials Sci. Div., Ispra Establ.-Joint Res. Centre, Comm. of the European Communities, Ispra, Italy).
J. Mater. Sci. (GB), vol.18, no.8, p.2471-83 (Aug. 1983).
The superplastic behaviour of the hot rolled Al-Ca eutectic alloy (7.6 wt.% Ca) was investigated at a temperature, $T=773$K, with strain rates varying from 2×10^{-5} to 4×10^{-1} sec^{-1} and for a grain size of the order of 3 μm. The results showed that the stress strain rate behaviour could be divided into two distinct portions: (a) region II at intermediate and low strain rates ($\dot{\epsilon}\leq4\times10^{-2}$ sec^{-1}) where the strain rate sensitivity index, m, was ≥0.30 (superplastic regime); (b) region III at higher strain rates ($\dot{\epsilon}>4\times10^{-2}$ sec^{-1}) where m was <0.30 (conventional deformation regime). Elongations at fracture of greater than 300% were achieved on the region II of superplasticity (maximum value about 570%). There was experimental evidence in superplastic flow conditions of a grain boundary sliding process and dislocation activity within the aluminium matrix grains. The fracture depended on a void linkage mechanism which included on a microscopic scale the internal necking of the tiny ligaments already formed between the cavities. (30 refs.)

103219 Effects of SME cycle on the mechanical properties of the TiNi alloys. Y.Sekiguchi (Dept. of Precision Machinery Engng., Univ. of Tokyo, Tokyo, Japan), Y.Watanabe, K.Funami, H.Funakubo, Y.Suzuki.
J. Fac. Eng. Univ. Tokyo Ser. B (Japan), vol.36, no.4, p.777-86 (Sept. 1982).
A wire material is obtained from TiNi shape memory alloy, and then the heat treatment temperature is changed. After that, measurement of electric resistance, hardness and tensile strength were taken. As a result of that, it is found that the best shape memory function is retained under the heat treatment conditions at 500°C. It is also explained that an efficient shape memory effect has been acquired by providing approximately 30 times of SME (shape memory effects) cycle with prestrain of 6% from the SME cycle test results, when the heat-treated wire material is used as a functional element under the above conditions. (11 refs.)

103220 Effect of small additions of titanium and boron on the electrical and mechanical properties of an electroconductor aluminum alloy. M.S.Devgun, T.Perez, O.Nino (Dept. of Mech., Univ. Simon Bolivar, Caracus, Venezuela).
J. Met. (USA), vol.35, no.5, p.55-8 (May 1983).
The effects of small additions of titanium and boron on the electrical resistivity and mechanical properties of an electroconductor aluminum alloy have been reported. The amount of titanium was varied within a range from 0.001 to 0.005% and boron from 0.002 to 0.042%. It was concluded in the case of both elements that, for any fixed percent of one element, the increasing additions of the second element produces a linear increase in both the electrical resistance and the ultimate strength of the resultant alloy but decreased its ductility linearly. Also, larger additions of these elements produces finer grain material. (7 refs.)

103221 Relation between Bauschinger effect and work-hardening in copper single crystals. T.Yakou, T.Hasegawa (Dept. of Mech. Engng., Tokyo Univ. of Agriculture & Technol., Tokyo, Japan), M.Shimizu, S.Karashima.
J. Jpn. Inst. Met. (Japan), vol.47, no.7, p.555-60 (July 1983). In Japanese.
In order to get information on the dislocation mechanism of the Bauschinger effect, the Bauschinger strain, $\gamma_B(n)$, during compression after tensile prestraining was measured at room temperature in copper in a reversed-stress range of $0\leq n\leq1(n=|\tau/\tau_p|;\tau$: the reversed stress at which $\gamma_B(n)$ was measured, τ_p: the stress in prestraining at which the stress direction was reversed). The behaviour of increase of $\gamma_B(n)$ for $n\leq\sim0.5$ (at an early stage of reversed straining) with the progress of work-hardening during prestraining was found to be different from that for $n>\sim0.5$ (at a later stage of reversed straining), that is, the increase was linear over the deformation stages in prestraining I, II and III for $n\leq\sim0.5$, but it was rapid, slow and again rapid in stages I, II and III, respectively, for $n>\sim0.5$. In spite of this behaviour, however, an amount of $\gamma_B(n)$ in a fixed value of n was given as a unique function of an amount of work-hardening, not depending on the specimen orientation. The fact implies that the Bauschinger effect is mainly controlled by the work-hardening phenomena during prestraining. The behaviour of increase of $\gamma_B(n)$ with the progress of work-hardening was explained from dislocation structures formed during prestraining. (20 refs.)

103222 Nonlinear stress-strain response of plain woven glass cloth reinforced laminates. S.Amijima (Faculty of Engng., Doshisha Univ., Kyoto, Japan), T.Adachi.
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.356, p.498-502 (May 1983). In Japanese.
Presents a method of predicting the nonlinear stress-strain curves up to the tensile failure for plain woven glass fiber cloth reinforced polyester laminates, when the load direction does not coincide with the fiber direction. The application of the laminate plate theory to the small stress increments of the stress-strain curve was done in the proposed analytical procedure. Comparisons were made between the analytical prediction and the experimental results for plain woven and nonwoven glass fiber reinforced laminates. As the results, the calculated stress-strain curves were found to be in considerably good agreement with the experimental results and the nonwoven laminate had higher strength and rigidity than the plain woven laminate for those with low fiber orientation angles, but had lower strength and rigidity for those with high fiber orientation angles. (10 refs.)

103223 The cyclic stress-strain response of polycrystalline Al-Zn-Mg alloy and commercial alloys based on this system. A.Renard, A.S.Cheng, R.de la Veaux, C.Laird (Dept. of Materials Sci. & Engng., Univ. of Pennsylvania, Philadelphia, PA, USA).
Mater. Sci. & Eng. (Switzerland), vol.60, no.2, p.113-20 (Aug. 1983).
An investigation of cyclic reponse has been made on pure Al-Zn-Mg ternary alloy, heat treated by two methods so as to produce shearable and non-shearable precipitates, and two commercial alloys based on this system. A particular feature of the investigation was the measurement of cyclic stress-strain curves at very low strains not hitherto reported for aluminum-based commercial alloys. Plateaux have not been observed in the cyclic stress-strain curves of any of these alloys. The Al-Zn-Mg alloy was found to be cyclically stable for both heat treatments and the constituent and dispersoid particles in the commercial alloys acted to homogenize the strain distribution. Moreover, the small grain size of all the alloys also helped to suppress any evidence of strain localization in the cyclic stress-strain curves. Life measurements for these alloys are also reported. (24 refs.)

103224 Microstructural mechanism for the anomalous tensile behaviour of aluminum-killed steel prestrained in plane strain tension. B.V.N.Rao (Analytica Chem. Dept., General Motors Res. Labs., Warren, MI, USA), J.V.Laukonis.
Mater. Sci. & Eng. (Switzerland), vol.60, no.2, p.125-35 (Aug. 1983).
Aluminum-killed steel subjected to a tensile deformation following a prestrain in plane strain tension exhibits increases in yield strength, an earlier onset of strain localization and less work hardening than it would exhibit had it been subjected to an equivalent uniaxial prestrain. The effects are generally larger if the tensile axis is orthogonal to the prestrain axis. To understand the substructural origin of such anomalous behaviour, transmission electron microscopy of the steel was performed after each step of processing. It has been found that, when the tensile axis is orthogonal to the prestrain axis, the dislocation cell structure of the prestrain becomes unstable and 'dissolves', whereas it is stable and reinforced if the tensile axis is parallel to the prestrain axis. These differences in substructure and the concepts of the cell wall 'polarization' and 'memory' have been used to account for the anomalous tensile behaviour of the prestrained material. (11 refs.)

103225 Control of the steady creep in Ag-2.7 wt.% Al by dissolution-enhanced diffusion. M.R.Nagy, G.H.Deaf, R.Kamel (Phys. Dept., Ain Shams Univ., Cairo, Egypt).
Mater. Sci. & Eng. (Switzerland), vol.60, no.2, p.173-6 (Aug. 1983).
The temperature dependence of the steady state creep rate of Ag-2.7 wt.% Al was determined by measuring the creep rate for a period of 2 min at a series of temperatures, 10°C apart. The temperature range covered was 180-280°C to include the dissolution temperature (about 250°C) of the μ phase. In the range 180-250°C the material showed creep resistance due to an ordered μ phase in the form of a precipitate. Above 250°C the creep resistance was affected by the dissolution of the precipitates. An activation energy for the creep rate above 250°C was found to be 6.5 ± 1 kcal mol^{-1}, much lower than the activation energy for self-diffusion (42 ± 1 kcal mol^{-1}). (9 refs.)

103226 Cyclic softening and thermally activated deformation of titanium and zirconium. J.I.Dickson, L.Handfield, G.L'Esperance (Dept. de Genie Metall., Ecole Polytech., Montreal, Quebec, Canada).
Mater. Sci. & Eng. (Switzerland), vol.60, no.2, p.L3-7 (Aug. 1983).
Cyclic softening in commercial purity zirconium and titanium corresponds principally to a decrease in effective stress and to an increase in screw dislocation mobility. This result indicates that the thermally activated deformation of these metals is not controlled by the overcoming of individual interstitial solute atoms by dislocations as usually proposed. (32 refs.)

103227 Some surprising features of the plastic deformation of body-centered cubic metals and alloys. J.W.Christian.
Metall. Trans. A (USA), vol.14A, no.7, p.1237-56 (July 1983).
The metals which have the BCC structure at and below room temperature include iron, the refractory metals of groups VA and VIA, and the alkali metals. Extensive experimental and theoretical investigations of the deformation behavior of these metals and their alloys which have been carried out at Oxford and elsewhere in the last twenty years are reviewed. Attention is

concentrated mainly on the low temperature properties where many surprising or anomalous features have been discovered. The phenomena discussed include slip asymmetry, the failure of the Schmid law of critical resolved shear stress, the observation of 'anomalous slip' in very pure metals and alloys, solution softening, and the ductile-brittle transition. (110 refs.)

103228 Deformation behavior of a 16-8-2 GTA weld as influenced by its solidification substructure. J.R.Foulds (Dept. of Materials Sci., Univ. of Cincinnati, Cincinnati, OH, USA), J.Moteff, V.K.Sikka, J.W.McEnerney.
Metall. Trans. A (USA), vol.14A, no.7, p.1357-66 (July 1983).
Weldment sections from 'formed and welded' type 316 stainless steel pipe are characterized with respect to some time-independent (tensile) and time-dependent (creep) mechanical properties at temperatures between 25°C and 649°C. The GTA weldment, welded with 16-8-2 filler metal, is sectioned from pipe in the 'formed+welded+solution annealed+straightened' condition, as well as in the same condition with an additional 're-solution' treatment. Detailed room temperature microhardness measurements on these sections before and after reannealing enable a determination of the different recovery characteristics of weld and base metal. The observed stable weld metal solidification dislocation substructure in comparison with the base metal 'random' dislocation structure, in fact, adequately explains weld/base metal elevated temperature mechanical behavior differences from this recovery characteristic standpoint. The weld metal substructure is the only parameter common to the variety of austenitic stainless steel welds exhibiting the consistent parent/weld metal deformation behavior differences described. (27 refs.)

103229 The effect of prior heat treatments on the structure and properties of warm-rolled AISI 52100 steel. T.R.McNelley (United States Naval Postgraduate School, Monterey, CA, USA), M.R.Edwards, A.Doig, D.H.Boone, C.W.Schultz.
Metall. Trans. A (USA), vol.14A, no.7, p.1427-33 (July 1983).
Isothermal rolling of AISI 52100 steel at 923K (650°C) has been used to produce very fine spheroidized carbide particles 0.1 to 0.2 μm in size in a submicron grain size ferrite matrix. Pearlitic starting structures are not completely spheroidized by such warm rolling and some isolated pearlite colonies remain after rolling. Tempered martensitic starting structures result in more uniform structures after rolling. The effect of varying the austenitizing time and temperature and of two cycle austenitizing treatments before rolling of tempered martensite were studied. After rolling, the room temperature yield strength was raised, a result of the finer dispersion of carbides and the associated reduction in ferrite grain size. The presence of isolated pearlite colonies in rolled material reduces the room temperature ductility. (16 refs.)

103230 Cyclic creep and stress rupture of a mechanically alloyed oxide dispersion and precipitation strengthened nickel-base superalloy. V.C.Nardone, D.Matejczyk, J.K.Tien (Henry Krumb School of Mines, Columbia Univ., New York, NY, USA).
Metall. Trans. A (USA), vol.14A, no.7, p.1435-41 (July 1983).
Cyclic creep and stress rupture results of Inconel MA 6000E are reported and discussed as a function of frequency. Inconel MA 6000E is a new alloy system developed for high creep resistance at intermediate as well as at high temperatures. It is a mechanically alloyed oxide dispersion ($\sim$2.5 vol pct) and γ' precipitation ($\sim$50 vol pct) strengthened nickel-base superalloy. A decrease in the minimum strain rate and increase in the rupture life were found to accompany cyclic frequency increase. The deceleration of the creep rate is related to the anelastic strains recovered during the off-load periods. The data are also discussed relative to those obtained for an alloy containing only the oxide dispersoids. (16 refs.)

103231 The effect of titanium on creep strength in 2.25 pct Cr-1 pct Mo steels. J.Pilling, N.Ridley, D.J.Gooch (Joint Univ. of Manchester/UMIST Dept. of Metall., Manchester, England).
Metall. Trans. A (USA), vol.14A, no.7, p.1443-9 (July 1983).
The effect of a low level of titanium on the microstructure and creep properties of 2.25 pct Cr-1 pct Mo steels has been examined as a function of carbon content and austenitizing temperature. The addition of 0.04 wt pct titanium resulted in a dramatic increase in creep strength at 565°C, and this was found to be associated with the presence in the microstructure of very small (50 to 100 Å) titanium-bearing precipitates based upon both TiC and Mo_2C. The variation of the minimum creep rate with carbon content and austenitizing treatment was explained in terms of the solubility of TiC in austenite. The titanium-bearing carbides have an important effect on microstructural stability and on the maintenance of creep strength, but it is also apparent that solid solution strengthening by molybdenum can make a significant contribution to creep strength at low carbon levels (0.02 wt pct). (16 refs.)

103232 Observations of grain boundary sliding during superplastic deformation. G.Rai (Dept. of Materials Sci. & Engng., MIT, Cambridge, MA, USA), N.J.Grant.
Metall. Trans. A (USA), vol.14A, no.7, p.1451-8 (July 1983).
Flat test specimens of a 10-micron grain size Al-33 pct Cu alloy were deformed in air over a range of strains at 450°C (723 K) and at 10^{-5} strain per second, and examined by SEM. Direct observations and measurements were also made in a SEM during superplastic deformation of a 5-micron Pb-Sn eutectic alloy at room temperature at a strain rate of about 10^{-5} s^{-1}. Extensive grain boundary sliding was noted. Microcreep curves were obtained between initially adjacent grains and showed that deformation is cyclical in nature and varies by several orders of magnitude locally from point to point. Many surface grains are observed to change neighbors many times, to undergo some rotation and tilt, to show little change in size or shape, and yet to avoid intergranular cracking. Superplastic deformation is a highly heterogeneous process, not unlike that observed in the creep of conventional types of alloys at elevated temperatures, but differing in the extent of plastic deformation free of intergranular cracking, combined with extensive recovery in the form of boundary migration. (27 refs.)

103233 Plastic behavior of aluminum-killed steel following plane-strain deformation. R.H.Wagoner (General Motors Res. Labs., Warren, MI, USA), J.V.Laukonis.
Metall. Trans. A (USA), vol.14A, no.7, p.1487-95 (July 1983).
Aluminium-killed steel sheets have been subjected to plane-strain prestrain in three ways: two-pass rolling, multi-pass rolling, and inplane, plane-strain tension. Subsequent uniaxial tensile tests were performed to evaluate the residual work-hardening behavior. The subsequent hardening curves depended primarily on the relative direction between major strain axes in the two deformation stages and very little on the specific prestrain procedure. These curves showed high initial yield stresses followed by a region of low (or negative) work hardening rate. This behavior contrasted with earlier results for 70/30 brass sheet, and a model of subsequent tensile behavior based on a strain-induced stress transient emerged. (36 refs.)

103234 Role of retained austenite of the deformation of an Fe-0.07 C-1.8 Mn-1.4 Si dual-phase steel. Joon Jeong Yi (Dept. of Materials Sci. & Engng., Korea Advanced Inst. of Sci. & Technol., Seoul, Korea), Ki Joon Yu, In Sup Kim, Sang Joo Kim.
Metall. Trans. A (USA), vol.14A, no.7, p.1497-504 (July 1983).
The influence of retained austenite on the work hardening behavior of dual-phase steel has been investigated with an Fe-0.07 C-1.8 Mn-1.4 Si steel. With a constant cooling rate of 5°C per second after intercritical annealing at 780°C, a significant quantity (about 8 vol. pct) of retained austenite was obtained in the dual-phase microstructure. The retained austenite was classified morphologically into either 'isolated' or 'capsulated' types by TEM observation. The 'capsulated' type, which was found without a particular shape inside the microtwinned martensite particle, withstood much deformation without a particular shape inside the microtwinned martensite particle, withstood much deformation of being protected by the surround martensite. While the 'isolated' type, which was found with an equiaxed shape and was isolated from martensite particles, was easily deformed by the first several percent plastic strain. The increase in work hardening rate, caused by the strain induced transformation of retained austenite to martensite, was ascribed to the contribution of the 'isolated' type, the major volume fraction of retained austenite. (22 refs.)

103235 On the strain dependence of plastic-strain ratio of deep-drawing sheet steels. Hsun Hu (Basic Res. Div., United States Res. Lab., Monroeville, PA, USA).
Metall. Trans. A (USA), vol.14A, no.7, p.1521-3 (July 1983).
The plastic strain ratios, r values of aluminium killed temper rolled steel sheets are presented. Results on the strain dependence of the r values are compared with those of Arthey and Hutchinson (see ibid., vol.12, p.1817-22, 1981). (7 refs.)

103236 Role of internal stress for continuous yielding of dual-phase steels. T.Sakaki, K.Sugimoto, T.Fukuzato (Dept. of Mech. Engng., Tokyo Metropolitan Univ., Tokyo, Japan).
Mem. Fac. Technol. Tokyo Metrop. Univ. (Japan), no.32, p.3093-102 (1982).
In a dual-phase steel, the distributions of the plastic strain and the internal stress arising from the martensite transformation were calculated based on the continuum mechanics. It was found that there are preferentially yielding zones around each martensite island, and initial yielding begins in these zones under very low applied stress because the internal stress assists the initial yielding. There are a number of preferentially yielding zones in the dual-phase steel, thus the Luders band is masked. (8 refs.)

103237 Superplastic forming of alumina. C.Carry, A.Mocellin.
Proc. Br. Ceram. Soc. (GB), no.33, p.101-15 (May 1983). (Meeting of the Basic Science Section of the British Ceramic Society, 'Fabrication Science 3', London, England, 13-14 Dec. 1982).
The experimental conditions are evaluated under which plastic deformation of alumina polycrystals could be considered superplastic from both macroscopic and microscopic points of view. Fine grained Al_2O_3 samples were produced by hot pressing at 1500°C. Parallelepiped specimens were deformed in compression in the same temperature range under constant stress (25 to 30MPa). Strain rates varied from 5.10^{-4}/s down and strains up to 0.30 were obtained. Strain rate exponents, m 1 $(\delta \log \sigma)/(\delta \text{ Log } \dot{\epsilon})$, were measured at various stages during testing. Subsequently half shells were hot formed in the same temperature range from alumina discs five centimeter diameter and two millimeter thick. The macroscopic behaviour and the microstructural evolution during the deformation of such alumina materials are presented and discussed. In particular, it is suggested that superplastic micromechanisms have been predominant. (23 refs.)

103238 Physical ageing in rigid chain polymers. G.Levita (Dept. of Chem. Engineering, Univ. of Pisa, Pisa, Italy), L.C.E.Struik.
Polymer (GB), vol.24, no.8, p.1071-4 (Aug. 1983).
Torsional and tensile creep properties of a cellulose acetate butyrate ester and the polyimide Kapton-H were studied in order to reveal physical ageing in these rigid chain polymers. The measured shift rates, μ, were 0.75 and 0.5 for cellulose and polyimide respectively, which indicates that physical ageing also occurs in polymers with stiff chains. These values, compared with those already known for most thermoplastics ($\mu \sim 1$), suggest that physical ageing is slowed down by the rigidity of the main chain. (5 refs.)

103239 Characterization of elastomeric network structures using the effects of swelling on stress-strain isotherms and the extents of swelling at thermodynamic equilibrium. J.P.Queslel, J.E.Mark (Dept. of Chem., Univ. of Cincinnati, Cincinnati, OH, USA).
Polym. Bull. (Germany), vol.10, no.3-4, p.119-25 (July 1983).
Swelling has long been used in the study of elastomeric networks. In the case of stress-strain measurements on swollen networks, the most important observation was the decrease of the Mooney constant $2C_2$, which is widely used to represent the magnitude of the departure of an observed stress-strain isotherm from that predicted by the simplest molecular theories. Swelling equilibrium data were generally analysed by the Flory-Rehner equation for affine networks simply to obtain a measure of the degree of cross-linking. The advent of model networks whose structures are well known and of a new theory due to Flory constitute great improvements for the study of rubberlike elasticity. In this new context, swelling can be used to obtain additional important molecular information through both uniaxial extension of swollen samples and swelling equilibrium. In particular, the relation between the main parameter κ characterizing the local constraints on junction fluctuations in the Flory theory, the extent of swelling, and the molecular weight between cross-links can be probed. (16 refs.)

103240 Some mechanical properties of rigid polyurethane structural form. J.M.Lifshitz (Faculty of Mech. Engng., Technion-Israel Inst. of Technol., Haifa, Israel).
Polym. Eng. & Sci. (USA), vol.23, no.3, p.144-54 (Feb. 1983). [received: July 1983]
The mechanical response of integral-skin rigid polyurethane foam, with an average density of 300 to 700 kg/m^3, to constant rate and creep loading was determined. Sandwich specimens were modeled by layers of a core material and two skins, whose secent moduli had been determined experimentally by separate tests and approximated by linear functions of the density. The effective rigidities of the sandwich in tension and flexure were calculated and compared favorably to experimental measurements. The sandwich structure improved the flexural rigidity of homogeneous foam by a factor of more than 2.20. Tensile creep tests of sandwich specimens at relatively low stress levels (up to about 38 percent of their strength) showed that the creep was nonlinear, but a single creep curve could represent creep of specimens of various densities, provided the relative load on them was the same. A limited number of flexural creep tests led to similar conclusions, but the creep rate was smaller than in tension. (18 refs.)

103241 Analysis of the puncture of a bisphenol-A polycarbonate disc. R.P.Nimmer (Corporate Res. & Dev., General Electric Co., Schenectady, NY, USA).
Polym. Eng. & Sci. (USA), vol.23, no.3, p.155-64 (Feb. 1983). [received: July 1983]
The finite element technique is applied to analytically predict the response of a disc made of BPA-polycarbonate during a displacement-controlled puncture test with a hemispherical indenter. The analysis includes effects of contact load, large displacements and rotations, and large strains and material yielding. Two general topics are addressed with this analysis. First, it is shown that the load-displacement behavior of impacted, BPA-polycarbonate plates can be accurately predicted over a wide range of engineering interest (strains up to 30 percent) using a bilinear representation of the stress-strain curve and flow theory of plasticity. For this purpose, the von Mises criterion is applied to define yielding in a generalized biaxial stress state, and strain rate effects are incorporated through the use of a yield stress consistent with the initial strain rate during the test. Second, in order to broaden the understanding of results associated with this widely used test, a number of mechanial and material effects are discussed, including large displacements, friction at the clamped support and indenter head, and clamping pressure at the support. (26 refs.)

103242 Effect of the addition of EPM copolymers on the properties of high density polyethylene/isotactic polypropylene blends. II. Morphology and mechanical properties of extruded samples. L.d'Orazio, R.Greco, E.Martuscelli, G.Ragosta (Istituto di Ricerche su Tecnologia dei Polimeri e Reologia, CNR, Naples, Italy).
Polym. Eng. & Sci. (USA), vol.23, no.9, p.489-97 (June 1983).
For pt.I see ibid., vol.22, p.536 (1982). The influence of the addition of two ethylene-propylene random copolymers (EPM) with different composition on the mechanical properties, thermal behavior and overall morphology of high density polyethylene (HDPE)/isotactic polypropylene (iPP) blends, was investigated on extruded samples. The experimental data showed that the morphology of binary HDPE/iPP blends is drastically modified by these additives and that the ultimate mechanical properties of these mixtures are greatly improved. A reasonable explanation of these results can be ascribed to the fact that these copolymers can act as 'compatibilizing agents' in the amorphous regions of the two semicrystalline homopolymers. The extent of such effects is dependent on the chemical structure and/or on the molecular mass of the added copolymer as well as on the HDPE/iPP blend compositions. (14 refs.)

103243 Microsnonuniform deformation of steel containing non-metallic inclusions. G.I.Bel'chenko, S.I.Gubenko.
Russ. Metall. (GB), no.4, p.82-6 (1981). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.4, p.94-7 (1981). [received: June 1983]
Depending on structure, non-metallic inclusions have a higher or lower plasticity than the steel matrix. Close to the non-deforming inclusions of corundum, spinel and titanium nitrides and oxides an increased deformation develops in the matrix at all the temperatures investigated. Plastic inclusions of sulphides and silicates control the deformation of the ferritic and austenitic matrix of low carbon steel, which, due to its good plastic properties, adapts to the inclusion and deforms with it, to the same degree. Microdeformations around rigid inclusions and cavities are distributed non-uniformly relative to the tensile axis, whilst the microdeformations around the plastic inclusions are distributed more uniformly. The strength of the interface boundary inclusion-matrix can be higher or lower than the intermolecular strength of the inclusion, and this determines the nature of the microfractures occurring close to the non-metallic inclusions during the deformation of steel. (5 refs.)

103244 Effect of structural transformations in the cast conditions on the high-temperature ductility of nickel alloys. K.K.Burnakov.
Russ. Metall. (GB), no.4, p.102-6 (1981). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.4, p.112-16 (1981). [received: June 1983]
If nickel alloy ingots are deformed under industrial conditions a stable dislocation structure and substructure forms which is not removed by intermediate heating. This leads to accumulation of internal stresses which are not relaxed during working and give rise to fracture of the ingots during further deformation. The fracture is also brought about by other factors, namely, lath-shaped inclusions, eutectic, impurities, etc. Cooling the ingots in air after preliminary partial deformation gives rise to the evolution of carbide intermetallic phases in the structure. During subsequent heating recrystallisation nuclei form around these inclusions which grow intensively when the metal is held under these temperatures. After such treatment a structure will form which consists of coarse grains in the previous axial zones and fine grains in the interaxial zones. (4 refs.)

103245 A note on different ways to calculate the activation enthalpy of serrated flow from stress drops. E.Pink (Erich-Schmid-Inst. fur Festkorperphys. der Osterreichischen, Akad. der Wissenschaften, Leoben, Austria).
Scr. Metall. (USA), vol.17, no.7, p.847-52 (July 1983).
The equal suitability has been ascertained of methods which start from easily measurable characteristics of serrations. Empirical relations have been found which correlate the values of Δt with the strain rates. The assumption that the results from such stress drop methods are equal to those which are derived with the conventional method using the critical onset strain, is verified for A-type, but not for C-type serrations. But there are again indications that dynamic strain aging does not follow in every aspect the stationary aging law as formulated by Cottrell and Bilby. (10 refs.)

103246 Deformation properties of high purity α-Fe single crystals. M.Feller-Kniepmeier, M.Hundt (Inst. fur Metallforschung, Tech. Univ. Berlin, Berlin, Germany).
Scr. Metall. (USA), vol.17, no.7, p.905-8 (July 1983).
The strong temperature dependence of the critical shear stress of BCC metals at low temperatures is mainly accounted for by the decreasing mobility of screw dislocations. These processes are superposed by interactions with foreign atoms especially with interstitials. In order to obtain a closer view of the intrinsic deformation properties of α-Fe, tensile and compression tests were done with high purity single crystals. (15 refs.)

103247 Calculating the thermal and stress-strain state of complex shaped steel articles during hardening. V.S.Morganyuk (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.6, p.807-13 (June 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.6, p.80-5 (June 1982).
As a result of solving the thermal conductivity and thermoplasticity problems for the cooling process, a complete picture was obtained for changes in the temperature field, structure and stress strain state during specimen hardening. Curves for calculated residual stresses are compared with experimental data. Agreement of calculated and experimental results is satisfactory. (7 refs.)

103248 Analysis of the strength of copper over wide ranges of temperature and strain rate. V.A.Borisenko, B.D.Kosov, V.P.Krashchenko, V.E.Statsenko, S.V.Guchalov (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.6, p.833-8 (June 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.6, p.101-6 (June 1982).
A general equation was formulated by Borisenko et al. (1982) based on certain preconditions of a physical and empirical nature connecting material ultimate strength σ with thermodynamic parameters, i.e. temperature T and activation energy spectrum (enthalpy) of the plastic deformation process U, and also strain rate $\dot{\epsilon}$. The present authors' aim is to give experimental proof of the equation from test results for copper over a wide range of temperature and strain rates. (3 refs.)

103249 Mechanical properties of composite microwires (copper-glass). I.A.Annanurova, M.V.Zakharova, D.F.Miglei, A.A.Predvoditelev (Moscow State Univ., Moscow, USSR).
Strength Mater. (USA), vol.14, no.6, p.849-52 (June 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.6, p.114-17 (June 1982).
Detailed investigations were made of the mechanical properties of microwires in a glass shell. The results of the X-ray diffraction investigations showed that in general the metal strands are polycrystalline but individual grains may cover the whole cross section of the microwire. It was also established that the structure of the metal strand grains corresponds to the cast condition. The analysis of the strain curve indicates that the deformation of the copper strands is accompanied by marked plastic flow. (9 refs.)

103250 Influence of ultrasonic action on the bending deformation of D16 and V95 alloy plates. G.Ya.Bazelyuk, A.M.Lyubchik, S.Ya.Matsievskaya, G.A.Petrunin, L.V.Tikhonov (Inst. of Metal Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.6, p.853-7 (June 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.6, p.117-21 (June 1982).
Ultrasonic action on plates of D16 and V95 aluminum alloys subjected to a small degree of bending deformation increases the degree of residual deformation. The latter increases with an increase in the time and intensity of the ultrasonic action. The dislocation structure of D16 alloy plates deformed under ultrasonic action differs in the presence of a high density of helical dislocations and dislocation loops, which is an indication of the increased vacancy concentration and also of intense creep over of screw and mixed dislocations during ultrasonic action. Apparently, the processes of creep over of dislocations serve as the basic reason for the increase in residual deformation in deformation in an ultrasonic field. The investigations made make it possible to recommend the method of combined static and acoustic loading for shaping small thin sheet aluminum alloy parts. (4 refs.)

103251 Nonuniformity of distribution of residual microstrains during cyclic deformation. E.A.Belugina, S.I.Popov, N.A.Khudyakova (All-Union Sci.-Res. Inst. Railroad Transportation, USSR).
Strength Mater. (USA), vol.14, no.7, p.895-8 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.34-6 (July 1982).
Microstrain distribution is significantly less uniform under cyclic loading than under static loading and depends on the degree of nonuniformity of the microstructure. A region of compressive strain is formed at the tip of fatigue cracks propagating in austenitic steel G13L. The function representing the dependence of the microstrain correlation coefficient on distance is periodic in nature, with a period roughly equal to two grain sizes for the steel. (4 refs.)

103252 Changes in the structure and mechanical properties of 25Kh2MFA steel under the effect of programmed increasing load and irradiation. I.A.Gindin, V.M.Netesov, L.A.Chirkina, V.S.Okovit, I.F.Borisov, V.K.Aksenov (Physicotech. Inst., Kharkov, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.7, p.898-902 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.36-40 (July 1982).
25Kh2MFA steel in the initial condition is characterized by a finely disperse cellular structure and by the presence of carbide precipitates. The maximum size of the mobile dislocation segment is 5×10^{-7} m. Programmed loading at 473K results in the formation of a structure characterized by the presence of a short-loop spectrum of the dislocations ($L_s=2.5\times10^{-7}$ m) with weak pinning by the point defects. Such a structure has, firstly, a higher resistance to plastic deformation than the initial condition and, secondly, the process of plastic deformation takes place more uniformly in the entire volume of the material. The irradiation of 25Kh2MFA steel with high-energy electrons (225 MeV) with a flux of 7×10^{20} electrons/m^2 increases, because of the formation of a large number of deformation centers in the vicinity of the dislocations, the probability of formation of double kinks thus causing plasticizing of the steel. (12 refs.)

103253 Effect of stress-state invariants on the geometry of strength theories of structural materials. II. V.A.Man'kovskii (Sevastopol' Higher Naval Engng. School., Sevastopol', USSR).
Strength Mater. (USA), vol.14, no.7, p.915-20 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.51-6 (July 1982).
For pt.I see Probl. Prochn., vol.14, no.6, p.49-53, 1982, or Strength Mater., vol.14, no.6, p.769-72, 1982. Macrostatistical normalised stress analysis leads to an important conclusion in principle. The effect of the cubic invariant $I_3(D_\sigma)$ of the normalized-stress deviator on the strength geometry of structural materials can be neglected. Moreover, a similar approach makes it possible to interpret the most prevalent strength criteria in terms of mathematical statistics, to produce the dispersion strength condition, which applies to virtually all known tests (including tests with orthotropic materials) and which results in a majority of prevalent strength theories with certain rather rigid assumptions. (19 refs.)

103254 Effect of the ferrite grain size on the deformation and fracture characteristics of a structural steel. L.I.Gladshtein, N.P.Larionova (Central Sci. Res. & Design Inst. of Engng. Metal Structures, Moscow, USSR).
Strength Mater. (USA), vol.14, no.7, p.936-44 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.68-75 (July 1982).
Refining of the ferrite grains increases the plastic deformation resistance in all the stages of deformation and, in a number of cases, also improves the ductility and energy capacity of the structural steel in a wide range of temperature and loading rate. The cold strength increases simultaneously; this is associated with an increase in the microcleavage stress in the intial and deformed conditions. These changes are particularly marked at grain sizes smaller than 25-30 µm. In the range of the variation of the factors examined in the experiments, the effect of the structure and loading conditions of cold strength was analyzed with the aid of the force criterion of brittle fracture formulated on the basis of the investigations carried out by Ioffe, Davidenkov, Fridman, and Uzhik. It is shown that this procedure can be used to calculate the brittleness transition temperature in various loading conditions. (14 refs.)

103255 Anisotropy of the physicomechanical characteristics of asbestos, glass, and carbon textolites in the 293-873K temperature range. E.A.Eskin, V.K.Fedchuk, V.V.Vengzhen (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.7, p.984-9 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.109-13 (July 1982).
The investigated materials possess significant anisotropy of mechanical properties in tension and bending and insignificant in compression. With an increase in temperature the parameters of anisotropy increase, especially in carbon and carbon-metal plastics. The relationships of tensile strength and modulus of elasticity of the studied materials to the angle of the test α have the form of steadily dropping curves which with an increase in temperature do not change substantially. (5 refs.)

103256 Comparison between high temperature dead-load creep and stress-relaxation deformation in iron-doped polycrystalline aluminum and magnesium oxides. Y.Ikuma, D.K.Shetty, R.S.Gordon (Dept. of Materials Sci. & Engng., Univ. of Utah, Salt Lake City, UT, USA).
Yogyo-Kyokai-Shi (Japan), vol.91, no.5, p.251-7 (1983).
The high temperature deformation of iron-doped polycrystalline aluminum and magnesium oxides was studied by stress relaxation and dead-load creep. Linear and non-linear anelastic effects, which are important in stress relaxation, can lead to significant differences in apparent creep rates and strain rate-stress relationships which are inferred from dead-load creep and stress relaxation data. In the low stress regime, the effects of the major variables, such as temperature and grain size, are similar for both modes of deformation and are consistent with diffusional creep controlled by various combinations of lattice and grain boundary diffusion. In the non-viscous deformation of magnesium oxide, dead-load creep and stress relaxation testing yielded similar results in terms of the grain size effect and activation energy for deformation. However, in the case of iron-doped aluminum oxide, the stress relaxation is apparently athermal and strongly influenced by non-linear anelasticity. (22 refs.)

103257 Some aspects of thermoplasticity. T.Lehmann (Ruhr Univ., Bochum, Germany).
Z. Angew. Math. & Mech. (Germany), vol.63, no.4, p.T3-13 (1983). In German.
Describes the rate-independent non-isothermal form changes in metals assuming the classical continuum, and considering the elements of the solids as thermodynamic systems. The analysis is carried out on the basis of a model by applying tensor calculations for the reversible elastic strains and for the plastic irreversible phenomena. The study indicates the complexity of the problem with unresolved points in the process. (18 refs.) *I.G.*

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81.40N Fatigue, embrittlement, and fracture

(inc. hardness; see also 62.20M Fatigue, brittleness, fracture and cracks)

103258 Sliding mode crack closure and mode III fatigue crack growth in mild steel. E.K.Tschegg (Inst. of Appl. & Tech. Phys., Tech. Univ. Vienna, Vienna, Austria).
Acta Metall. (USA), vol.31, no.9, p.1323-30 (Sept. 1983).
Mode III fatigue crack growth behaviour in AISI C10108 steel ($R=-1$, 1Hz) is investigated in circumferentially notched cylindrical specimens. The crack surfaces in contact glide against each other, the friction, abrasion and mutual support between them reducing the effective stress at the crack tip ('sliding mode crack closure'). Crack growth rates under the effective stressing (so-called 'true' crack growth rates) can be obtained by extrapolation to

zero crack length ($c \rightarrow 0$), when no friction can be present. This way the effect of sliding mode crack closure can be quantified. It increases with increased plastic strain intensity reaches a maximum for $\Delta\Gamma_{III} \sim 1.5 \times 10^{-2}$ mm for the tested specimens and decreases drastically for stressing beyond that value. For these large loadings the large plastic zones formed in mode III open the crack in mode I and eliminate friction. Fractographic evidence for the processes involved is obtained. (16 refs.)

103259 Comparison of transition temperatures from instrumented impact tests with the Robertson crack-arrest-temperature. K.E.Hagedorn (Max-Planck-Inst. fur Eisenforschung, Dusseldorf, Germany).
Arch. Eisenhuettenwes. (Germany), vol.54, no.6, p.239-44 (June 1983).
Presents a definition of a transition temperature in instrumented impact tests characterizing the crack arrest behaviour of steels as the highest temperature up to which the steep drop of the impact load extends down to zero. The comparison of this temperature and the crack arrest temperature of isothermal Robertson tests yielded a good linear correlation. (18 refs.)

103260 Influence of the notch radius on the collapse and initiation limiting temperature of weldable structural steels. H.Krafka, K.Wobst, D.Aurich (Bundesanstalt fur Materialprufung, Berlin, Germany).
Arch. Eisenhuettenwes. (Germany), vol.54, no.6, p.245-52 (June 1983).
Investigates the collapse limiting temperature T_{gy}, initiation limiting temperature T_i the influence of the notch radius for various specimen sizes, material-mechanical correlations, the influence of the plastic stress concentration factor, the cleavage fracture strength and the yield point on T_{gy}. Also gives an estimation of the influence of notch radius and specimen size on the plastic stress concentration factor with the aid of the slip line theory and the stress according to the HRR field and discusses the significance of the results for the safety analysis and T_i as limiting temperature for the application of the elastoplastic fracture mechanics in terms of initiation and growth of stable cracks. (24 refs.)

103261 Crack growth in vitreous silica under dynamic loading. Y.Hibino, S.Sakaguchi, Y.Tajima (Ibaraki Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Ibaraki, Japan).
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.388-92 (Aug. 1983).
The authors studied the stable crack growth process in silica glass under various dynamic loading conditions. Remarkable crack growth was observed. The crack growth process in a constant environment was expressed uniquely as a crack growth rate curve against stress intensity factor, independent of the loading method. (7 refs.)

103262 Load bearing capacity of TiN coated WC-Co cemented carbides. M.T.Laugier (Hard Materials Res. Centre, Sandvik Ltd., Coventry, England).
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.419-21 (Aug. 1983).
TiN coatings produced by CVD on cemented carbide substrates have been found to fail by brittle fracture under normally loaded indenters. In the case of flat indenters the critical load P_c to produce ring cracks was found to be proportional to $D^{3/2}$ when D is the crack diameter. From this result which is consistent with Auerbach's law, values for the room temperature fracture surface energy and the fracture toughness were deduced. (7 refs.)

103263 Fracture morphology of rubber compounds containing recycled rubber powder. R.P.Burford, M.Pittolo (School of Chem. Engng. & Industrial Chem., Univ. of New South Wales, Kensington, NSW, Australia).
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.422-4 (Aug. 1983).
The failure process responsible for the diminution in mechanical properties of rubber compounds containing 'crumb' filler is examined. SEM micrographs of representative fracture surfaces are presented. It is shown that the failure process is associated with dewetting of the crumb particles, with ultimate failure occurring by growth of the voids formed. (13 refs.)

103264 High velocity indentation study of the brittleness of rigid PVC after ageing. G.Roux, G.Revirand (CSTB, St. Martin d'Heres, France).
Cah. Groupe Fr. Rheol. (France), vol.5, no.6, p.305-16 (Feb. 1982). In French. [received: July 1983]
The authors present a direct evaluation by mechanical testing of the mechanical durability of thin rigid PVC profiles. It is made by following a durability index: the brittle temperature, T_F, measured at a constant speed by indentation test after artificial or natural ageing. (5 refs.)

103265 The effect of moisture on the shear properties of carbon fibre composites. O.K.Joshi (Materials & Structures Dept., Royal Aircraft Establ., Farnborough, England).
Composites (GB), vol.14, no.3, p.196-200 (July 1983). (Symposium on Environmental Effects on Fibre-Reinforced Plastics, London, England, 12-13 July 1983).
A study was made of the effect of moisture on the mechanical properties of composites (carbon fibre-reinforced epoxy resins) which are dominated by the matrix or matrix/fibre interface. Such properties are the interlaminar shear strength in unidirectional laminates and tensile strength in (±45) laminates. Unidirectional material was either immersed in boiling water or aged in a hot-humid atmosphere and then the interlaminar shear strength was measured at room temperature in short beam bending. The values obtained were found to be independent of the mode of exposure but depended on the amount of moisture present in the composite. The (±45) material was aged at 70°C and 95% relative humidity to accelerate the moisture uptake and then tested at 20°C, 70°C, 110°C and 130°C. At test temperatures above 70°C the tensile strength decreased as the composite absorbed moisture. Plasticization, swelling and debonding were identified as the factors affecting the failure mechanisms in these laminates.

103266 Effect of moisture on the notch sensitivity of carbon fibre composites. S.M.Bishop (Materials & Structures Dept., Royal Aircraft Establ., Farnborough, England).
Composites (GB), vol.14, no.3, p.201-5 (July 1983). (Symposium on Environmental Effects on Fibre-Reinforced Plastics, London, England, 12-13 July 1983).
The effect of absorbed moisture on the notched tensile strength of multidirectional carbon fibre/epoxy laminates with two different poly stacking sequences has been evaluated at room temperature. In laminates made from fibres with either the standard commercial level or lower levels of fibre surface treatment, moisture resulted in a significant decrease in notched tensile strength and toughness for one stacking sequence but no decrease in the other. Examination of the fractured specimens showed that in the first case, less delamination and shear cracking parallel to the fibres had occurred in wet specimens. It was concluded that the effect of moisture on notch sensitivity was dependent on the mechanisms controlling failure at the notch and these depended on ply stacking sequence. The effect of moisture on the failure mechanisms occurring at the notch is discussed. (6 refs.)

103267 The effects of water absorption on a polyester/chopped strand mat laminate. B.Ellis, M.S.Found (Dept. of Ceramics, Glasses & Polymers, Univ. of Sheffield, Sheffield, England).
Composites (GB), vol.14, no.3, p.237-43 (July 1983). (Symposium on Environmental Effects on Fibre-Reinforced Plastics, London, England, 12-13 July 1983).
The water uptake by polyester resins and a CSM polyester laminate on immersion in liquid water, and the effects of such water uptake on laminate fatigue life and residual strength after fatigue cycling until resin cracking occurs, is described. Diffusion coefficients for water sorption into three resins were determined and also an apparent diffusion coefficient for the net weight change of the laminates. It was found that the fatigue behaviour of laminates after water immersion was complicated, whilst that of unsoaked laminates agrees with expected behaviour. There was an increase in residual strength of the soaked laminates after fatigue cycling. (20 refs.)

103268 Environmental fatigue of reinforced plastics. C.J.Jones, R.F.Dickson (School of Materials Sci., Univ. of Bath, Bath, England), T.Adam, H.Reiter, B.Harris.
Composites (GB), vol.14, no.3, p.288-93 (July 1983). (Symposium on Environmental Effects on Fibre-Reinforced Plastics, London, England, 12-13 July 1983).
Presents the results of a series of experiments on the fatigue behaviour of cross-plied (0/90) epoxy-based laminates reinforced with glass, carbon and Kevlar-49 fibres and, in particular, on the effects of environmental conditioning on this behaviour. Conditioning treatments used include drying, storage in an atmosphere of 65% relative humidity and boiling in water, prior to fatigue tests in repeated tension and in bending. The fatigue resistance of CFRP is unaffected by conditioning treatment and mode of stressing; for GRP there is no significant difference between the behaviour of the dry material and that conditioned at 65% relative humidity. On the other hand, boiling in water always weakens GRP and KFRP, although the effect is small except for the case of GRP in the 0/90 orientation tested in tension. The large reduction in this case results directly from loss of fibre strength during pre-conditioning. Complete drying of KFRP laminates is more damaging even than boiling. (5 refs.)

103269 The effects of environmental exposure on the fatigue behaviour of CFRP laminates. P.T.Curtis, B.B.Moore (Materials & Structures Dept., Royal Aircraft Establ., Farnborough, England).
Composites (GB), vol.14, no.3, p.294-300 (July 1983). (Symposium on Environmental Effects on Fibre-Reinforced Plastics, London, England, 12-13 July 1983).
Tensile and compressive static and fatigue tests were carried out on two CFRP lay-ups; $[(90 \pm 30)_3]_s$ and $[0_2 + 45_2\ 90_2 - 45_2]_s$, both as-received and after exposure to a hot/wet environment for varying times. The rates of moisture absorption of fatigue damaged and undamaged coupons were compared. Static strengths were also measured at 100°C. Damage development was monitored by optical microscopy and ultrasonic C-scan. Despite the laminates having essentially resin dominated behaviour, environmental exposure had little effect on the strengths and fatigue lives compared with the as-received material. There were, however, significant differences in the damage developed during fatigue. (10 refs.)

103270 Post-impact fatigue performance of carbon fibre laminates with non-woven and mixed-woven layers. W.Cantwell (Dept. of Aeronautics, Imperial Coll. London, London, England), P.Curtis, J.Morton.
Composites (GB), vol.14, no.3, p.301-5 (July 1983). (Symposium on Environmental Effects on Fibre-Reinforced Plastics, London, England, 12-13 July 1983).
Woven and non-woven carbon fibre laminates were subjected to drop-weight impact at energies of up to seven Joules. The damaged laminates were tested to differing periods of O-tension and O-compression fatigue, and then static residual strength tests were performed. The non-woven composite showed greater losses in static strength after impact than the mixed-woven composite, particularly when tested in compression. After tensile fatigue, significant improvements in residual strength were recorded, which coincided with the observation of micro-delaminations throughout the laminate. After compressive fatigue there was little change in residual strength. (9 refs.)

103271 Effect of composition on the fracture toughness of hard metals. J.S.August, S.Kalish (Adamas Carbide Corp., Kenilworth, NJ, USA).
Int. J. Refract. & Hard Met. (GB), vol.2, no.2, p.88-92 (June 1983).
The influence of composition and grain size on the fracture toughness of hard metals based upon tungsten carbide, cobalt and titanium carbide was investigated. The correlation between fracture toughness properties and transverse rupture strength was also investigated. The method used is the short rod fracture toughness test and the investigation demonstrated that this test is an important tool for the development of new carbide grades and for gaining an understanding of the mechanisms of the effect of cubic carbide phase additions on the properties of cemented carbide. Results also showed that the fracture toughness measurement will not substitute for the necessity of an impact test of good reliability to determine the application properties of hard metals. (6 refs.)

103272 Structure and quantitative fractography of brittle fracture faces of low-carbon and low-alloy steels. V.M.Goritskii, D.P.Khromov (Central Sci.-Res. & Design Inst. of Structural Metal Materials, Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1169-78 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The structure of brittle fracture faces was studied, including the size distribution of transgranular fracture facets, nucleation and direction of propagation of transgranular fractures relative to the direction of growth of macrocracks, and elongation of ferrite grains. The relationship between these properties and the structure of low-carbon and low-alloy steels was determined. It was found that the size of transgranular fracture facets of steels with a ferrite-pearlite structure was determined by the ferrite grain size. The nature of the distribution of the directions of transgranular fracture in steels depended on the composition and on conditions during thermomechanical treatment. It was concluded that in the process of brittle fracture the main crack propagated by nucleation (ahead of it) of leading microcracks and their subsequent coalescence with the macrocrack. (13 refs.) *A.T.*

103273 Influence of the cohesive strength of grain boundaries on strain and structure characteristics of fracture of dispersion-hardening copper-base alloys. N.V.Nikitina, V.N.Khodorenko, A.D.Korotaev, S.I.Bogdanova, Yu.I.Chumlyakov (V.D. Kuznetsov Siberian Physicotech. Sci.-Res. Inst., State Univ., Tomsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.6, p.1194-201 (June 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The flow curves right up to the moment of fracture, formation of the first cracks, and fracture surfaces of dispersion-hardening Cu-8% Al-2% Co-0.3% Sb and Cu-8% Al-2% Co (at.%) alloys, characterized by a cohesive strength of grain boundaries, were investigated in the temperature range 77-293K. A reduction in the cohesive strength of grain boundaries reduced greatly the

plasticity and strength of the material at low temperatures. The stresses corresponding to the onset of crack formation were determined. The methods of optical and scanning electron microscopy were used to identify the sources of cracks and their growth paths as a function of the flow stress and localization of slip. A relationship was found between the strain and structure characteristics of fracture. (10 refs.) *A.T.*

103274 Investigation of the mechanical lifetime of polymer films under the action of electrical fields and discharges. S.A.Abasov, M.A.Kurbanov, S.Sh.Bedirhanova, T.M.Veliev, S.S.Ragimov.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.6, p.63-6 (1982). In Russian.
The dependence of the lifetime (τ_M) of polystyrene of the mechanical stress (σ) under the action of electrical field and discharges in air and liquid nitrogen has been investigated. It has been established that the dependence of lg τ_M on σ at the action of discharges in air has two linear parts, one of which (at $\sigma > \sigma^*$) conforms with dependence $\lg\tau_M = f(\sigma)$ in discharges absence, and anoitselfr (a *t* $\sigma < \sigma^*$) distinguishes the from it by the slope as a function of the decrease of the lifetime. In the case of action of discharges in liquid nitrogen a linear relation between lg τ_M and σ is apparent in the whole measured range of σ. (6 refs.)

103275 Fracture toughness of composite adherend adhesive joints under mixed mode I and III loading. E.J.Ripling, J.S.Santner, P.B.Crosley (Materials Res. Lab., Glenwood, IL, USA).
J. Mater. Sci. (GB), vol.18, no.8, p.2274-82 (Aug. 1983).
A tapered double cantilever beam specimen was modified in order to evaluate the fracture toughness of scarf joints. The modification was relatively simple: the bond line which is normally perpendicular to the applied load with this type of specimen was inclined to form the scarf joint. With this change, both normal and shear components of force act on the crack plane. Hence, in addition to measuring the total strain energy release rate, $\mathcal{G}_{total}$, its two components, the opening mode toughness, $\mathcal{G}_I$, and the edge shearing or tearing toughness, $\mathcal{G}_{III}$, were measured as well. In spite of the fact that the separation loads increased continuously with increasing scarf angle, or over-lap length, $\mathcal{G}_{total}$ and $\mathcal{G}_{III}$ only increased so long as the ratio of over-lap length to thickness did not exceed 1.75:1. Further increases in over-lap length decrease the toughness because of separation of fibres within the composite adherends. (9 refs.)

103276 Influence of precracking load on critical stress intensity factor of mild steel. Hsing-Shih Chen, Ji-Liang Doong (Dept. of Mech. Engng., Nat. Cheng Kung Univ., Tainan, Taiwan).
J. Mater. Sci. (GB), vol.18, no.8, p.2305-10 (Aug. 1983).
The effects of precracking load on critical stress intensity factor are studied. A plane stress model of elastic/plastic stress distribution which has strain hardening effects included is used. The effects of residual stresses and strain hardening due to fatigue load are calculated by choosing plastic zone size as fracture criterion. And experimental results are obtained to prove the reliability of theoretical calculations. The results show that the influence of fatigue load can be estimated directly by a computer program. (16 refs.)

103277 A fracture mechanics analysis of polypropylene/rubber blends. J.M.Hodgkinson, A.Savadori, J.G.Williams (Dept. of Mech. Engng., Imperial Coll. of Sci. & Technol., London, England).
J. Mater. Sci. (GB), vol.18, no.8, p.2319-36 (Aug. 1983).
Static fracture tests have been carried out on a series of polypropylene/EPR/HDPE blends in order to compare their behaviour with that of the copolymers. From the evidence it appears that these materials are very similar to the copolymers in terms of fracture behaviour and morphology. The examination of impact fracture behaviour of the blends showed that both instrumented and energy measuring pendulum machines yield similar results when loading times are similar. However, it has been shown that short loading times may lead to high fracture energies, which cause blunting of the crack tip. This behaviour has been modelled using previously developed theory. The effects described demonstrate the care required in impact data interpretation. (21 refs.)

103278 Contribution of texture to the strengthening and fracture in hot-rolled magnesium-12.7 at.% cadmium alloy. G.Sambasiva Rao (Dept. of Metall., Regional Engng. Coll., Warangal, India), Y.V.R.K.Prasad.
J. Mater. Sci. (GB), vol.18, no.8, p.2385-92 (Aug. 1983).
The grain size dependencies of the yield and fracture stresses in hot rolled Mg-12.7 at.% Cd alloy have been measured in the temperature range 77 to 420K and are found to be in accordance with Hall-Petch type of equations. In hot rolled Mg−12.7 Cd alloy, the Hall-Petch intercept σ_{0y} is higher than that in hot rolled magnesium, while the slope k_y is comparable. The fracture is intercrystalline at 77K, mixed mode at 300K and ductile at 420K. The above flow and fracture behaviours are interpreted in terms of the complimentary effects of texture hardening and solid solution strengthening. (26 refs.)

103279 Strength and fracture of amorphous and partially crystallized selenium. A.R.Daudi, K.N.Subramanian (Dept. of Metall., Mech. & Materials Sci., Michigan State Univ., East Lansing, MI, USA).
J. Mater. Sci. (GB), vol.18, no.8, p.2393-400 (Aug. 1983).
The role of spherulitic crystallization on strength and fracture of the elemental glass-former selenium was investigated. Partially crystallized selenium samples having various sizes and volume fractions of spherulites were obtained by heat-treating amorphous selenium at 62, 82 and 100°C for different lengths of time. The flexure strength of partially crystallized selenium decreases with increasing size of spherulites. Scanning electron microscopy of fractured specimens showed that fracture nucleated in the peripheral regions of the spherulites. (22 refs.)

103280 Properties of $Na_2O.3SiO_2$ glasses impregnated with ethyl alcohol. M.Nogami, M.Tomozawa (Materials Engng. Dept., Rensselaer Polytech. Inst., Troy, NY, USA).
J. Mater. Sci. (GB), vol.18, no.8, p.2453-8 (Aug. 1983).
$Na_2O.3SiO_2$ glasses impregnated with up to 8.5 wt.% ethanol were prepared under high pressure and hydrothermal conditions and their properties such as hardness, fracture toughness and density were measured. Both hardness and density increased initially with increasing ethanol content up to $1{\sim}2$ wt.% ethanol and then decreased with further increase in ethanol content, while fracture toughness decreased monotonically. This initial increase of hardness and density of ethanol-impregnated glasses is in contrast to the behaviour of glasses with high water content, which showed a steadily decreasing hardness and density with increasing water content. A structural study using IR and X-ray diffraction analyses was also made and changes in properties of glasses with increasing ethanol was related to the formation of Si-O-C bonds and the precipitation of sodium carbonate crystal. (21 refs.)

103281 The measurement of glass fibre strength in composites from studies of their fracture surfaces. A.C.Jaras, B.J.Norman (Res. & Dev. Labs., Pilkington Brothers plc, Ormskirk, England), S.C.Simmens.
J. Mater. Sci. (GB), vol.18, no.8, p.2459-65 (Aug. 1983).
Scanning electron microscopy provides a convenient technique for the study of glass fibre-reinforced composite fracture surfaces. The work describes how a detailed examination and measurement of the 'mirror zones' on the fracture surfaces of the fibres themselves can be used to evaluate the fibre strength at the time of failure of the composite. A mirror zone/fibre strength calibration for single E-glass fibres and alkali resistant (AR) glass fibres was made giving an inverse square root relationship for fibres down to 12 μm diameter and for strengths as high as 2000 MN m^{-2}. Using the calibration, fibre strengths in situ can be measured on failed composites and strength histograms compiled. The technique has primarily been used on fibre strength studies of glass reinforced cement composites and reinforced plastics. (36 refs.)

103282 The hardness of $PbO\text{-}ZnO\text{-}B_2O_3$ glasses. N.Shinkai, R.C.Bradt, G.E.Rindone (Ceramic Sci. & Engng. Program, Dept. of Materials Sci. & Engng., Pennsylvania State Univ., University Park, PA, USA).
J. Mater. Sci. (GB), vol.18, no.8, p.2466-70 (Aug. 1983).
Glasses were prepared within the ternary $PbO\text{-}ZnO\text{-}B_2O_3$ system and their microhardnesses were measured. Maxima in the hardnesses were found at about the 60 mol.% B_2O_3 composition and were related to the glass structure. Trends of the hardnesses were explained in terms of the coordination of the boron and the effects of the PbO and ZnO on the structure as well as the void fraction within the glass. The hardnesses and the Young's elastic moduli were observed to be related and are also discussed. (19 refs.)

103283 The tearing of highly oriented linear polyethylene. J.Clements, I.M.Ward (Dept. of Phys., Univ. of Leeds, Leeds, England).
J. Mater. Sci. (GB), vol.18, no.8, p.2484-96 (Aug. 1983).
The tearing behaviour of oriented linear polyethylene has been studied with particular emphasis on the effects of draw ratio, draw temperature and molecular weight distribution. In all cases the values of fracture surface energy were in the range 10^2 to 10^4 Jm^{-2}. The difference between the low molecular weight grades and high molecular weight grades of linear polyethylene were large. At high molecular weight the energy for crack propagation parallel to the direction of orientation fell by a factor of approximately two as the draw ratio was increased from 10 to 20. At low and medium molecular weights, increasing the draw ratio above a value of 10 had no significant effect on the fracture surface energy. Observation of the fracture surfaces showed a simple relationship between the nature of the fracture surface and the value of the fracture surface energy. (18 refs.)

103284 Fracture toughness and limiting strength of cermets. E.Ohtsuki (Dept. of Metal Processing, Tohoku Univ., Sendai, Japan), H.Fujita, T.Kito, Y.Masuda.
J. Jpn. Inst. Met. (Japan), vol.47, no.7, p.568-74 (July 1983). In Japanese.
The fracture toughness K_{IC} and limiting strength of TiC-base cermets were determined by means of analysis of the effect of fracture-initiating defect-size on fracture stress. The K_{IC} value of TiC-16-44 mass%Ni alloys increases in the range of 6.0-9.5 $MPa\sqrt{m}$ with increase in nickel content. The value of K_{IC} (8.2 $MPa\sqrt{m}$) of a TiC-28 mass%Ni alloy decreases monotonically to 5.8-6.4 $MPa\sqrt{m}$ with increase in the content of the added carbides (Mo_2C, NbC, TaC, VC) up to 18.5 mol% (added carbides in carbide phase), except for WC addition. The decrease of K_{IC} by adding different carbides is due to the embrittlement of binder phase which is caused by dissolution of titanium and other elements be contained in the added carbides. By comparing the K_{IC} of TiC-Ni alloys with that of WC-Co alloys, it was found that the K_{IC} for a cermet composed of carbide and metal phases depends mainly on the elastic moduli ($E\&\nu$) of the alloy, and also on the critical strain energy release rate (G_{IC} (BP)) and volume fraction (f) of metal phase, according to the following equation. $K_{IC} = (E.G_{IC}(BP).f/(1-\nu^2))^{1/2}$. The limiting strength of TiC-Ni alloys, which is independent of the size of fracture-initiating defect, is raised from 1.98 to 2.57 GPa as the nickel content increases from 16 to 44 mass%, and is lowered slightly by addition of carbides except tungsten carbide. (26 refs.)

103285 Hydrogen embrittlement of Ni-Cu binary alloys. T.Maruno, R.Hotta (Graduate Student, Nagoya Inst. of Technol., Nagoya, Japan), R.Otsuka.
J. Jpn. Inst. Met. (Japan), vol.47, no.7, p.582-9 (July 1983). In Japanese.
To clarify the correlation between the hydrogen embrittlement and the hydride (β-phase) formation in transition metals, Ni-Cu binary alloys have been investigated by means of electrolytic hydrogen charging and X-ray diffraction methods. The hydride formation was controlled by varying three factors, i.e. copper content, charging current-density and temperature. In any case of these three factors, it was found that independent of hydrogen content the hydrogen embrittlement occurred always only when the hydride was formed. It was concluded that the hydrogen embrittlement can be ascribed to the discontinuous expansion which accompanies the α-β transformation (hydride formation) caused by the change in hydrogen concentration. (20 refs.)

103286 Some problems on the practical use of a 3.5 GPa grade maraging steel. Zhong da Yin (Harbin Inst. of Technol., Harbin, China), H.Suto.
J. Jpn. Inst. Met. (Japan), vol.47, no.7, p.590-6 (July 1983). In Japanese.
Some problems on the practical use of a 3.5 GPa maraging steel, that is, mechanical anisotropy, hydrogen embrittlement and the strength of welded joints were examined. The typical texture as a *BCC* metal was developed by cold rolling, but the mechanical anisotropy was not so distinct. The conventionally heat treated steel is very sensitive to hydrogen embrittlement. Electron beam welding reduced the tensile strength from 3.5 GPa to 3.0 GPa, but it is recommended as an available welding process for this steel. The structures of weld metal and heat affected zones were observed by means of transmission electron microscopy. (15 refs.)

103287 Fatigue crack propagation characteristic and fatigue fracture toughness in 780 MPa grade high strength steel weldments at low temperature. K.Sato (Faculty of Engng., Tohoku Univ., Sendai, Japan), T.Yokobori, H.Igarashi, S.Nishida, H.Masumoto.
J. Jpn. Inst. Met. (Japan), vol.47, no.7, p.596-602 (July 1983). In Japanese.
Fatigue test and fracture toughness test in 780 MPa grade high strength steel weldments in the temperature range from 98K to room temperature were experimentally carried out. Both the tests were performed with a compact tension specimen by using a program-load-controlled 0.98 MN fatigue crack testing machine. It was found that the fatigue propagation rate in the base metal shows a similar value in both the weld metal and HAZ. The trend of fatigue crack propagation characteristic in weldments in the temperature range from 223K to room temperature is in good agreement with the dislocation dynamics theory of fatigue crack propagation. Fatigue fracture toughness, K_{fc} and fracture toughness, K_c in the base metal are larger than in both the weld metal and HAZ. (22 refs.)

103288 Effects of aging treatment on the mechanical properites of cold rolled high strength low alloy steel. M.R.Kim (Engng. Graduate School, Seoul Nat. Univ., Seoul, Korea), D.B.Hyun, T.H.Kim, S.C.Maeng.
J. Korean Inst. Met., vol.21, no.4, p.380-8 (April 1983). In Korean.
Hardness, tensile properties and impact toughness of 0.07C-1.4Mn=0.08Nb and 0.07C-1.4Mn-0.09V steels, which had been cold rolled by different degrees, were studied after aging treatment at 600°C for varying period of times. By increasing aging times, there appeared two peaks of hardness values or strength. Aging time, which caused the hardness peaks, were interdependent of cold rolling degree and were constant for the same steel. When compared at the same hardness level, ductility and impact toughness of the samples of secondary hardness peak were much better than that of the samples of primary hardness peak. Test results of mechanical properties are discussed in relation with the precipitation particle size and its distribution, coherency of the particles, and recrystallization. (14 refs.)

103289 A study on the tempered embrittlement of martensite-bainite duplex structure in Ni-Cr-Mo steel. Young Keun Oh (Graduate School, Nanyang Univ., Seoul, Korea), Jin Tae Song.
J. Korean Inst. Met., vol.21, no.4, p.389-400 (April 1983). In Korean.
A study has been made on tempered embrittlement of AISI 4340 steel having martensite-bainite duplex structure, as compared with that in tempered martensite, metallographically. Impact toughness was measured by Charpy impact tester, microstructure was examined by means of optical and transmission electron microscope, and fracture surface scanning electron microscope. The lower bainite was precipitated acicularly so as to partition prior austenite grain and the upper bainite was precipited massively so as to fill prior austenite grain. These shapes of bainite had an effect on the impact toughness, temper embrittlement and brittle fracture resistance of martensite-bainite duplex structure. The 300°C-tempered martensite embrittlement was greatly improved by martensite-bainite duplex structure and the ductile-brittle transition temperature of martensite-bainite duplex structure was lower than that of martensite. (22 refs.)

103290 Mechanical properties of ceramics. II. Strength and fracture of ceramics. N.Miyata, H.Jinno.
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.354, p.340-6 (March 1983). In Japanese.
For pt.I see ibid., vol.32, p.229 (1983). Briefly describes factors affecting the strength and fracture of ceramics, based on a recent study of the effect of microstructure on them. The topical areas include: (1) factors affecting the strength of ceramics, (2) brittle fracture in ceramics, (3) the theoretical tensile strength of solids, (4) Griffith's fracture theory and fracture mechanics, (5) the effect of microstructure on fracture, (6) the effect of porosity and grain size on strength, (7) the effect of local stress field on crack nucleation and propagation, (8) stress-induced microcracking mechanism, and (9) stress-induced phase transformation mechanism. (47 refs.) *K.B.*

103291 Mechanical properties of ceramics. III. Hardness and toughness of ceramics. M.Shimada, M.Koizumi (Osaka Univ. Osaka, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.355, p.451-7 (April 1983). In Japanese.
For pt.II see ibid., vol.32, no.354, p.340 (1983). Data on hardness of ceramics is reviewed and values of different materials are plotted for comparison. Methods of determining hardness are outlined. Particular attention is given to the Vickers hardness test and resultant data. In reviewing ceramic toughness, methods of measurement and data obtained are compared. The possibilities for improving the toughness of ceramics are discussed. (12 refs.) *M.O.*

103292 Results of fatigue tests and prediction of fatigue life under superposed stress wave and combined superposed stress wave (case of SCM 435 and $2^1/_4$Cr-1Mo steel, room temperature and 500°C). S.Takasugi, T.Horikawa, T.Tsunenari, H.Nakamura (Tech. Inst., Kawasaki Heavy Industries Ltd., Akashi, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.356, p.471-7 (May 1983). In Japanese.
In order to examine fatigue life prediction methods at high temperatures where creep damage need not be taken into account, fatigue tests were carried out on plane bending specimens of alloy steels (SCM 435, $2^1/_4$Cr-1Mo) under superposed and combined superposed stress waves at room temperature and 500°C. The experimental data were compared with the fatigue lives predicted by using the cycle counting methods (range pair, range pair mean and zero-cross range pair mean methods), the modified Goodman's equation and the modified Miner's rule. The fatigue life prediction method which is being used for the data at room temperature is also applicable to predict the life at high temperatures. (12 refs.)

103293 Flexural properties of moldings of rigid polyurethane RIM. H.Yokono, M.Iida, M.Gotoh (Production Engng. Res. Lab., Hitachi Ltd., Yokohama, Japan), Y.Miyano.
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.356, p.503-8 (May 1983). In Japanese.
Flexural properties of moldings made by RIM (reaction injection molding), which are structural foams consisting of high density skin and low density core, were investigated by three-point bending tests. Two breaking modes were observed in bending tests of the moldings, depending upon the density ratio of skin layer and core layer. The other side of the skin layer on which load was applied was broken by tensile stress. The same side of the skin layer on which load was applied was broken by compressive stress, causing Wrinkling buckling. The conventional composite beam theory was applied to the former breaking mode and Hoff's buckling to the latter, and equations were derived to predict the flexural properties of the structural foams which involve buckling from the flexural properties of solid construction. (8 refs.)

103294 Fracture criterion of flake graphite cast iron. T.Noguchi (Faculty of Engng., Hokkaido Univ., Sapporo, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.356, p.516-21 (May 1983). In Japanese.
Fracture criterion of gray cast iron under non-uniform stress was discussed on the basis of bending and eccentric tension tests performed on the rectangular specimens at room and liquid nitrogen temperatures. The experimental results were analyzed with a concept of 'over stressed depth δ', which was proposed as a fracture criterion of notched cast iron. The values of δ, obtained from the calculated stress distribution at fracture and the tensile strength of the material, were almost constant and 2-5 mm for both bending and eccentric tension at room temperature, coinciding with those obtained in notched plates and bars. At liquid nitrogen temperature, δ decreased to less than 1 mm, also coinciding with that in notched tension. Thus the applicability of constant δ as the fracture criterion under the stress gradient conditions was confirmed. (6 refs.)

103295 Relation between bending and direct stress fatigue strengths of steels. S.Koe, H.Nakamura, T.Tsunenari, T.Okada (Tech. Inst., Kawasaki Heavy Industries Ltd., Akashi, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.356, p.522-7 (May 1983). In Japanese.
An attempt was made to correlate bending and direct stress fatigue strengths by using the cyclic stress-strain relation of the material. The cyclic stress-strain relation was shown to be representable with the ultimate tensile strength: σ_B as follows $\sigma = 1.73\sigma_B\epsilon_p^{0.16}$. By using this relation, the nominal stress σ_n in bending was calculated and related with the true stress σ at the specimen surface. Then, by replacing the nominal stress by the surface stress, *S-N* curves obtained from the bending and direct stress fatigue tests on S15 CK steel were compared to each other and shown to be in good agreement. Therefore, the bending fatigue strength was found to be correlatable with the reversed direct stress fatigue strength through σ_n-σ diagrams. (9 refs.)

103296 Propagation and non-propagation of fatigue cracks in notched plates of low-carbon steel. Y.Nakai (Dept. of Mech. Engng., Osaka Univ., Suita, Japan), K.Tanaka, R.Kawashima.
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.356, p.535-41 (May 1983). In Japanese.
Sharply notched specimens of structural low-carbon steel were fatigued under several ratios of maximum to minimum stresses. The growth behavior of a fatigue crack near the notch root was analysed based on the crack closure measurement. A fatigue crack first decelerated with increasing crack length, and then accelerated or became non-propagating depending on the range and ratio of the applied stress. The effective range of the stress intensity factor was found to be the single-valued parameter in describing the growth rate of small cracks near the notch root, and their relation agreed well with that obtained for long cracks. By considering the increase in crack closure stress with crack length, a quantitative method was proposed for predicting the non-propagating crack length and the fatigue strength reduction of notched specimens as a function of the applied stress and the notch geometry. (22 refs.)

103297 Evaluation of fatigue crack growth characteristics of SCM 435 steel by ultrasonic method. K.Hirano, A.Ishii, H.Kobayashi, H.Nakazawa (Faculty of Engng., Tokyo Inst. of Technol., Tokyo, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.356, p.542-8 (May 1983). In Japanese.
Fatigue crack growth tests in a wide range of fatigue crack propagation rates covering the threshold condition were conducted at various stress ratios using a quenched-tempered and high strength steel SCM 435 with changing heat treatment. The crack closure behavior due to both the plastic deformation at the crack tip and the formation of oxide deposits on crack faces at an ultralow, near-threshold propagation rate were confirmed experimentally by the proposed Top-on ultrasonic method. The influences of stress ratio, strength level and microstructure on fatigue crack growth characteristics were discussed on the basis of the crack closure concept. It was shown that the fatigue crack propagation rate, da/dN, can be related uniquely to the effective stress intensity factor range, ΔK_{eff}, and the threshold level defined at $da/dN = 10^{-8}$ mm/cycle in terms of effective stress intensity factor range, $\Delta K_{eff,th}$, are nearly constant regardless of stress ratio and strength level. (33 refs.)

103298 High temperature strength of SUS 316 stainless steel subjected to creep damage. K.Yagi, C.Tanaka, K.Kubo, H.Tanaka (Nat. Res. Inst. for Metals, Tokyo, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.356, p.556-62 (May 1983). In Japanese.
The tensile, creep and fatigue tests were carried out on stress aged SUS 316 stainless steel in order to clarify the effect of creep damage on fatigue strength. The interaction between creep damage and high temperature strength, especially fatigue life, was discussed. The precipitates of $M_{23}C_6$, χ-phase and Laves-phase were observed, and σ-phase precipitated mainly along grain boundaries in the long-term stress aged material. In the long-term stress aged material the creep cavities were found to exist along the grain boundary particles and non-metallic inclusions in grain. The fatigue life of the stress aged material decreased with increasing ageing time. On the other hand, the fatigue life of the thermal aged material increased by ageing. It was considered that the increase of fatigue life of the thermal aged material was related to structural change, especially the precipitation of carbides, etc., and that the decrease of fatigue life of the stress aged material was related to creep cavities which accelerate fatigue-crack initiation and propagation. (19 refs.)

103299 Thermal fatigue strength of high-temperature structural materials for power plant. K.Kuwabara, A.Nitta, T.Kitamura (Central Res. Inst. of Electric Power Industry, Komae, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.356, p.570-6 (May 1983). In Japanese.
In order to investigate the basic thermal fatigue (TF) life properties of materials used for high-temperature components in a power plant, in-phase and out-of-phase TF tests as well as isothermal low-cycle fatigue tests at maximum temperature, T_{max}, were carried out on low-alloy steels, austenitic steel and superalloys. Also, based on these test results, TF life prediction from other mechanical properties was discussed. The dependence of TF life on strain range could be classified into four categories, and two of them (i.e. I- and O-types) showed shorter in-phase and out-of-phase TF lives at low strain ranges. The I-type was due to creep-fatigue interaction in the in-phase TF, while the O-type was caused by the difference in crack initiation life between both phases. The TF lives of low-alloy and stainless steels with low-strength and high-ductility, except a case of the I-type, were almost the same. In general the TF lives of superalloys with high-strength and low-ductility were shorter than those of the above steels, but approached to them at low strain ranges. (13 refs.)

103300 Energetic conditions for brittle fracture. XI. Interaction between strength and elasticity. G.A.Prantskyavichyus.
Liet. TSR Mokslu Akad. Darbai B Ser.(USSR), no.134, p.61-6 (1983). In Russian.
A thermodynamic model of a rod in tension is proposed, being a balance between surface energy and work required for extension, which takes into account nonlinearities in the elasticity of the material and predicts tensile strength. The model is used to calculate the tensile strength of a number of metallic and nonmetallic materials in the form of crystal filments. These data successfully predict the increase in tensile strength of filaments with decreasing cross section. The use of the method to predict tensile strengths of polycrystalline materials is indicated. (9 refs.) *C.J.S.*

103301 Fatigue life of brittle superconducting alloys in normal and superconducting states. L.F.Yakovenko, V.V.Pustovalov, N.M.Grinberg (Phys.-tech. Inst. of Low Temperatures, Acad. of Sci., Kharkov, Ukrainian SSR).
Mater. Sci. & Eng. (Switzerland), vol.60, no.2, p.109-12 (Aug. 1983).
The temperature dependence of the fatigue life was studied over a wide temperature range for two superconducting niobium-based alloys which have different brittleness. It was revealed that the transition to the superconducting state in the 50 Nb-50 Ti alloy results in a rapid rise in the fatigue life, while the fatigue lifetime of the 50 Nb-50 Zr alloy is independent of both the superconductor state and the temperature. It is proposed that the difference between the behaviours of the two alloys is due to the different amounts of microplasticity resulting from the cyclic loading. (5 refs.)

103302 Creep fracture in polymers: technique and data handling for a statistical characterization. A.Pavan, G.D'Ariano, L.Benini (Politecnico di Milano, Milan, Italy).
Mater. Sci. & Eng. (Switzerland), vol.60, no.2, p.137-43 (Aug. 1983).
The need for a more thorough statistical characterization of creep fracture in polymers than is usually made is stressed. An automatic recording apparatus that can test a hundred specimens simultaneously is described. An example of data acquisition and handling is given for notched polymethyl methacrylate. The results show a high degree of experimental scatter even for propagation-controlled creep fracture. (12 refs.)

103303 The transition from stage I to stage II fatigue crack propagation in copper single crystals cycled at constant strain amplitudes. A.S.Cheng, C.Laird (Dept. of Materials Sci. & Engng., Univ. of Pennsylvania, Philadelphia, PA, USA).
Mater. Sci. & Eng. (Switzerland), vol.60, no.2, p.177-83 (Aug. 1983).
Stage I crack propagation has been studied in smooth specimens of copper single crystals cycled at strain amplitudes corresponding to the plateau of the cyclic stress-strain curve. The transition from stage I to stage II propagation received special attention with respect to crystal orientation. It has been observed that the transition is accompanied by slip on the secondary slip system and the maximum stage I crack length decreases drastically for orientations in which the shear stress on the secondary system more closely approaches that on the primary system. A theory for the transition is offered, based on the postulate that stage II propagation occurs at a stage I crack when work hardening at the tip of the crack in the primary persistent slip band (PSB) raises the resolved shear stress locally acting on the secondary slip system to that required to initiate a PSB in that system. Reasonable agreement between calculated and measured values of the stage I crack length at transition to stage II supports the approach used. (16 refs.)

103304 The micro-mechanisms of tempered martensite embrittlement in 4340-type steels. N.Bandyopadhyay (Dept. of Materials Sci. & Engng., Univ. of Pennsylvania, Philadelphia, PA, USA), C.J.McMahon,Jr..
Metall. Trans. A (USA), vol.14A, no.7, p.1313-25 (July 1983).
A study of the micro-mechanisms of tempered martensite embrittlement was made on a series of 4340-type steels in which the contents of manganese, silicon, and trace impurities, especially phosphorus and sulfur, were varied. One plain-carbon steel was also examined. The study employed Charpy impact tests and four-point slow-bend tests coupled with an elastic-plastic stress analysis, as well as scanning electron fractography. Auger electron spectroscopy, transmission electron microscopy of extraction replicas, and magnetic measurements of the transformation of retained austenite. The results indicate that in these steels the TME phenomenon is an intergranular embrittlement problem caused by carbide precipitation on prior austenite grain boundaries which are already weakened by segregated phosphorus and sulfur. The transformation of intragranular retained austenite is concluded not to be of primary significance in the TME in these steels, although it may contribute to the magnitude of the TME toughness trough. (38 refs.)

103305 Fatigue of Cu-1 pct Cd. N.Behnood (Dept. of Metall. & Engng. Materials, Univ. of Newcastle upon Tyne, Newcastle upon Tyne, England), J.T.Evans.
Metall. Trans. A (USA), vol.14A, no.7, p.1327-32 (July 1983).
The fatigue properties of high conductivity Cu-1 pct Cd are reported. In contrast to Cu, the fatigue strength of Cu-Cd is grain-size dependent in high cycle fatigue. Strain aging is responsible for the superior fatigue properties of Cu-Cd, and the effect of dislocation pinning is carried over to the cold work state, giving a work hardened structure which is stable in fatigue loading. A notable feature of the results is that fatigue fracture in Cu-Cd is almost entirely intergranular at long fatigue lives, in contrast to the fracture in tensile loading and in contrast to the transgranular fracture which was observed in Cu. The effect is due to segregation of Cd at the grain boundaries and to the effect of Cd on the cohesive strength of the boundary. Moderate cold work suppresses intergranular fracture. (14 refs.)

103306 Deformation and fracture of strongly textured Ti alloy sheets in uniaxial tension. K.S.Chan (Dept. of Metall. Engng., Michigan Technol. Univ., Houghton, MI, USA), D.A.Koss.
Metall. Trans. A (USA), vol.14A, no.7, p.1333-42 (July 1983).
The influence of crystallographic texture on the deformation and fracture behavior of strongly textured Ti alloy sheet has been investigated. Uniaxial tensile tests have been performed on Ti-6Al-4V and Ti-5Al-2.5 Sn sheet with both a basal and a basal-transverse texture. The results indicate that, by controlling the ease of through-thickness slip, the crystallographic texture strongly affects the plastic anisotropy of the material but has relatively little effect on the strain-rate sensitivity and work-hardening rates at large strains. A strong resistance to through-thickness slip, manifested by a high R-value, enhances the post-uniform elongation and the ability of the material to retain the load-carrying capacity beyond maximum load. This behavior can be qualitatively understood in terms of the effect of R on the hardening which occurs as the strain state within the diffuse neck shifts from uniaxial tension toward plane strain. A higher R-value also increases significantly the limit strain at the onset of localized necking as well as the fracture strain. (27 refs.)

103307 Stretch forming and fracture of strongly textured Ti alloy sheets. K.S.Chan (Dept. of Metall. Engng., Michigan Technol. Univ., Houghton, MI, USA), D.A.Koss.
Metall. Trans. A (USA), vol.14A, no.7, p.1343-8 (July 1983).
The influence of plastic anisotropy and R-value on the stretch forming and fracture behavior of strongly textured Ti-6Al-4V and Ti-5Al-2.5Sn sheets has been examined utilizing sheet specimens with a wide range of R-values but with similar word hardening and strain-rate sensitivity characteristics. The results indicate that a high R-value and difficult through-thickness slip enhance the forming limit as well as fracture strains when the minor strain in the plane of the sheet is negative, this effect being most pronounced at uniaxial tension. At plane strain, the R-value has little or no influence on the limit or fracture strain. A direct determination of the effect of R-value on the biaxial stretch forming characteristics of Ti-6-4 sheet is precluded by the intervention of fracture prior to localized necking when the minor strain is positive. The influence of plastic anisotropy on both the localized necking and the fracture behavior can be generally understood in terms of the difficulty of attaining critical thickness strains as through-thickness slip becomes more difficult. (25 refs.)

103308 Statistical aspects of cleavage fracture in steel. A.G.Evans (Dept. of Materials Sci. & Mineral Engng., Univ. of California, Berkeley, CA, USA).
Metall. Trans. A (USA), vol.14A, no.7, p.1349-55 (July 1983).
The fracture of mild steel in the cleavage range has been evaluated using a weakest link statistical model, assuming the preexistence of a distribution of cracked carbides. The model provides a rationale for the critical fracture distance, namely the distance from the crack tip at which the probability of cleavage cracking exhibits a maximum. The critical distance depends on the size distribution and volume fraction of carbides. The model also predicts trends in K_{IC} with material properties: flow strength, cracked carbide size and volume fraction, and grain size. The resultant temperature dependence of K_{IC} is shown to derive exclusively from the temperature dependence of the flow stress, as in prior models. The effects of microstructure on K_{IC} depend primarily on the size distribution of cracked carbides, with additional influences of the grain size and of the volume fraction of carbides. (21 refs.)

103309 Effect of prestrain on the mechanical properties of eutectoid steel. M.C.Juhas (Dept. of Metall. Engng. & Materials Sci., Carnegie-Mellon Univ., Pittsburgh, PA, USA), I.M.Bernstein.
Metall. Trans. A (USA), vol.14A, no.7, p.1379-88 (July 1983).
This investigation was designed to study the effect of prior compressive deformation and temperature on the subsequent dynamic fracture toughness, K_{Id}, of fully pearlitic 1080 rail steel. Charpy instrumented impact tests on precracked specimens were performed at room temperature at a variety of prior strain levels from 0 to 20 pct. In addition, transition temperature tests were performed on specimens of zero, low (5 to 10 pct), and high (15 to 20 pct) prior strains. Dynamic fracture toughness (K_{Id}) and energy absorbed per fractured area (W/A) were obtained from instrumented impact data. It was found that, at room temperature, compressive strain had no effect on either K_{Id} or W/A. In the transition temperature range, W/A decreased with increasing prior strain, while there was no effect on K_{Id}. At temperatures in the upper shelf region, prior strain decreased both K_{Id} and W/A. There was no effect on the transition temperature as the amount of prior strain was increased. Thus, while both dynamic fracture toughness and impact properties can be significantly changed by varying temperature, cold working the material has at best a modest effect on impact energy and then primarily only in the upper shelf region. (21 refs.)

103310 Tempered martensite embrittlement in Fe-Mo-C and Fe-W-C steel. H.Kwon, C.H.Kim (Dept. of Materials Sci. & Engng., Korea Advanced Inst. of Sci. & Technol., Seoul, Korea).
Metall. Trans. A (USA), vol.14A, no.7, p.1389-94 (July 1983).
A study on the phenomenon of tempered martensite embrittlement (TME) has been made in experimental Fe-Mo-C and Fe-W-C steel. Charpy impact testing was conducted to evaluate the impact toughness, sensitive to TME. Retained austenite was observed by an analytical transmission electron microscopy in both steels. Both steels represented TME. TME was correlated with the formation of the interlath cementite, resulting from the decomposition of interlath retained austenite. TME occurred in a limited range of test temperatures where the interlath cementite could act as a source of embrittling cracks. Therefore, both the interlath cementite resulting from the decomposition of the interlath retained austenite, and the level of matrix toughness, enabling the interlath cementite to act as an effective embrittler, are necessary to produce TME. (16 refs.)

103311 The influence of the $M_{23}(C,N)_6$ compound on the mechanical properties of type 422 stainless steel. P.R.Landon (Lawrence Livermore Nat. Lab., Livermore, CA, USA), R.D.Caligiuri, P.S.Duletsky.
Metall. Trans. A (USA), vol.14A, no.7, p.1395-408 (July 1983).
Ductility and toughness of type 422 stainless steel was shown to be strongly influenced by either the presence or absence of large grain boundary precipitates of the $M_{23}(C,N)_6$ compound. A lengthy, isothermal solution heat treatment combined with a longer, lower temperature precipitation heat treatment was used to exaggerate the $M_{23}(C,N)_6$ compound along the boundaries of large austenite grains. After a subsequent conventional heat treatment, the presence of this compound along the prior austenite grain boundaries substantially reduced the ductility and the Charpy V-notch impact energy. The primary fracture mode was intergranular failure along these prior austenite grain boundaries. This is a reversible process and this compound can be completely dissolved. The $M_{23}(C,N)_6$ compound was removed from these prior austenite grain boundaries by another lengthy, isothermal resolution heat treatment. After a subsequent conventional heat treatment, the ductility returned to values which are near those found in as-received and heat treated material; the Charpy V-notch impact energy increased to values above that found in commercially processed type 422 stainless steel. The fracture appearance returned to the more normal transgranular ductile dimple mode. (19 refs.)

103312 Localized heat generation during fracture of cyclically loaded steel. P.J.Loos (Res. Lab., Hughes Tool Co., Houston, TX, USA), F.R.Brotzen.
Metall. Trans. A (USA), vol.14A, no.7, p.1409-19 (July 1983).
A theoretical model describing heat generation in the plastically deforming region near a crack tip under cyclic loading conditions has been developed. It predicts crack-tip temperature as a function of stress-intensity amplitude, cyclic loading frequency, time under load, and material parameters. Crack-tip temperatures are measured in AISI 4135 steel at a loading frequency of 20 Hz by employing a scanning infrared camera system. Measured temperatures compare reasonably well with values predicted by the theoretical model. Temperature changes are small under prevailing testing conditions. (23 refs.)

103313 Surface deformation and crack initiation during fatigue of vacuum melted iron: environmental effects. D.Majumdar, Yip-Wah Chung (Dept. of Materials Sci. & Engng., Northwestern Univ., Evanston, IL, USA).
Metall. Trans. A (USA), vol.14A, no.7, p.1421-5 (July 1983).
Samples of vacuum melted commercially pure iron were fatigued in the reverse bending mode in different environments including ultrahigh vacuum, oxygen, water vapor, and their combinations. Reverse bending alternating stress in ultrahigh vacuum produced a rumpled surface (without any prominent slip lines) with cracks initiated along grain boundaries. In the presence of oxygen, such fatigue generated well-developed slip lines. Fatigue cracks were observed more along slip lines than grain boundaries. When the same sample was fatigued in both ultrahigh vacuum and oxygen in succession, the resulting surface structure was dependent on the order in which two environments were employed. In water vapor, there was a reduction in surface deformation at low pressures and coarse, prominent slip lines at high pressures. It also caused grain sliding and void formation. In an environment of water vapor and oxygen, fatigue caused grain boundary cracking and reduced plastic deformation inside grains surrounded by those cracks. Possible reasons for these observations are discussed. Suggestions are also made for utilizing some of these findings to improve the fatigue performance of metals. (34 refs.)

103314 Comparison of the plane strain crack arrest fracture toughness of 4340, 4140, and 1340 steel. E.J.Ripling (Materials Res. Lab. Inc., Glenwood, IL, USA), J.H.Mulherin, P.B.Crosley.
Metall. Trans. A (USA), vol.14A, no.7, p.1459-65 (July 1983).
The plane strain crack arrest fracture toughness of 4140 and 1340, both in a fully martensite condition, was measured over a yield strength range of 965 to 1240 MPa, and a test temperature range of -54 to 74°C. These results were compared with each other and with the data collected earlier on 4340. The 4340 was found to be far tougher than the other two alloys at all yield strengths and test temperatures. The 4140 was tougher than the 1340, although the difference appeared to decrease as the yield strength increased. The toughness of the fully hardened 4140 was also compared with the toughness measured earlier on a 25 pct thicker plate that did not through-harden. Although all data were plane strain, there was a sizable toughness loss for the plate that was not through-hardened. Crack arrest fracture toughness was found to be sensitive to steel composition, test temperature, yield strength, and microstructure. (8 refs.)

103315 Creep crack growth behavior of several structural alloys. K.Sadananda, P.Shahinjan (Naval Res. Lab., Washington, DC, USA).
Metall. Trans. A (USA), vol.14A, no.7, p.1467-80 (July 1983).
Creep crack growth behavior of several high temperature alloys, Inconel 600, Inconel 625, Inconel X-750, Hastelloy X, Nimonic PE-16, Incoloy 800, and Haynes 25 (HS-25) was examined at 540, 650, 760, and 870°C. Crack growth rates were analyzed in terms of both linear elastic stress intensity factor and J^*-integral parameter. Among the alloys Inconel 600 and Hastelloy X did not show any observable crack growth. Instead, they deformed at a rapid rate resulting in severe blunting of the crack tip. The other alloys, Inconel 625, Inconel X-750, Incoloy 800, HS-25, and PE-16 showed crack growth at one or two temperatures and deformed continuously at other temperatures. Crack growth rates of the above alloys in terms of J^* parameter were compared with the growth rates of other alloys published in the literature. Alloys such as Inconel X-750, Alloy 718, and IN-100 show very high growth rates as a result of their sensitivity to an air environment. Based on detailed fracture surface analysis, it is proposed that creep crack growth occurs, by the nucleation and growth of wedge-type cracks at triple point junctions due to grain boundary sliding or by the formation and growth of cavities at the boundaries. (48 refs.)

103316 Low cycle fatigue of Ti-Mn alloys: microstructural aspects of fatigue crack growth. Y.Saleh (Metals Res. Labs., Olin Corp., New Haven, CT, USA), H.Margolin.
Metall. Trans. A (USA), vol.14A, no.7, p.1481-6 (July 1983).
Fatigue crack path behavior of a series of Ti-Mn alloys heat treated to produce volume fractions of the alpha phase ranging from 0 to 97.5 pct was investigated. Both Widmanstatten and equiaxed morphologies of the α phase were used in the study. Interior and surface crack paths are discussed in terms of slip behavior and microstructural details. (12 refs.)

103317 The effect of hydrogen gas on the plasticity/cleavage balance in Fe-3.5 pct Si. J.T.Evans (Dept. of Metall. & Engng. Materials, Univ. of Newcastle upon Tyne, Newcastle upon Tyne, England), D.Hardie, R.J.Harrison.
Metall. Trans. A (USA), vol.14A, no.7, p.1505-10 (July 1983).
Notched specimens of grain-oriented iron-3.5 pct silicon were strained in air and in hydrogen gas at different displacement rates. The presence of hydrogen was found to induce cleavage fracture, mainly on the cube face planes, whereas fracture in air under the same conditions was ductile. A notable feature of the results is that some cleavage fracture, apparently occurring on the (110) plane, was seen in specimens strained at right angles to the rolling direction. The presence of hydrogen was found to induce cleavage most easily at the fast and intermediate displacement rates; at the slowest strain rate the specimens were much more ductile. It is believed that the dynamic component of the flow stress must be maintained above a critical level to allow the hydrogen to alter the balance between cleavage fracture and ductile plastic flow in favor of cleavage. (25 refs.)

103318 Oxide scale induced cleavage fracture in an ODS Fe-Cr-Al alloy. J.M.Davidson, C.M.Austin, M.L.Robinson (Inco Alloy Products Co. Res. Center, Suffern, NY, USA).
Metall. Trans. A (USA), vol.14A, no.7, p.1516-18 (July 1983).
A novel mode of cleavage initiation has been observed in an oxide dispersion strengthened (ODS) ferritic stainless steel, INCOLOY alloy MA 956. Cleavage fracture in this alloy can be initiated by the presence of a surface oxide scale developed during elevated temperature exposure. This mechanism appears to be related to complex interactions between the oxide scale and the underlying alloy substrate during post-exposure deformation. (15 refs.)

103319 Flow localization accompanying the intergranular fracture of Ni_3Al. E.M.Schulson (Thayer School of Engng., Dartmouth Coll., Hanover, NH, USA), D.L.Davidson, D.Viens.
Metall. Trans. A (USA), vol.14A, no.7, p.1423-4 (July 1983).
Using the method of selected area electron channelling in scanning electron microscopy it was found that localized plastic flow accompanies the intergranular propagation of cracks in Ni_3Al broken under uniaxial tension at room temperature. (5 refs.)

103320 Fatigue crack growth rate of Ti-6Al-4V prealloyed powder compacts. S.W.Schwenker (Air Force Wright Aeronaut. Labs., MLLS, Wright-Patterson Air Force Base, OH, USA), A.W.Sommer, D.Eylon, F.H.Froes.
Metall. Trans. A (USA), vol.14A, no.7, p.1524-8 (July 1983).
The fatigue performance of powder metallurgy material is compared with that of ingot metallurgy materials. It was found that microstructure influenced the fracture path in both cases. Fractographic features of prealloyed power compacts of Ti-6Al-4V were observed in both the low and high stress intensity regimes. (16 refs.)

103321 Microfracture model for hydrogen embrittlement of austenitic steels. R.E.Stoltz (Exxon Corporate Res. Lab., Linden, NJ, USA), N.R.Moody, M.W.Perra.
Metall. Trans. A (USA), vol.14A, no.7, p.1528-31 (July 1983).
A microfracture model based on a critical local stress for intergranular fracture is used to explain hydrogen embrittlement effects in austenitic steels. The model predicts variations in the size of a partially cracked region which is observed at crack arrest threshold. A critical stress for fracture in 200 MPa hydrogen gas at 298K of $\approx$2800 MPa is consistent with the data. Increases in grain size are predicted to raise the lower limiting threshold value for high strength alloys, if grain boundary segregation effects are eliminated. (20 refs.)

103322 Lower-tail approximations for the probability of failure of three-dimensional fibrous composites with haxagonal geometry. R.L.Smith (Dept. of Math., Imperial Coll., London, England), S.L.Phoenix, M.R.Greenfield, R.B.Henstenburg, R.E.Pitt.
Proc. R. Soc. London Ser. A (GB), vol.388, no.1795, p.353-91 (8 Aug. 1983).
The chain-of-bundles model for the strength of unidirectional fibrous materials is extended to cover 3D situations wherein the parallel filaments are arranged laterally in a hexagonal array. Within each bundle, the strengths of the fibres vary statistically and share load according to a local load-sharing rule, a rule which describes how the loads of failed fibres are redistributed on to nearby surviving fibres. The authors consider two idealized versions of this rule, one geometrically motivated and the other more mechanically motivated. They extend earlier asymptotic techniques for the 2D planar problem to the present 3D case, and obtain various approximations for the probability distribution of material strength. The Weibull distribution again emerges as central to the results, but the calculation of its shape and scale parameters is greatly complicated by the large number of new failure configurations that may arise in the haxagonal array of fibres. (17 refs.)

103323 Energy criterion for modelling creep rupture of high-density polyethylene. B.W.Cherry, Teoh Swee Hin (Dept. of Materials Engng., Monash Univ., Clayton, Victoria, Australia).
Polymer (GB), vol.24, no.8, p.1067-70 (Aug. 1983).
A technique involving the use of a three-element mechanical model with a critical stored energy criterion modelled accurately the creep rupture time of two types of high-density polyethylene (HDPE) specimens. The upper stress limit where the specimen ruptured immediately on application of load and the lower stress limit where the specimen sustained the load indefinitely were also features of the model. These two limits were found to depend on the resilience, elastic modulus and anelastic modulus of the HDPE. (21 refs.)

103324 Notch sensitivity and fractography of polyolefins. R.D.Goolsby, A.M.Chatterjee (Westhollow Res. Center, Shell Dev. Co., Houston, TX, USA).
Polym. Eng. & Sci. (USA), vol.23, no.3, p.117-24 (Feb. 1983). [received: July 1983]
The notch sensitivity of high-density polyethylene (HDPE), polypropylene (PP), and polybutylene (PB) was evaluated using uniaxial tensile deformation and fractographic analysis. Each polyolefin was tested at relatively low and high molecular weights (MW). Only the lower MW HDPE was found to be clearly notch-sensitive. The lower MW PP exhibited some tendency toward notch sensitivity. The lower and higher MW PB, the higher MW HDPE, and the higher MW PP displayed notch strengthening. Whereas PB showed similar notched tensile performance regardless of molecular weight, both HDPE and PP showed higher susceptibility to notch sensitivity at lower molecular weights (and concomitant higher crystallinity). Tendencies toward notch sensitivity or notch strengthening were evidenced in the failure modes of these materials. (15 refs.)

103325 Ductile fracture of a high manganese steel. M.A.Shtremel', S.A.Nikulin, V.P.Kanev.
Russ. Metall. (GB), no.4, p.87-96 (1981). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.4, p.98-106 (1981). [received: June 1983]
Depending on the magnitude of the strain hardening exponent n, there are two alternative conditions for neck formation in tensile loading: at low n, it is the geometrical loss of flow stability for the strain $e_p=n$ while at high n stability is lost prior to reaching the strain $e=n$; evidently, this is caused by 'internal necking' (macrocracks on the axis of the specimen). As in the case of dimpled fracture, star or separation fracture starts at the 'bottom' crack on the axis of the specimen. This crack changes to an axial crack because of the anisotropy of the resistance to fracture. Axial fracture in steels with 5-9% Mn takes place completely at grain boundaries and is caused by temper brittleness. The anisotropy of the resistance to grain boundary fracture is caused by plastic elongation of the grains. (12 refs.)

103326 Low-cycle fatigue of the non-magnetic ageing 40G18N13F and 35Kh14G16N10FR steels at +20° and −196°C. V.M.Blinov, M.A.Kablukovskaya, Yu.P.Liberov, V.I.Skol'tsov, G.A.Stepanov.
Russ. Metall. (GB), no.4, p.97-101 (1981). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.4, p.107-11 (1981). [received: June 1983]
The fatigue strength diagram for 40G18N13F and 35Kh14G16N10FR steels under cyclic tension consists of repeated-static and fatigue-fracture regions. On the basis of 10^4 cycles, the cyclic strength of these steels at +20 and −196°C reached 80 and 100-110 kg/mm^2, respectively. The cyclic strength and the fatigue life of both steels increases as a result of ageing and with reduced test temperature. The notch sensitivity is manifested by the fact that the fatigue life of notched specimens is reduced by an order of magnitude, compared with smooth ones, in the range of stresses considered. A notch does not affect repeated-static failure appreciably. The ductile behaviour in the grain boundary zones which are free from precipitates of the hardening phase help to preserve in 35Kh14G16N10FR steel a higher cyclic strength and endurance life at −196°C than in the case of 40G18N13F steel, in spite of its greater tendency to develop intergranular failure. (5 refs.)

103327 Influence of martensite content on the hydrogen embrittlement of dual-phase steels. R.G.Davies (Ford Motor Co., Dearborn, MI, USA).
Scr. Metall. (USA), vol.17, no.7, p.889-92 (July 1983).
The ability of a crack to nucleate and grow in a hydrogen charged dual-phase steel will be a function of the strength (carbon content), size and distribution of the martensite islands. Increased carbon content, that is increased yield strength, will promote the likelihood of hydrogen embrittlement, and it certainly will occur for carbon contents exceeding 0.15%. Cracks may never develop and link-up if the martensite regions are small and widely dispersed. This influence of martensite morphology on the reversible hydrogen embrittlement of dual-phase steels, was studied in a series of low carbon steels heat-treated so as to produce ferritic structures containing from 5 to 45% martensite. (6 refs.)

103328 A comparison of microvoid sizes in nickel base alloys tested in air and in the presence of hydrogen. C.E.Price, L.B.Traylor (School of Mech. & Aerospace Engng., Oklahoma State Univ., Stillwater, OK, USA).
Scr. Metall. (USA), vol.17, no.7, p.901-4 (July 1983).
Presents some results upon the relative void sizes of Nickel 200 (UNS N02200) tested in air and in hydrogen, along with comparative data on Inconel 625. Both annealed and cold worked alloys were investigated. Breaks in air were of the customary cup and cone type for both alloys. By contrast, fractures in hydrogen began at the surface and were neither cup and cone nor 100% microvoid coalescence, irrespective of alloy and condition. At the periphery there was a zone of intergranular, slip plane, or largely featureless slant fracture. Once the fracture mode transition occurred in hydrogen, there was no systematic change in microvoid size over the remaining cross section. (11 refs.)

103329 Fracture mechanics in the presence of electrical fields. V.Z.Parton, B.A.Kudryavtsev (Moscow Inst. of Chem. Engng., Moscow, USSR).
Sov. Mater. Sci. (USA), vol.18, no.5, p.371-81 (Sept.-Oct. 1982). Translation of: *Fiz.-Khim. Mekh. Mater. (USSR)*, vol.18, no.5, p.3-15 (Sept.-Oct. 1982).
The following topics are discussed: equations of linear electrothermoelasticity; brittle fracture mechanics methods applied to piezoelectric materials; an arbitrarily oriented straight crack in an unlimited piezoelectric medium, and the plane problem for an unlimited piezoelectric medium with a crack in the plane of symmetry. (9 refs.)

103330 Combined manifestation of the factors of surface roughness and loading frequency in the fatigue of patented wire. O.N.Romaniv, L.P.Laz'ko, Yu.V.Zima (G.V. Karpenko Physicomech. Inst., Acad. of Sci., L'vov, Ukrainian SSR).
Sov. Mater. Sci. (USA), vol.18, no.5, p.454-8 (Sept.-Oct. 1982). Translation of: *Fiz.-Khim. Mekh. Mater. (USSR)*, vol.18, no.5, p.93-6 (Sept.-Oct. 1982).
The authors have established an increase in fatigue life at a frequency of 50 Hz for polished wire. This they have explained is due to the elimination in polishing of deep production stress raisers. However, they have found no such effect at low frequency when the fatigue resistance both of polished and the original wire is of the same low level, equal to the fatigue resistance of unpolished wire at a frequency of 50 Hz. (6 refs.)

103331 Fatigue damage caused to the material by inelastic loading with periods of load holding. K.M.Kononov, V.B.Poroshin, O.S.Sadakov (Chelyabinsk Polytech. Inst., Chelyabinsk, USSR).
Strength Mater. (USA), vol.14, no.7, p.883-7 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.23-6 (July 1982).
New parameters of state obtained in analyzing the structural model and describing the strain properties of structural materials in a cyclically stable condition during repeated-variable loading with periods of holding the load are proposed for use in the model of damage accumulation. These parameters, regardless of the fact that they can be macroscopically determined, characterize integrally the effects connected with the microheterogeneity of the material and have a definite physical content. A very simple version of the kinetic equation of state is proposed for determining the rate of damage accumulation which produces equations for the number of cycles to fracture resembling the method of rate partitioning. The equation enables the determination of fatigue life for complex regular cyclic loading breaks under load with holdings. The comparison of the model with the experimental data shows its adequacy (especially for pure shear) and also a systematic deviation in cycles with holdings of compressive load. (9 refs.)

103332 Correlation between cyclic plastic strain zone size and the fatigue fracture rate of 15Kh2MFA steel at low temperatures. L.R.Botvina, G.V.Klevtsov, V.M.Markochev, A.P.Bobrinskii (A.A. Baikov Inst. of Metall., USSR).
Strength Mater. (USA), vol.14, no.7, p.887-91 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.27-30 (July 1982).
An investigation was made of the cyclic plastic strain zone h under fatigue fracture surface as a function of test temperature and of the stress intensity factor range. Steel 15Kh2MFA was used as the investigation object and the initial ferrite grain size was $d=(4\text{-}5)\times10^{-5}$ m. An X-ray method was used to measure the cyclic plastic zone depth and plastic strain on fracture surfaces. (13 refs.)

103333 Effect of preliminary mechanical twinning on the ductile-brittle transition temperature for iron with different impurity contents. I.A.Gindin, L.A.Chirkina, V.S.Oskovit, V.M.Azhazha (Physicotech. Inst., Acad. of Sci., Kharkov, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.7, p.968-71 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.95-7 (July 1982).
The work concerns a study of the effect of impurity atoms on the alteration of mechanical properties of iron by preliminary twinning. The study was carried out on pure iron ZhSO from a vacuum electron-beam melt and iron containing 3% silicon. The chemical composition of the test metals is given. Specimens of pure and silicon iron were deformed up to 0.8% by twinning at 80-100K, then annealed at 720K for 2 h in order to relax stresses at the tips and coherent boundaries of twins. The alteration in yield point with slip σ_s and twinning σ_z, the true fracture stress S_K, and relative elongation δ_{tot} in relation to temperature for original pure and silicon iron specimens and those deformed by twinning are given. (7 refs.)

103334 Local exothermic effects during failure of rubber. V.I.Dyrda (Inst. of Geotech. Mech., Acad. of Sci., Dnepropetrovsk, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.7, p.977-9 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.102-4 (July 1982).
During fracture of rubber local exothermic effects have been studied by means of direct experimental methods (IR radiation method); it has been shown by experiment that in individual macroregions of rubber the warm-up temperature may reach that for thermal destruction. (10 refs.)

103335 Fracture toughness of Mn-Zn ferrite single crystal. T.Nishikawa, Y.Okamoto, S.Inagaki (Dept. of Chem., Kyoto Inst. of Technol., Kyoto-shi, Japan).
Yogyo-Kyokai-Shi (Japan), vol.91, no.4, p.149-56 (1983). In Japanese.
Mn-Zn ferrite crystals were fractured along the main low-index planes (100), (110) and (111) to obtain fracture toughness (K_{Ic}) for each plane. A controlled surface flaw (CSF) technique and indentation fracture (IF) technique were used. In the CSF technique, microplastic zones around vickers impressions were identified by slip traces. Removal of the zones by surface grinding resulted in the elimination of residual stress. In the IF technique, the proposed expressions for K_{Ic} evaluation and the effects of surface treatment were discussed. The plane of lowest toughness was (110) with K_{Ic} of 1.14 ± 0.06 $MN/m^{3/2}$ in CSF technique. For IF technique, there was a difference in K_{Ic} between chemically and mechanically polished surfaces: $K_{Ic}=0.73\pm0.02$ $MN/m^{3/2}$ for the former, $K_{Ic}=1.09\pm0.09$ $MN/m^{3/2}$ for the latter (indentation load:100 gf to 300 gf, crack to impression ratio:3 to 4). Etching after indentation resulted in underestimation of K_{Ic} because of crack growth. (24 refs.)

103336 Room temperature strength of sintered β-Sialon. M.Mitomo (Nat. Inst. for Res. in Inorganic Materials, Ibaraki, Japan), S.Nagata, M.Tsutsumi, Y.Fujii.
Yogyo-Kyokai-Shi (Japan), vol.91, no.4, p.171-5 (1983). In Japanese.
The strength of sintered β-Sialon was measured at room temperature. The average strength was 534 MPa. The Weibull modulus calculated from 25 measurements was 6.5. The value excluding two abnormally low strength specimens was 8.8, comparable to that of hot-pressed β-Sialon. The fractures were originated from surfaces or interior defects. The average strength and Weibull modulus of specimens fractured from surfaces were 490 MPa and 4.7, respectively, while those fractured from the interior was 564 MPa and 10.6, respectively. Almost all of the interior defects were large voids or clustered pores. The surface defects were flaws or interior defects exposed to surfaces by polishing. (15 refs.)

103337 Fracture toughness of polycrystalline Ni-Zn ferrite and polycrystalline Ba ferrite. T.Nishikawa, Y.Okamoto, S.Inagaki, K.Kuwahata, M.Tasaki (Dept. of Chem., Kyoto Inst. of Technol., Kyoto-shi, Japan).
Yogyo-Kyokai-Shi (Japan), vol.91, no.5, p.240-50 (1983). In Japanese.
Fracture toughness (K_{IC}) for polycrystals of Ni-Zn ferrite (grain size; 22 μm) and Ba hexaferrite (grain size; 3.5 μm) was measured at room temperature and elevated temperatures up to 1000°C. Room-temperature K_{Ic}'s determined by the controlled surface flaw (CSF) technique for Ni-Zn ferrite and Ba ferrite were 1.50 ± 0.12 and 2.97 ± 0.16 $MN/m^{3/2}$, respectively. In the indentation fracture (IF) technique, different K_{Ic} values were obtained, depending on the equations proposed to evaluate K_{Ic} and the indentation load for testing. There was a difference in fracture mode at room temperature between the two ferrites: transgranular fracture with relatively smooth surface in Ni-Zn ferrite, and intergranular fracture or cleavage of a specific plane in each grain with rough surface on a grainsize-scale in Ba ferrite. There were also differences in K_{Ic} value and fracture behavior at elevated temperatures between the two ferrites. (22 refs.)

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Effect of the stiffness of testing machines on the relationships of deformation and fracture of materials with a heterogeneous structure .... See Entry 103445

81.40P Friction, lubrication, and wear

(see also 62.20P Tribology)

103338 A study of the frictional, wear and contact resistance performance of tin alloy coatings. W.Baumann, W.Degner, J.Fiedler, J.Horn, G.Richter, C.Weissmantel (Tech. Hochschule Karl-Marx-Stadt, Karl-Marx-Stadt, Germany).
Thin Solid Films (Switzerland), vol.105, no.4, p.305-18 (29 July 1983).
The purpose of the present experimental study is to give an assessment of the extent to which tin alloy coatings are suitable as connector contact finishes in low power circuit applications. Sn-Pb and Sn-Ni alloy coatings were electrodeposited onto tin bronze and partially exposed to a thermal post-treatment. The performance of Sn-Pb-coated contacts during mutual sliding is characterized by significant decreases in the frictional force and in its range of variation and, simultaneously, by an increase in the contact resistance by several orders of magnitude after a certain number of sliding cycles. Similar results were obtained for Sn-Ni coatings. Investigations of the properties and structure of the coatings have clarified both the influence of heat treatment and the changes in frictional and contact resistance performance during sliding stress. For Sn-Pb coatings a partial phase transition to metastable α-Sn due to mechanical stress was shown to occur along the wear tracks. (2 refs.)

Analysis of the puncture of a bisphenol-A polycarbonate disc .... See Entry 103241

Rules of fatigue fracture under fretting conditions .... See Entry 103385

Influence of diffusion impregnation in polymer-containing compositions on the physicomechanical properties of steels .... See Entry 103394

81.40R Electrical and magnetic properties (related to treatment conditions)

(see also 72.80 Conductivity of specific semiconductors and insulators, 74.70 Superconducting materials, 75.50 Studies of specific magnetic materials)

Influence of the shape and transmission regime of current pulses on the plastic strain of zinc crystals .... See Entry 101849

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Effect of CuO addition on the electrical and dielectrical properties of semiconducting barium titanate ceramics .... See Entry 102826

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Effects of SME cycle on the mechanical properties of the TiNi alloys .... See Entry 103219

Effect of small additions of titanium and boron on the electrical and mechanical properties of an electroconductor aluminum alloy .... See Entry 103220

Physicomechanical properties of polytetrafluoroethylene treated in a high-frequency gas-discharge plasma .... See Entry 103360

Development of methods of nondestructive quality control for ferrofluids .... See Entry 103435

81.40T Optical properties (related to treatment conditions)

(see also 78.20 Optical properties and materials)

Thermal properties of highly birefringent optical fibers and preforms .... See Entry 100902

Optical absorption of transition metal ions in silica coating films prepared by the sol-gel technique .... See Entry 102974

Influence of annealing temperature on the exponential absorption edge of thin Si:H amorphous films deposited by 'glow discharge' .... See Entry 102978

81.60 CORROSION, OXIDATION AND SURFACE TREATMENTS

103339 On the mechanism of stress corrosion of E-glass fibres. F.R.Jones, J.W.Rock (Dept. of Metall. & Materials Technol., Univ. of Surrey, Guildford, England).
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.415-18 (Aug. 1983).
The authors have studied and compared the stress corrosion failure times of single E-glass filaments in aqueous sulphuric acid and aqueous sodium bisulphate solutions of similar pH. The results suggested that the bisulphate ion, HSO_4^-, is involved in the stress corrosion mechanism. (18 refs.)

103340 Thinning of InP by chemical etching. S.Aytac, A.Schlachetzki, H.-J.Prehn (Inst. fur Hochfrequenztech., Tech. Univ. Braunschweig, Braunschweig, Germany).
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.447-50 (Aug. 1983).
The authors report on a method how thin InP films can be obtained in a simple manner with good control. The salient features to assess the performance of an etchant are the quality of the etched surface, the etching rate and the reproducibility, i.e. the factors controlling the etch attack must be well known. The experiments reported were performed with (100) oriented, 250 μm thick InP crystals supplied with one side mirror. This side was subjected to the etching treatment. (15 refs.)

103341 The environmental degradation of notched CFRP in compression. R.T.Potter, D.Purslow (Materials & Structures Dept., Royal Aircraft Establ., Farnborough, England).
Composites (GB), vol.14, no.3, p.206-25 (July 1983). (Symposium on Environmental Effects on Fibre-Reinforced Plastics, London, England, 12-13 July 1983).
The effect of mechanical pre-loading on the subsequent environmental degradation of notched CFRP specimens has been investigated. Notched compressive strengths were measured using specimens conditioned to give about a 1% moisture content some of which had been preloaded in the dry state. The microstructural factors governing the mechanisms of failure and the resultant strengths have been examined fractographically. It is shown that even quite high levels of pre-loading are unlikely to affect the extent of subsequent environmental degradation. (13 refs.)

103342 Environmental resistance of carbon fibre-reinforced polyether etherketone. F.N.Cogswell, M.Hopprich (Petrochem. & Plastic Div., ICI, plc, Welwyn Garden City, England).
Composites (GB), vol.14, no.3, p.251-3 (July 1983). (Symposium on Environmental Effects on Fibre-Reinforced Plastics, London, England, 12-13 July 1983).
The use of thermoplastic resins as suitable matrix materials for structural composites is discussed. Results of tests on carbon fibre-reinforced polyether etherketone indicate that this material demonstrates satisfactory resistance to aerospace environments and, in particular, is insensitive to moisture even when hot. (14 refs.)

103343 Factors affecting the stress corrosion of GRP in acid environments. P.J.Hogg (Dept. of Metall. & Materials Sci., Univ. of Liverpool, Liverpool, England).
Composites (GB), vol.14, no.3, p.254-61 (July 1983). (Symposium on Environmental Effects on Fibre-Reinforced Plastics, London, England, 12-13 July 1983).
GRP fails by stress corrosion in acid environments which may result in catastrophic fracture. As design confidence in GRP improves and the value of arbitrary 'safety factors' is reduced, the need for reliable data on the long term behaviour of GRP in aggressive environments becomes increasingly important. Three factors which control stress corrosion, i.e. resin, fibre and gel-coats are considered. It is demonstrated that useful improvements may be achieved by varying the resin type and that the optimum resin system must be determined on the basis of mechanical as well as chemical properties. In addition, significant improvements are possible using acid-resistant glass fibre types. The use of resin gel-coats is shown to provide an excellent barrier to acid attack but gel-coat integrity is vital and damaged gel-coats are deleterious. (22 refs.)

103344 Stress corrosion cracking and its implications for the long-term durability of E-glass fibre composites. F.R.Jones, J.W.Rock, A.R.Wheatley (Dept. of Metall. & Materials Technol., Univ. of Surrey, Guildford, England).
Composites (GB), vol.14, no.3, p.262-9 (July 1983). (Symposium on Environmental Effects on Fibre-Reinforced Plastics, London, England, 12-13 July 1983).
The environmental stress corrosion cracking modes of model E-glass fibre-reinforced laminates in aqueous acidic environments, under both bending and tensile loads are discussed. The polyester resin protects the glass fibres more effectively than the epoxy resin, such that the apparent limiting failure strain for fracture within the environment is considerably in excess of that required for unprotected fibres. The failure of the unimmersed half of the polyester laminate after a year's exposure to aqueous sulphuric acid, has considerable implications for the long-term durability of stressed GRP. Further evidence for the reduction in the transverse failure strain of the epoxy coupons is also presented. These results therefore demonstrate that the stress corrosion resistance of GRP at low strains may be controlled by the rate of degradation of the fibre/resin interface. (24 refs.)

103345 Prediction of long-term stress-rupture life for glass fibre-reinforced polyester composites in air and in aqueous environments. M.G.Phillips (School of Materials Sci., Univ. of Bath, Bath, England).
Composites (GB), vol.14, no.3, p.270-5 (July 1983). (Symposium on Environmental Effects on Fibre-Reinforced Plastics, London, England, 12-13 July 1983).
Commences with a discussion of the assumptions embodied in the normal method of presenting results of environmental stress-rupture tests. Results are presented from two test programmes on glass fibre-reinforced polyesters: a chopped strand mast laminate in air; and a mixed woven rovings/chopped strand mat laminate in aqueous environments, revealing very large experimen-

tal scatter. The author then describes methods which have been employed in an attempt to extract from the data predictions of the long term behaviour of the composites and indications of the environment upon them. (9 refs.)

103346 A new self-limiting process for the production of thin submicron semiconductor films. K.C.Lee, J.Silcox, C.A.Lee (School of Appl. & Engng. Phys., Cornell Univ., Ithaca, NY, USA).

J. Appl. Phys. (USA), vol.54, no.7, p.4035-7 (July 1983).

This paper describes a new anodic etching technique for the fabrication of device quality, self-limited, thin submicron semiconductor films. The technique relies upon the creation of a thin slightly damaged surface layer in the semiconductor by low dosage ion implantation. Evidence is presented to show that the lifetime of holes in this layer is drastically reduced causing the etching rate to decrease by a factor of several thousand when the damaged layer is exposed to the anodic etching solution. (8 refs.)

103347 Anodic oxide films on $Pb_{1-x}Sn_xSe$. S.C.Gupta, H.J.Richter (Fraunhofer-Inst. fur Phys. Messtech., Freiburg, Germany).

J. Electrochem. Soc. (USA), vol.130, no.7, p.1469-72 (July 1983).

The process for forming the anodic oxide on $Pb_{1-x}Sn_xSe$ ($x \sim 0.068$) using a constant current source is studied. The electrolyte is composed of N-methyl acetamide, water, and propylene glycol. Reproducible films are obtained with the electrolyte when adjusted to $p\mathrm{H}=6.6 \pm 0.2$ by using oxalic acid and ammonium hydroxide. Surface analysis using X-ray photoelectron spectroscopy has been made. All the three components Pb, Sn, and Se participate in the oxidation. The anodic oxide is composed of PbO, SnO_2, and an oxide of Se. (19 refs.)

103348 Planarization properties of resist and polyimide coatings. L.K.White (RCA Labs., Princeton, NJ, USA).

J. Electrochem. Soc. (USA), vol.130, no.7, p.1543-8 (July 1983).

The planarization properties or thickness changes on topographical features are examined in detail for several types of spun-on polymer films. A profilometer is used to measure the step height changes of isolated line features of various dimensions. The viscosity of the solution appears to give a reasonable indication of the spun-on planarization properties. However, in many cases, the thermal flow of the polymer during a subsequent curing procedure is the dominant planarization mechanism. Methods for producing highly planarized surfaces with positive resist materials are described along with the effects of feature size on the planarization properties. (22 refs.)

103349 Oxidation of arsenic implanted polycrystalline silicon. E.Kinsbron, S.P.Murarka, T.T.Sheng, W.T.Lynch (Bell Labs., Murray Hill, NJ, USA).

J. Electrochem. Soc. (USA), vol.130, no.7, p.1555-60 (July 1983).

The techniques of Rutherford backscattering spectrometry, neutron activation, and transmission electron microscopy were employed in this extensive study of the thermal oxidation of arsenic implanted polycrystalline silicon (polysilicon) films. Some evidence for slower oxidation rates were found for polysilicon layers lying over silicon dioxide substrate as compared to the oxidation rates of films lying directly over bare silicon. Complete oxidation of films lying over silicon dioxide substrates left scattered arsenic-silicon-oxygen inclusions trapped at the original polysilicon/silicon dioxide interface. Significant arsenic diffusion through the underlying silicon dioxide layer, into the silicon substrate, was measured after the complete oxidation of thick polysilicon films over thin silicon dioxide substrates. (17 refs.)

103350 Reactive ion etching of silicon with $Cl_2/Ar(1)$. H.B.Pogge, J.A.Bondur, P.J.Burkhardt (General Technol. Div., IBM Corp., Hopewell Junction, NY, USA).

J. Electrochem. Soc. (USA), vol.130, no.7, p.1592-7 (July 1983).

A study of the use of reactive chlorine species for etching silicon and silicon dioxide in a plasma etching process has been made with a Cl_2-Ar gas mixture in a cathode-coupled diode system. A key advantage of the Cl_2-Ar gas mixture is the ability to achieve high etch rate ratios between silicon and silicon dioxide ($\geq 20:1$) coupled with no mask undercutting, which tends to be prevalent with fluorinated gas systems. Etching characteristics of Si as a function of process parameters (Cl_2 concentration, pressure, system loading) and material parameters (e.g. Si conductivity, edge shape of SiO_2 mask) have been evaluated. These parameters can influence the silicon etch rate, the Si/SiO_2 etch rate ratio, as well as the etched edge shape. (13 refs.)

103351 Chemical stress cracking of acrylic fibres. J.Herms, L.H.Peebles,Jr., D.R.Uhlmann (Dept. of Materials Sci. & Engng., MIT, Cambridge, MA, USA).

J. Mater. Sci. (GB), vol.18, no.8, p.2517-30 (Aug. 1983).

The generation of periodic microscopic transverse cracks in oriented acrylic fibres immersed in hot alkaline hypochlorite solution is described in detail and shown to be a variety of chemical stress cracking. It is greatly accelerated by external tensile stress, high fibre permeability, moderate fibre orientation, and water-plasticization. The proposed mechanism for bond cleavage involves cyclization of nitrile groups (similar to the 'prefatory reaction' in pyrolysis of acrylic fibres), followed immediately by *N*-chlorination and chain scission. Mechanical retractile forces (internal or external) then cause chain retraction and crack growth. Despite the remarkable regularity of the crack pattern, which typically resembles a series of stacked lamellae, the process is independent of any such underlying fibre morphology. The cracking process does, however, appear to be a sensitive indicator of residual latent strain in the fibre, which may persist even after high-temperature annealing. (18 refs.)

103352 Problems of cleaning a surface and evaluation of its cleanness. Z.Rymuza (Inst. Konstrukcji Przyrzadow, Precyzyjnych i Optycznych, Politech. Warszawskiej, Warsaw, Poland).

Pomiary Autom. Kontrola (Poland), vol.29, no.1, p.25-6 (Jan. 1983). In Polish.

Describes the techniques of cleaning a surface and methods of evaluating its cleanness as well as presenting problems and trends in the field of cleaning surfaces of elements. (8 refs.)

103353 Thermo-oxidative ageing and its effect on the network structure and fracture mode of natural rubber vulcanizates. N.M.Mathew, S.K.De (Rubber Technol. Centre, Indian Inst. of Technol., Kharagpur, India).

Polymer (GB), vol.24, no.8, p.1042-54 (Aug. 1983).

The changes in network structure and fracture mode of unfilled and filled natural rubber vulcanizates, during ageing at 100°C have been studied by chemical analyses and scanning electron microscopy. The fall in properties during ageing is caused mainly by chain scission. The increase in crosslink density during the initial periods of ageing causes an increase in modulus and tensile strength. Carbon black accelerates ageing, probably by surface catalysis. The simple network structure of efficiently vulcanized rubber results in better retention of properties during ageing. Antioxidant retards ageing. The extent of degradation of vulcanizates is reflected in the nature of the fracture surfaces. The roughness of the tensile fracture surface is affected to varying degrees depending upon the ageing resistance of the vulcanizates. However, in tear, the mode of fracture propagation is affected by ageing. (29 refs.)

103354 Molecular weight distribution effects on craze micromechanics. A.M.Donald, E.J.Kramer (Dept. of Materials Sci. & Engng., Cornell Univ., Ithaca, NY, USA).

Polymer (GB), vol.24, no.8, p.1063-6 (Aug. 1983).

Quantitative transmission electron microscopy has been used to investigate the micromechanics of crazes in monodisperse and polydisperse polystyrene (PS). In the monodisperse PS, a large stress is observed at the craze tip, but this stress falls rapidly with distance behind the tip. In the polydisperse PS (or in blends in which a small percentage of monodisperse low molecular weight PS has been added to monodisperse high molecular weight PS) the stress at the craze tip is lower and falls much less rapidly with distance behind the craze tip. These changes are attributed to the effects of diluting the network of entangled high molecular weight chains with molecules that are too short to entangle. This dilution increases the molecular stress on the load bearing chains of the network, thus increasing the ease of craze fibrillation. (21 refs.)

103355 Computation of craze surface stresses in high impact polystyrene. L.Bevan (School of Mfg. Studies & Mechanical Engng., North East London Polytech., Dagenham, England).

Polym. Bull. (Germany), vol.10, no.3-4, p.187-90 (July 1983).

The finite element method is used to compute surface stresses for a craze in high impact polystyrene (HIPS) and the results are compared with those obtained using a distributed dislocation stress analysis. There is very good agreement between the stress profiles for the major portion of the craze length. The estimates differ in the craze tip region where calculated stresses are very sensitive to small changes in the displacement profile. (8 refs.)

103356 Solvent-crazing criteria. D.C.Wright, K.V.Gotham (Rubber & Plastics Res. Assoc., Shrewsbury, England).

Polym. Eng. & Sci. (USA), vol.23, no.3, p.135-9 (Feb. 1983). [received: July 1983]

Craze initiation in amorphous thermoplastics can be regarded as a transition from the safe to the unsafe state and, as such, can constitute a rational engineering design limit. A critical appraisal is made of three different criteria for initiation, which are of current interest. From this, it is concluded that the approach which is based upon the concept of inelastic strain is to be preferred to the two other criteria, which are based upon an asymptotic total strain or constant inelastic strain energy criterion. The inelastic strain criterion is not only capable of modeling high stress/strain crazing in air but also satisfies the case of low stress/strain crazing in solvents. Furthermore, it offers an accurate method of extrapolating data to long times and, thus, satisfies a fundamental requirement for a parameter that can be used in engineering design. (7 refs.)

103357 Studies on whitening phenomena induced by some non-solvents on highly oriented glassy polymers. N.H.Sung, R.E.Gahan, R.E.Haven (Dept. of Chem. Engng., Tufts Univ., Medford, MA, USA).

Polym. Eng. & Sci. (USA), vol.23, no.6, p.328-36 (April 1983).

Whitening phenomena, characterized by optically opaque regions when a highly oriented glassy polymer is immersed in some liquids, were investigated as a function of temperature, extent of molecular orientation, different solvent and molecular weight, using oriented polymethyl methacrylate (PMMA) obtained by hot-stretching and cold drawn polycarbonate (PC). Whitened PMMA is highly porous resembling foamed plastics and shows the same T_g as in unwhitened PMMA, while whitened PC is denser with much smaller pores and ehxibits melting behaviour characteristics of solvent-induced crystallinity. Whitening progresses with a sharp boundary between whitened and unwhitened layers which advanced at a constant velocity. At a given temperature, a higher extent of orientation leads to faster whitening process. Entropy correlation theory was employed to correlate the dependency of the whitening rate on orientation. In PMMA, when the molecular weight is in the same order as the average molecular weight between entanglements, the orientation and the whitening rate are both lower than higher molecular weight specimens. (16 refs.)

103358 Influence of mineral oils on polystyrene fracture. E.Paredes, A.Bustamante, L.Rivas (Centro de Quimica, Inst. Venezolano de Investigaciones Cientificas, Caracas, Venezuela).

Polym. Eng. & Sci. (USA), vol.23, no.9, p.498-502 (June 1983).

Polystyrene specimens coated with mineral oils of different viscosities were tested in tension. It was found that craze initiation and tensile fracture stresses, and also the breaking energy decreased with decreasing oil viscosity, all being lower than for specimens tested in air. Crazes formed in oil showed a lower fibril volume fraction and thicker fibrils than air crazes. The most striking difference in the fracture patterns was found in the initiation regions, where a globular morphology appears as a result of fibrils breakage at the stages of slow propagation, these globules becoming bigger with decreasing viscosity of the oil environment. Since the polymer-oil interfacial tensions are similar for the different oils, the trends in mechanical properties and craze and fracture morphologies cannot be attributed to a surface energy effect, but to plasticization because the deterioration in the polymer properties and the increasing craze fibrils thickness go along with the plasticizing ability of the oils. (15 refs.)

103359 Influence of liquid media on the strength of a composite with an aluminum matrix. M.I.Yatsenko, A.G.Vasilenko (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).

Sov. Mater. Sci. (USA), vol.18, no.5, p.399-401 (Sept.-Oct. 1982). Translation of: *Fiz.-Khim. Mekh. Mater. (USSR)*, vol.18, no.5, p.35-8 (Sept.-Oct. 1982).

The authors investigated the influence of liquid media on the anisotropy of the strength of unidirectional boroaluminium sheet in tension. It was found that the corrosion resistance of a composite with brittle fibres is in direct relationship to the direction of reinforcement and the volume content of fibres. (5 refs.)

103360 Physicomechanical properties of polytetrafluoroethylene treated in a high-frequency gas-discharge plasma. V.A.Vonsyatskii, E.A.Roter, V.A.Teterskii, A.N.Tynnyi (G.V. Karpenko Physicomech. Inst., Acad. of Sci., L'vov, Ukrainian SSR).

Sov. Mater. Sci. (USA), vol.18, no.5, p.425-9 (Sept.-Oct. 1982). Translation of: *Fiz.-Khim. Mekh. Mater. (USSR)*, vol.18, no.5, p.64-70 (Sept.-Oct. 1982).

The authors studied the mechanical properties of PTFE irradiated in high-frequency discharge plasma and VUV at different temperatures and also the electrophysical properties of PTFE irradiated in the discharge and then heat treated. The causes of strength and plasticity reduction and conductivity changes are analysed in terms of pyrolysis and radical formation using EPR. (26 refs.)

103361 Influence of water on the relaxation properties of filled elastomers. T.P.Bankovskaya, L.A.Akopyan, V.P.Nikiforov, G.M.Bartenev (Inst. of Phys. Chem., Acad. of Sci., Moscow, USSR).

Sov. Mater. Sci. (USA), vol.18, no.5, p.432-4 (Sept.-Oct. 1982). Translation of: *Fiz.-Khim. Mekh. Mater. (USSR)*, vol.18, no.5, p.73-5 (Sept.-Oct. 1982).

The results of spectrometric analysis of the relaxation processes in rubbers in a wide water temperature range (50-180°C) make it possible to draw conclusions important for practical predictions. In hot and superheated water the same relaxation processes occur in rubbers. With an increase in water temperature they are only accelerated and the relative share of the contributions of the λ- and ϕ-processes to the total mechanism decreases. Therefore, prediction of the relaxation behavior of rubbers in water at comparatively low temperatures by methods of relaxation spectrometry assumes the use of data obtained both in hot and in superheated water. This makes it possible to sharply reduce the time of the preliminary experiment in predicting the limiting times of maintenance of effectiveness of rubbers. (6 refs.)

103362 Distribution of elements according to the thickness of anodic oxide films on gallium arsenide. I.P.Sorokin, V.P.Kuznetsov, S.S.Olevskii (Moscow Inst. of Electronics, Moscow, USSR).
Sov. Electrochem. (USA), vol.18, no.10, p.1170-4 (Oct. 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.10, p.1316-20 (Oct. 1982).
The chemical composition of anodic oxide films on gallium arsenide has been investigated by Auger spectroscopy. The composition of an anodic oxide film depends on the chemical nature of the electrolyte. (27 refs.)

103363 Thermal formation of SiO_2 films over NiSi, $NiSi_2$ and $CoSi_2$ via silicide decomposition. F.M.d'Heurle (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Thin Solid Films (Switzerland), vol.105, no.3, p.285-92 (22 July 1983).
The thermal oxidation of NiSi, $NiSi_2$ and $CoSi_2$ layers on silicon substrates causes the formation of surface films of SiO_2 while the silicide layers are preserved. This is shown to occur via a mechanism of silicide decomposition followed by metal diffusion and recombination. In the disilicides, a measurable fraction of the silicon atoms diffuse together with the metal atoms. The process responsible for the uphill diffusion of the silicon atoms is thought to be similar to oxidation-enhanced diffusion. (22 refs.)

103364 A two-stage solution to the anisotropic polysilicon etching problem. N.P.Armstrong, J.Maleham (Plessey Res. (Caswell), Towcester.Ltd.,England).
Vacuum (GB), vol.33, no.5, p.291-4 (May 1983).
A 2 micron MOS process can make many demands upon dry-etching techniques. The needs of one such process are outlined, together with the search for an etchant gas suitable for the production environment in question. The observed etching characteristics of two well-known contenders, Freon 115 and CCl_4, are described, leading to the development of a useful two-stage solution helped by the real time monitoring ability of a laser interferometric endpoint detector. The final process has been utilised for pilot production over a ten-month period, and is discussed in terms of performance and applications, being capable of batch-etching with less than 0.1 μm linewidth loss per feature, and less than 100 Å underlying SiO_2 loss. (3 refs.)

103365 Role of silicon carbide in Al_2O_3-SiC-C refractories. T.Takahashi, F.Kitani, Y.Miyashita (Tech. Res. Center, Nippon Kokan K.K. Fukuyama-shi, Japan), A.Yamaguchi.
Yogyo-Kyokai-Shi (Japan), vol.91, no.4, p.157-65 (1983). In Japanese.
Al_2O_3-SiC-C refractories are used in ladles for hot metal pretreatment. In the Al_2O_3-SiC-C refractories used in such treatments, the surface of SiC grains is corroded in a comb-like shape, and deposits of carbon are found in the affected section. Na_2O-Al_2O_3-SiO_2 compounds are also deposited on the surface of Al_2O_3 grains and inside the micropores. Microscopic observation is made of the refractories used and a thermodynamic study of the system SiO_2-SiC-C is carried out. (3 refs.)

103366 Laser chemical etching of conducting and semiconducting materials. T.J.Chuang (IBM Res. Lab., San Jose, CA, USA).
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.45-56
The purpose of the paper is to examine the basic processes involved in the laser-enhanced chemical etching of solids. Specifically, the process of chemisorption, the reaction between the adsorbate and substrate atoms and the vaporization of product species affected by the laser radiation are discussed. It is shown that the laser method can provide important insight into the gas-surface reaction mechanisms. In addition, a number of examples are given to demonstrate the potential of the technique for applications to material processing. Some current studies on the laser-induced chemical etching of materials relevant to microelectronics are reviewed. Certain practical experimental approaches are also considered. (53 refs.)

103367 Laser-induced fluorescence diagnostics of $CF_4/O_2/H_2$ plasma etching. S.Pang, S.R.J.Brueck (Lincoln Lab., MIT, Lexington, MA, USA).
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.161-8
Laser-induced fluorescence experiments have been carried out during $CF_4/O_2/H_2$ plasma etching of Si and SiO_2. Measurements of relative CF_2 radical concentrations as a function of RF power, frequency, pressure, and gas composition are reported. The results are correlated with etch rates of Si and SiO_2. The balance between CF_2 and F concentrations is shown to influence the etching process strongly. (20 refs.)

Symposium on Environmental Effects on Fibre-Reinforced Plastics .... See Entry 98620

Ellipsometric method of determining the quality of surface processing .... See Entry 99159

Ion-etching as a means of blazing and optimizing holographic diffraction gratings .... See Entry 100688

Cleaning of GaAs surfaces with low-damage effects using ion-beam milling .... See Entry 100797

High resolution etching of GaAs and CdS crystals .... See Entry 100935

Characteristics of polynorbornene and ethylene-propylene terpolymer blends .... See Entry 101974

Oxygen transport through silica surface layers on silicon-containing ceramic materials .... See Entry 102060

The diffusion of salt solutions into nylon-6 .... See Entry 102078

X-ray spectral study of the surface of flat glass .... See Entry 102140

An ESR investigation of environmental effects on polymeric materials. II. Polyethylene .... See Entry 102752

Study of breakdown fields of oxides grown on reactive ion etched silicon surface: improvement of breakdown limits by oxidation of the surface .... See Entry 102817

Photoemission studies of molecular beam epitaxially grown GaAs(001) surfaces exposed to a nitrogen plasma .... See Entry 103030

Electrodeposition of Ni-B_4C dispersion coatings .... See Entry 103079

Ceramic materials stronger than steel .... See Entry 103165

Water absorption of glass/epoxy laminates under bending stresses .... See Entry 103213

Load bearing capacity of TiN coated WC-Co cemented carbides .... See Entry 103262

The effects of water absorption on a polyester/chopped strand mat laminate .... See Entry 103267

Environmental fatigue of reinforced plastics .... See Entry 103268

The effects of environmental exposure on the fatigue behaviour of CRFP laminates .... See Entry 103269

The influence of structure on the corrosion of glassy copper-zirconium alloys .... See Entry 103371

A consideration about the antireflective coating of silicon solar cells .... See Entry 103706

81.60B Metals and alloys

(inc. stress corrosion cracking; anticorrosion)

103368 Study by factorial analysis of the influence of chemical composition on the stress corrosion cracking of austenitic stainless steels. S.Faty, M.Da Cunha Belo (CNRS, Vitry-sur-Seine, France), J.-C.Dore.
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.14, p.1055-60 (18 April 1983). In French.
The stress corrosion cracking of austenitic stainless steels has been treated by factorial correspondence analysis. This statistical method gives a relationship between chemical characteristics and the susceptibility of the steels of the phenomenon. (7 refs.)

103369 Effect of surfactants upon corrosion inhibition of high-strength steels and aluminum alloys. M.Khobaib (Univ. Energy Systems Inc., Dayton, OH, USA), L.Quakenbush, C.T.Lynch.
Corrosion (USA), vol.39, no.7, p.253-7 (July 1983).
Research has been conducted on the corrosion inhibition of high-strength steels and aluminum alloys. Several formulations such as borate-nitrite, molybdate-nitrite, and benzoate-nitrate provide good inhibition to these alloys in ordinary tap water. However, when the concentration of chloride ions is high (as in the case of seawater), these formulations, in low concentrations, lose their effectiveness. It has been found that small additions of some surfactants improve the inhibition of borate-nitrite systems tremendously, and these combinations act as excellent inhibitors for high chloride-containing water and other aggressive media such as bilge solutions. Several sodium and barium compounds of phosphonates and sulfonates have been studied. The results of anodic and cathodic polarization and immersion tests on high-strength steels and aluminum alloys are discussed. (16 refs.)

103370 On the electrochemical behavior of anodic oxide films on tungsten in phosphate solutions. M.M.Hefny, M.S.El-Basiouny, A.S.Mogoda (Chem. Dept., Faculty of Sci., Cairo Univ., Giza, Egypt).
Corrosion (USA), vol.39, no.7, p.266-70 (July 1983).
The kinetics of chemical dissolution of tungsten anodic oxide films were investigated by capacitance and potential measurements in phosphate solutions. In these solutions, the oxide film appears to be composed of two layers. The outer layer ($\simeq$2/3 of the entire film) as revealed by potential measurements. In the absence of phosphate, the oxide dissolves with a rate proportional to the remaining thickness. From the observed rate of dissolution, the oxide film appears to be composed of two layers. The outer layer ($\sim$2/3 of the entire film) dissolves faster than the inner layer. The film formed in H_2SO_4 is more protective than that formed in HCL or H_3PO_4. (15 refs.)

103371 The influence of structure on the corrosion of glassy copper-zirconium alloys. J.C.Turn,Jr. (United State Steel Res. Lab., Monroeville, PA, USA), R.M.Latanision.
Corrosion (USA), vol.39, no.7, p.271-9 (July 1983).
Glassy alloys of $Cu_{60}Zr_{40}$ were melt spun and subsequently devitrified, yielding single phase polycrystalline material. Comparing the potentiodynamic polarization response of these structural types revealed no significant difference in ϕ_{corr}, b_a, b_c, I_{corr}, and I_o. Other alloys, $Cu_{58}Zr_{42}$ and $Cu_{55}Zr_{45}$ compared in glassy and crystal-line forms revealed that inhomogeneity, caused by precipitation of a second phase, did not alter the corrosion behavior from that of single phase $Cu_{60}Zr_{40}$. Corroded glassy surfaces were generally smooth except for scattered hemispherical features, while crystalline surfaces were generally smooth except for scattered hemispherical features, while crystalline surfaces were densely populated with these features. Corrosion of copper-zirconium alloy occurs by the selective dissolution of zirconium in the vicinity of ϕ_{corr}, whereas, at potentials noble to $-0.1\ V_{SCE}$, copper contributes to the anodic current. Above approximately $0.0\ V_{SCE}$, the alloys passivate. Results of potentiodynamic polarization studies suggest that for these alloys, unlike transition metal-metalloid glasses, devitrification does not significantly affect the corrosion kinetics of copper-zirconium alloys. (30 refs.)

103372 Intergranular corrosion of type 304 stainless steel and Alloy 600 in aqueous solutions containing SO_2. M.Da Cunha Belo, C.Bombart (CNRS, Vitry-sur-Seine, France), P.Berge.
Corrosion (USA), vol.39, no.7, p.279-84 (July 1983).
The susceptibility to intergranular corrosion of type 304 stainless steel and alloy 600 has been investigated in aqueous solutions containing SO_2. Experimental results indicate that both alloys are very susceptible to this phenomenon after sensitizing heat treatments. The rate of penetration of the intergranular attack appears to be governed by chromium depletion at grain boundaries. In the higher sensitized condition, the intergranular corrosion penetrates the entire thickness of 0.5 mm specimens exposed for a week to a solution 0.1 M SO_2 at 40C. Chloride and H_2SO_4 additions could be considerable importance, but SO_2 represents the major factor. (5 refs.)

103373 Analysis of oxide wedging during environment assisted crack growth. S.J.Hudak,Jr., R.A.Page (Dept. of Materials Sci., Southwest Res. Inst., San Antonio, TX, USA).
Corrosion (USA), vol.39, no.7, p.285-90 (July 1983).
Simple models, based on combining electrochemical and fracture mechanics concepts, have been formulated and shown to be useful in analyzing oxide wedging within cracks. These models were used in conjunction with measured oxide induced crack openings in turbine discs to conclude that oxide wedging does not significantly influence stress corrosion cracking in turbine discs containing NDE-detectable flaw sizes. The measured residual stress intensities were found to be between 10 and 20 $MPa\text{-}m^{1/2}$, these being about 20 to 30% of the applied stress intensities. The major contribution to the measured residual stress intensities was shown to be due to oxide contact remote from the crack tip. Based on the models developed, only 1 to 3 $MPa.m^{1/2}$ was applied by the oxide while the cracks were loaded during service. The contribution from oxide wedging generally becomes increasingly important as crack size decreases, thereby suggesting that it would be most significant during crack initiation and early growth of small cracks. (21 refs.)

103374 Intercrystalline corrosion of nickel. J.L.Bentata, S.Corretja, M.C.Petit (Univ. de Bordeaux I, Talence, France), M.Cid.

Mater. Chem. & Phys. (Switzerland), vol.8, no.6, p.553-62 (June 1983). In French.

The authors investigate the influence of the grain size and of the surface state of the passivation-depassivation phenomenon, for nickel in normal sulphuric acid. Up to a value of 750 mV vs. SSE, an instantaneous depassivation leads to an I(t) response which tends towards a stable value of the current, whatever the electrode structure and surface state might be. Corrosion is essentially of an intergranular type. For higher values of potential, electrode response during depassivation is quite different. Current intensity never tends towards a stable value whatever the grain size and the kind of polishing of the sample, this leads to different corrosion facets. (9 refs.)

103375 Generalised corrosion of nickel in sulphuric acid media: influence of grain size and surface preparation. J.L.Bentata, S.Corretja, M.C.Petit (Univ. de Bordeaux I, Talence, France), M.Cid.

Mater. Chem. & Phys. (Switzerland), vol.8, no.6, p.563-72 (June 1983). In French.

The influence of the grain size and of the surface state of crystallographic type corrosion of nickel in sulphuric solutions is investigated. Nickel electrodes of three different kinds are used and their active section is prepared with three different surface treatments. In all cases the I(t) response never tends towards a stable value. (7 refs.)

103376 Dynamic and static crack propagation properties of austenitic steels in dilute acidic geothermal brine. E.Fukushima, S.Kobatake, I.Arima, M.Morita (Res. & Dev. Centre, Toshiba Corp., Kawasaki, Japan).

J. Jpn. Inst. Met. (Japan), vol.47, no.7, p.611-16 (July 1983). In Japanese.

Austenitic steels for geothermal power plants may meet with failure by stress corrosion in geothermal brines containing Cl^-. In this concern, dynamic and static crack propagation properties were investigated for austenitic steels (SUS 304 and SUS 316) in dilute acidic geothermal brine at Onikobe containing 5400 ppm of Cl^-. Experiments were made at Onikobe, and results obtained were analysed especially referring to fractographs. Dynamic crack propagation of austenitic steels except sensitized SUS 304 appeared to be that of corrosion fatigue, for the rate of crack propagation depended on the frequency. As for dynamic crack propagation of sensitized SUS 304, the rate of crack propagation increased rapidly in the region of $\Delta K_I \geq 15$ MPa.m$^{1/2}$ at a low frequency (0.002 Hz) by predominant influence of IGSCC. For sensitized SUS 304, K_{ISCC} was presumed to be about 19 MPa.m$^{1/2}$, and K_{FSCC} (the value of ΔK_I at which the influence of SCC begins to appear in dynamic crack propagation) was presumed to be about 15 MPa.m$^{1/2}$. For SUS 316, no characteristics of IGSCC were observed even in sensitized specimens. (19 refs.)

103377 Carbide-dispersion carburizing of Fe-Ni alloys containing titanium and vanadium. A.Chiba (Dept. of Metall., Faculty of Engng., Kumamoto Univ., Kumamoto, Japan), K.Yamaguchi.

J. Jpn. Inst. Met. (Japan), vol.47, no.7, p.622-30 (July 1983). In Japanese.

Carbide-dispersed layers (CD layers) containing fine particles of TiC or V_4C_3 were formed by carburizing Fe-Ni-2%Ti and Fe-Ni-4%V alloys at temperatures between 1073 and 1273K. The microstructures and the formation rate of the CD layers and the particle size in the CD layers were investigated. A boundary between the CD layer and an unreacted region was plane and distinct in Fe-Ni-Ti alloys, but the boundary in Fe-Ni-V alloys was more irregular and less distinct. TiC particles in Fe-Ni-Ti alloys appeared to have no definite shape, but V_4C_3 particles in Fe-Ni-V alloys were massive and had the cube-cube orientation relationship with the austenite matrix; $(100)_\tau//(100)_{V4C3}$, $[010]_\tau//[010]_{V4C3}$ and $[001]_\tau//[001]_{V4C3}$. The particle size of V_4C_3 in the CD layer of Fe-Ni-V alloys increased linearly with the depth from the specimen surface, and the change in particle size with depth was more remarkable in high Ni alloys. The CD layer grew in proportion to the square root of time, and the reaction rate constant A was shown quantitatively as follows; $A=2\Delta C_C{}^\tau.D_C{}^\tau M_M/(\nu C_M{}^{(0)}.M_C)$, where $\Delta C_C{}^\tau$ is the carbon concentration difference between the specimen surface and the reaction front, $D_C{}^\tau$ is the diffusion coefficient of carbon in austenite, ν is the molar ratio of carbon to the solute (Ti or V) in the carbide MC_ν formed by carburizing, $C_M{}^{(0)}$ is the initial solute concentration (Ti or V) in the bulk alloy, and M_M and M_C are the atomic weights of solute atom and carbon atom. (15 refs.)

103378 Surface hardening or high-C steel by CO_2 laser. T.H.Kim, Y.S.Park, Y.J.Yoon, U.Kim.

J. Korean Inst. Met., vol.21, no.4, p.365-70 (April 1983). In Korean.

The hardened layer of the high-C (1%) steel with a thickness of 25 μm was obtained by the irradiation of CO_2 laser with a power density of 2×10^{15} W/cm^2 for about 0.23 second (spot size of 0.23 mm, scanning speed of 6 cm/min). When the thickness of hardened layer was compared with the temperature calculated by the conduction of heat in solid, the hardening mechanism was due to the solid-state transformation in steel. (17 refs.)

103379 Stress corrosion cracking susceptibility of SUS 304 stainless steel cathodically precharged with hydrogen. H.Uchida, K.Aburatani, K.Koterazawa, I.Yamada (Himeji Inst. of Technol., Himeji, Japan), H.Kawabe.

J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.356, p.549-55 (May 1983). In Japanese.

The stress corrosion cracking (SCC) susceptibility of SUS 304 stainless steel cathodically precharged with hydrogen was investigated in boiling 35% $MgCl_2$ solution at 398K. The specimen preparation was carried out by precharging at 200 A/m^2 for 7.2 ks in the SCC test solution after 0~35% prestrained at 195K, and successively SCC tested by the constant loading method. The mechanical properties of specimens precharged with hydrogen are closely related to the hydrogen-induced phase transformation. The lattice of α'-martensite in high prestrain, in particular, is expanded and activated. In this case, the crack initiation during SCC of these specimens is controlled, consequently the SCC susceptibility shows a marked decrease. On the other hand, the SCC fracture surface morphology of specimens precharged with hydrogen depends on the distribution and form of strain-induced martensite (ϵ, α'), which contributes considerably to the susceptible path for cracking. It is considered from these results that the role of hydrogen dissolved in specimen during SCC has the effect of embrittlement and active dissolution to ϵ- and α'-martensite, respectively. (20 refs.)

103380 Oxidation of carburized Hastelloy X. D.Gan (HTGR Safety Div., Brookhaven Nat. Lab., Upton, NY, USA).

Metall. Trans. A (USA), vol.14A, no.7, p.1518-21 (July 1983).

Extensive research has been performed on many candidate alloys to study their properties in HTGR helium, and in addition to oxidation, it has been found that carburization is also a possible problem in HTGR. Carbon in the graphite core, carried out by carbon-containing impurities such as CO and CH_4, can deposit on the diffuse into metallic components and cause carburization. The possible effects of carburization on the oxidation of Hastelloy X was studied by an accelerated carburization and oxidation test. (24 refs.)

103381 The distribution of the nitride formation at the iron surface during gas nitriding. R.E.E.Pulkkinen (Dept of Mining & Metall., Helsinki Univ. of Technol., Espoo, Finland).

Prakt. Metallogr. (Germany), vol.20, no.5, p.222-31 (May 1983). In English, German.

The distribution of the $\gamma(Fe_4N)$- and $\varepsilon(Fe_{2-3}N)$-iron nitrides at the surface of unalloyed and chromium-, molybdenum-and silicon-alloyed α-iron during the first stages of gas nitriding at 507°C has been studied. Chromium alloying was observed to favour grain boundary precipitations, while silicon alloying, on the contrary, favoured quite homogeneous precipitations of the γ-iron nitride. The surface γ-iron nitrides began to grow from the grain boundaries both in molybdenum-alloyed α-iron and in unalloyed α-iron. In unalloyed α-iron the γ-nitrides was also nucleated at the surface far from the grain boundaries. It was not found that the alloying of iron affects the distribution of the ε-iron nitride at the α-iron surface. The surface condition (roughness, defects, contamination etc.) has a great effect on the distribution of iron nitrides. (13 refs.)

103382 Forming conditions and geometric variety of etch pits. II. Rectangular and triangular etch pits. Luo yang, Wang Zhen-Chin, Li Wen-Chen (Central Iron & Steel Res. Inst., Peking, China).

Prakt. Metallogr. (Germany), vol.20, no.5, p.232-44 (May 1983). In English, German.

For pt. I see ibid., vol.20, p.194-200 (1983). The forming conditions and characteristics of {100} etch pits appearing in the (hOO), (hkO) and (hkl) planes of metal with cubic lattices are discussed in detail. Based on the results, the criterions for the variety of etch pits with the same crystalline parameters are given, according to which the origin of variety of etch figures is shown to be the natural result of their forming conditions. The main parameter is the ratio of attacking speeds between the sample plane and the facets of etch pits. A graphic method for determining the reference cube and the variation of corresponding etch pits on a given (hkl) plane is proposed. (no refs.)

103383 Precipitation hardening in the carbonitrides of iron of the 'epsilon' type. M.El Hajjaji, M.Foos, H.Michel, M.Gantois (Lab. de Genie Metall. Associe au CNRS, Ecole Nat. Superieure de la Metall. et de l'Industrie des Mines de Nancy, Nancy, France).

Scr. Metall. (USA), vol.17, no.7, p.879-84 (July 1983). In French.

The composition and crystallographic structure of the thin hard case formed on, for example, Armco iron in a luminous electric discharge were examined. The carbonitride 'ϵ' layer which was formed at about 600°C on a ferritic test piece was supported by an austenitic sub-surface. The partial pressures of N_2, H_2 and CH_4 determined the configuration and composition of the hard case. A diffusion zone of nitrogen and carbon in the ferrite formed the matrix. 8 hours' treatment gave the maximum microhardness. After 32 hours annealing at 200°C a new phase $[Fe_4(C,N)\gamma]$ was detected. A carbonitride grain showed after 16 hours annealing at 200°C inclusions of the type $Fe_{16}(C,N)_2\alpha$. Interstitial minute precipitates between the two phases were observed by X-ray diffraction. (14 refs.) *R.S.*

103384 Influence of composite protection on the cyclic crack resistance of medium-carbon steel in a corrosive medium. Yu.I.Babei, I.B.Polutranko, M.N.Zima (G.V. Karpenko Physicomech. Inst., Acad. of Sci., L'vov, Ukrainian SSR).

Sov. Mater. Sci. (USA), vol.18, no.5, p.382-7 (Sept.-Oct. 1982). Translation of: *Fiz.-Khim. Mekh. Mater. (USSR)*, vol.18, no.5, p.16-22 (Sept.-Oct. 1982).

Among the effective methods of increasing the resistance of steel to mechanical corrosion fracture are inhibitor protection and impulse surface hardening. However, the mechanism of increasing the effectiveness, particularly the crack resistance, of parts and also the micromechanism of fracture of steels with simultaneous impulse hardening and inhibiting of the working medium (in the case of so-called composite protection) are not completely clear. To study this question, the authors have made tests on hot-rolled medium-carbon 45 sheet steel with a pearlite-ferritic structure (as-received condition). (6 refs.)

103385 Rules of fatigue fracture under fretting conditions. I.A.Nironovich (G.V. Karpenko Physicomech. Inst., Acad. of Sci., L'vov, Ukrainian SSR).

Sov. Mater. Sci. (USA), vol.18, no.5, p.387-90 (Sept.-Oct. 1982). Translation of: *Fiz.-Khim. Mekh. Mater. (USSR)*, vol.18, no.5, p.22-5 (Sept.-Oct. 1982).

The author investigated the rules of fatigue fracture of steel samples with press-fitted parts in relation to the properties and structural conditions of the contacting materials for the purpose of developing the optimum methods of strengthening. The results are found to well describe the kinetics of fatigue damage in fretting. (13 refs.)

103386 Influence of phosphorus impurity on the intergranular corrosion cracking of iron and iron-carbon alloys in nitrates. E.E.Glikman, Yu.V.Goryunov, I.Yu.Ledovskaya, E.V.Mindukshev, S.V.Trubin, E.K.Zenkova (M.V. Lomonosov Moscow State Univ., Moscow, USSR).

Sov. Mater. Sci. (USA), vol.18, no.5, p.390-5 (Sept.-Oct. 1982). Translation of: *Fiz.-Khim. Mekh. Mater. (USSR)*, vol.18, no.5, p.26-31 (Sept.-Oct. 1982).

The authors' study estabilished that the phosphorus impurity significantly strengthens the susceptibility of Fe-C alloy to intergranular corrosion cracking in 4 N NH_4NO_3. There are bases for assuming that such action of phosphorus is caused by acceleration of anodic dissolution of the grain boundaries as the result of adsorption displacement from the boundaries of the carbon impurity, which increases the resistance to intergranular corrosion cracking. In the carbon-free iron (0.003 wt.% C) phosphorus does not influence the susceptibility of the metal to corrosion cracking. The basic reason for strengthening of corrosion cracking under the influence of phosphorus is acceleration of the microcrack origin stage at the grain boundaries without a marked influence on their subcritical growth. (13 refs.)

103387 Influence of a passive film on the corrosion cracking of austenitic steel. A.V.Timoshenko, V.Yu.Vasil'ev, Yu.I.Podgornyi, Yu.G.Ozhiganov, O.F.Shevchenko.

Sov. Mater. Sci. (USA), vol.18, no.5, p.395-9 (Sept.-Oct. 1982). Translation of: *Fiz.-Khim. Mekh. Mater. (USSR)*, vol.18, no.5, p.31-5 (Sept.-Oct. 1982).

The authors' study confirms the significant role of passivation of the surface of 45G17Yu3 steel in long tests of it in the stressed state in the sea without intermediate inspections, when cracks develop only in individual areas at the points of failure of continuity of the films of corrosion products. With periodically repeated inspections, in which the passivating layer is completely removed, the sources of anodic dissolution are delocalized as in the case of increasing the density of the polarizing alternating current. Therefore, not only in long tests in the sea but also with polarization with an alternating current the reason for origin of cracks is local anodic activation of the surface of 45G17Yu3 steel. (10 refs.)

103388 Corrosion fracture micromechanism of cast steel. A.I.Osaul, I.P.Volchok, Yu.A.Shul'te (V.Ya. Chubar' Zaporozh'e Mech. Engng. Inst., USSR).
Sov. Mater. Sci. (USA), vol.18, no.5, p.402-4 (Sept.-Oct. 1982). Translation of: *Fiz.-Khim. Mekh. Mater. (USSR)*, vol.18, no.5, p.38-41 (Sept.-Oct. 1982).
The influence of heat treatment on the corrosion fracture of 27GL steel with 0.021% sulphur was investigated. The inclusion content of the steel was found to determine the corrosion rate to a significantly greater degree than heat treatment. Therefore, with an increase in the cleanliness of steel, its corrosion resistance increases significantly. (3 refs.)

103389 Electrochemical mechanism of jump-like corrosion crack development under stress in carbon steels. L.N.Petròv, Yu.V.Stepurenko (M.V. Lomonosov Odessa Food Industry Technol. Inst., Odessa, USSR).
Sov. Mater. Sci. (USA), vol.18, no.5, p.404-8 (Sept.-Oct. 1982). Translation of: *Fiz.-Khim. Mekh. Mater. (USSR)*, vol.18, no.5, p.41-5 (Sept.-Oct. 1982). (15 refs.)

103390 Influence of oxidation and gas-impregnation process on the mechanical properties of VT1-0 and VT14 titanium alloys. G.G.Maksimovich, V.N.Fedirko, A.T.Lizun, L.A.Bunin (G.V. Karpenko Physicomech. Inst., Acad. of Sci., L'vov, Ukrainian SSR).
Sov. Mater. Sci. (USA), vol.18, no.5, p.422-4 (Sept.-Oct. 1982). Translation of: *Fiz.-Khim. Mekh. Mater. (USSR)*, vol.18, no.5, p.61-4 (Sept.-Oct. 1982).
Results are presented of investigations which provide a basis for concluding that gas-impregnated layers with a thickness of more than 10 μm promote an increase in the strength characteristics of VT1-0 and VT14 titanium alloys and the higher the microhardness of the gas-impregnated layer, the greater the increase. (6 refs.)

103391 KhOSP inhibitors for protection of steel from corrosion, hydrogen absorption, and mechanical corrosion fracture in acid media. A.K.Mindyuk, O.P.Savitskaya, N.A.Kravchuk, A.D.Tkach (G.V. Karpenko Physicomech. Inst., Acad. of Sci., L'vov, Ukrainian SSR).
Sov. Mater. Sci. (USA), vol.18, no.5, p.435-9 (Sept.-Oct. 1982). Translation of: *Fiz.-Khim. Mekh. Mater. (USSR)*, vol.18, no.5, p.76-80 (Sept.-Oct. 1982).
The authors present the results of investigations of the protective capacity of KhOSP-10, KhOSP-A, KhOSP-N, and also KI-1, KPI-3, I-1-V, PB-5, S-5, ChM(r), KS, PKU-K, PKU-M, and other inhibitors in retarding corrosion, hydrogen impregnation, and mechanical corrosion fracture of steel in solutions of sulfuric, hydrochloric, and phosphoric acids. (10 refs.)

103392 Influence of inhibitors on the corrosion fatigue of steel in hydrogen-sulfide-containing media. E.S.Ivanov, V.P.Zavadskaya, M.D.Getmanskii (V.I. Lenin Moscow Pedagogical Inst., Moscow, USSR).
Sov. Mater. Sci. (USA), vol.18, no.5, p.443-5 (Sept.-Oct. 1982). Translation of: *Fiz.-Khim. Mekh. Mater. (USSR)*, vol.18, no.5, p.83-5 (Sept.-Oct. 1982).
The purpose of the authors' investigation was a study of the influence of two-phase heterogeneous media on the cyclic strength of steel and the possibilities of protection from this form of fracture with the use of corrosion inhibitors. (3 refs.)

103393 Optimizing the method of cathodic protection of austenitic steels. A.G.Zaluzhnyi, D.M.Skorov, A.G.Zholnin, V.B.Tarasyuk, T.A.Krasina (Moscow Engng. Phys. Inst., Moscow, USSR).
Sov. Mater. Sci. (USA), vol.18, no.5, p.445-8 (Sept.-Oct. 1982). Translation of: *Fiz.-Khim. Mekh. Mater. (USSR)*, vol.18, no.5, p.85-8 (Sept.-Oct. 1982).
The authors show that in electrolytic hydrogen impregnation of type 03Kh16N15M3B austenitic steels, in order to eliminate the appearance in samples of irreversible defects, impregnation should be done at increased electrolyte temperatures and with low ionic current densities (100 A/m^2 and lower). (11 refs.)

103394 Influence of diffusion impregnation in polymer-containing compositions on the physicomechanical properties of steels. T.P.Seroshtan, A.I.Soshko (Lenin Komsomol L'vov Polytech. Inst., L'vov, Ukrainian SSR).
Sov. Mater. Sci. (USA), vol.18, no.5, p.453-4 (Sept.-Oct. 1982). Translation of: *Fiz.-Khim. Mekh. Mater. (USSR)*, vol.18, no.5, p.91-2 (Sept.-Oct. 1982).
Wear resistance investigations of steels have shown that the diffusion layers have a structure and properties close to those which are created in their treatment in polymer-containing production media. Chemicothermal treatment in polymer-containing compositions significantly accelerated the hardening process and made it possible to obtain cases with high physicomechanical characteristics. (3 refs.)

103395 Role of iron sulfide in the formation of solidification cracks in welding of electrical steel. G.F.Deev, V.V.Popovich, V.N.Palash, V.V.Karikh (Lipetsk Polytech. Inst., Lipetsk, USSR).
Sov. Mater. Sci. (USA), vol.18, no.5, p.458-60 (Sept.-Oct. 1982). Translation of: *Fiz.-Khim. Mekh. Mater. (USSR)*, vol.18, no.5, p.96-8 (Sept.-Oct. 1982).
An investigation was made of the influence of FeS on the formation of solidification cracks in tungsten arc welding of type E412 electrical steel. It was found that the reduction in ductility in molten FeS was caused to a significant degree by its corrosion action on the metal. (4 refs.)

103396 Influence of an oxide film on the anodic anionic activation of metals. A.D.Davydov, A.N.Kamkin, O.V.Zemskova (Inst. of Electrochem., Acad. of Sci., Moscow, USSR).
Sov. Electrochem. (USA), vol.18, no.10, p.1216-20 (Oct. 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.10, p.1367-72 (Oct. 1982).
An investigation was made of the influence of a preliminarily grown anodic oxide film on iron, zirconium, and titanium on the potential of anodic activation of these metals in chloride solutions. Local nonuniformity of the anodic oxide film with respect to their protective capacity against the aggressive action of chloride was demonstrated. One of the necessary conditions of the beginning of anodic activation of titanium is a critical increase in the imperfection of the anodic oxide film (cracking, porosity) when it thickens. (30 refs.)

103397 Chromium passivity. Effect of potential and pH on passive film thickness. M.N.Shlepakov, A.M.Sukhotin, Yu.P.Kostikov, V.S.Strykanov (M.I. Kalinin Leningrad Polytech. Inst., Leningrad, USSR).
Sov. Electrochem. (USA), vol.18, no.10, p.1276-8 (Oct. 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.10, p.1430-2 (Oct. 1982).
The authors used ESCA spectra to support prior evidence that the passive fim on Cr in acid solutions is basically Cr_2O_3. (10 refs.)

103398 Chromium passivity. Presence of Cr(VI) in the passive film. M.N.Shlepakov, A.M.Sukhotin, Yu.P.Kostikov.
Sov. Electrochem. (USA), vol.18, no.10, p.1279-81 (Oct. 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.10, p.1433-4 (Oct. 1982).
ESCA spectra have been presented which show that the passive film on Cr in acid solutions is G_2O_3. In addition to the spectral lines for both this compound and Cr metal, the authors also found peaks with binding energies of 579 eV at all potentials in the passive region. The nature of such peaks is studied using passive Cr anodes in H_2SO_4 solution. (7 refs.)

103399 Corrosion behaviour of 18-8 austenitic stainless steel in NaOH solutions and the effect of chloride ions. S.S.Abd El Rehim, S.M.Abd El Haleem, S.M.Abd-El Wahaab, M.S.Shalaby (Chem. Dept., Faculty of Sci., Ain Shams Univ., Cairo, Egypt).
Surf. Technol. (Switzerland), vol.19, no.3, p.261-71 (July 1983).
The corrosion behaviour of commercial Egyptian 18-8 austenitic stainless steel was investigated in NaOH solutions of various concentrations between 1×10^{-3} and 2.5 M. The results indicate that the current densities, corresponding to the active, passive and transpassive regions increase with increases in the concentration of the electrolyte, whereas the corrosion potential varies with the NaOH concentration according to $E_{corr}=a-b \log C_{NaOH}$. The relation between the potentiodynamic sweep rate and the maximum dissolution current density was found to be $\log v=a+b \log j$. It was concluded that the corrosion potential depends on both the alkali and the chloride ion concentrations. (20 refs.)

103400 The solid-state reaction of copper and tin: an assessment of the value of an iron barrier layer. B.C.Scott, M.E.Warwick (Internat. Tin Res. Inst., Greenford, England).
Trans. Inst. Met. Finish. (GB), vol.61, pt.2, p.43-5 (Summer 1983).
The solid state diffusion of copper and tin to produce intermetallic compounds at the interface between a coating of tin on copper or brass may be severely restricted by the use of a barrier layer of electroplated iron. Ultimately the barrier fails by rupturing due to the growth of copper/tin intermetallic compounds at pores in the iron layer. (13 refs.)

103401 The fatigue properties of mild steel with surface diffusion coatings of nickel-iron and nickel-cobalt-iron alloys. G.M.C.Lee (Dept. of Mech. Engng., Univ. of Edinburgh, Edinburgh, Scotland), W.J.D.Jones.
Trans. Inst. Met. Finish. (GB), vol.61, pt.2, p.50-6 (Summer 1983).
Nickel and nickel-cobalt alloys were electroplated onto mild steel and then diffused into the surface layer of the steel by heating at 970°C or 1010°C for periods of up to 50 hours. The diffusion coated steels were then fatigue tested in air. All the diffusion alloyed specimens showed an improvement in fatigue properties compared with similarly heat treated but uncoated steel. The maximum improvement in fatigue limit stress was 27%. (8 refs.)

103402 Atmospheric oxidation of chromium between 270 and 490°C. K.Shanker, P.H.Holloway (Dept. of Materials Sci. Engng., Univ. of Florida, Gainesville, FL, USA).
Thin Solid Films (Switzerland), vol.105, no.4, p.293-303 (29 July 1983).
Auger electron spectroscopy was used to study the oxidation behaviour of pure chromium in the temperature range 270-490°C for exposures ranging from 1 h to more than 100 h in air. Regression analysis indicated that the oxide thickness on mechanically polished bulk chromium samples increased logarithmically with time, although some spallation was observed at the highest temperature. Oxidation of mechanically polished samples was slower than that for electropolished bulk chromium or that for chromium films on glass substrates. Possible factors responsible for the slower logarithmic growth rate of the oxide on the mechanically polished samples are discussed. (25 refs.)

103403 Planar plasma etching of chromium. H.M.Naguib, R.A.Bond, H.J.Poley (Bell-Northern Res., Ottawa, Ontario, Canada).
Vacuum (GB), vol.33, no.5, p.285-90 (May 1983).
The plasma etching characteristics of chromium thin films in an RF planar (parallel plate) reactor were investigated. The experimental work was performed using a commercial reactor operating at 13.56 MHz with power variable up to 500 W. The etch rate of the Cr films deposited on glass substrates by e-beam evaporation was measured as a function of the concentration of O_2 in a CCl_4/O_2 gas mixture, the total flow rate of input gases and the RF power density. Using a total gas flow of 15 sccm and an input power density of 0.4 W cm^{-2}, the maximum etch rate was obtained in CCl_4 plasma containing 40% O_2. It was found that doubling the number of the substrates in the reactor decreased the etch rate by 20%. Also, the etch rate at the back of the reactor was twice that at the front. Methods to alleviate nonuniformity and loading effects are discussed and the mechanism of plasma etching of Cr is examined through the effect of various processing parameters on the etching characteristics. (31 refs.)

103404 Changes in the chemical reactivity of metals exposed to an inert gas glow discharge. D.F.Klemperer, D.J.Williams (Dept. of Phys. Chem., Univ. of Bristol, Bristol, England).
Vacuum (GB), vol.33, no.5, p.301-5 (May 1983).
From time to time the literature mentions curious effects on the chemical reactivity of metals due to inert gas ion bombardment: reactivity in corrosive environments is variously said to be inhibited or enhanced. Although there is no obvious explanation for such effects, some possible mechanisms have been suggested. A few simple experiments have been carried out designed to demonstrate that reactivity effects really do exist and to test such mechanisms as have been proposed. The results are qualitative because a glow discharge was used to implant the rare gas ions. Evaporated films of aluminium and nickel become amorphous after bombardment with xenon ions and the films resisted gaseous and liquid corrosion. On the other hand, aluminium foil bombarded with xenon ions in a Penning pump arrangement was attacked more heavily than unbombarded aluminium. Passivation was attributed to the known lack of reactivity of amorphous metals. Glassy materials appear to lack the normal routes of attack between their subsurface regions and the attacking medium. On the other hand, when a metal surface is heavily ion bombarded the surface is probably damaged to such an extent that the attacking medium gains physical access to the interior and corrosion proceeds rapidly. (32 refs.)

103405 Plasma arc coatings combat component wear. J.L.Desir (Eutectic+Castolin Inst., Lausanne, Switzerland).
Weld. & Met. Fabr. (GB), p.219-22 (June 1983).
There is an increasing demand for reliable and low maintenance industrial machinery. One way of protecting original components against abrasive and corrosive wear and of repairing damaged parts is plasma surfacing. There are two plasma processes: Transferred arc process: an arc is struck between a heat-resistant cathode in the torch and the workpiece which forms the anode. The arc is constricted by a second anode in the torch. Non-transferred arc process: an arc is struck between a cathode and a nozzle-type anode in the torch. Gases, expelled at high speeds through the nozzle, are raised to high temperatures and projected onto the workpiece. Examples of application of these are presented. (no refs.)

103406 Laser-pulsed plasma chemistry: surface oxidation of niobium. R.F.Marks, R.A.Pollak, P.Avouris (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.257-64
Laser irradiation of a solid surface under an oxidizing ambient gas can activate localized, heterogeneous chemical reactions which modify the surface. Under suitable conditions, the laser initiates a reactive plasma near the gas/solid interface. This plasma mechanism is proposed as the basis for a new

surface chemical technique which the authors denote as laser-pulsed plasma chemistry (LPPC). LPPC experiments on niobium metal under one atmosphere of oxygen employed a pulsed CO_2 laser and displayed single-pulse, self-limiting, oxide growth. Product oxide thickness increased with optical intensity. Surface layer thickness and chemical composition were determined for oxide layers between 1 nm and 5 nm thick using X-ray photoelectron spectroscopy (XPS or ESCA). Composition of these niobium oxide ($Nb_2O_{5-\delta}$) surfaces was similar to the composition produced by RF plasma oxidation, but the valance defect, δ, for LPPC oxides was approximately two to five times lower. At high laser intensity ($\gtrsim 4\times10^6$ W/cm^2), direct optical heating or plasma-mediated thermal coupling to the solid activates interdiffusion at the oxide/metal interface. (23 refs.)

103407 Formation of CdO and Cu_2O films by laser irradiation of the corresponding metallic films in air. R.Andrew, L.Baufay, A.Pigeolet, M.Wautelet (Univ. de l'Etat, Mons, Belgium).
Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.283-9
Describes the oxidation of 1000 Å thick metal films on glass substrates when exposed to a scanning laser beam. For Cd and Cu films optical spectroscopy shows an energy gap of 2.45 eV and 2 eV respectively, in agreement with published data for CdO and Cu_2O. The authors measure the power threshold for complete oxidation in a single scan and deduce the maximum temperature, which is inconsistent with thermal oxidation data but corresponds to the m.p. of the metals. They point out the important contribution of the heat of formation to the temperature balance and demonstrate that in the case of Al this effect is sufficient to destroy any oxide formed. (10 refs.)

The corrosion products in primary and secondary circuits of PWR plants ....See Entry 99691

Predicting stress corrosion crack growth rates at high stress levels. II. The general yield situation ....See Entry 101144

^{55}Fe diffusion in magnetite crystals at 500°C and its relevance to oxidation of iron ....See Entry 102047

The electro- and photoluminescence spectra of oxide films formed during anodic oxidation of zinc ....See Entry 102963

A computer controlled investigation of the electron energy spectra formed under electron bombardment during the early stages of the oxidation of iron ....See Entry 103013

Measurement of electroless plating rate by coulostatic method ....See Entry 103081

Laser heat treatment: the state of the art ....See Entry 103182

Surface deformation and crack initiation during fatigue of vacuum melted iron: environmental effects ....See Entry 103313

Oxide scale induced cleavage fracture in an ODS Fe-Cr-Al alloy ....See Entry 103318

Combined manifestation of the factors of surface roughness and loading frequency in the fatigue of patented wire ....See Entry 103330

An autoradiographic technique for studying the segregation of hydrogen absorbed into carbon and low alloy steels ....See Entry 103418

Adsorption and oxidation of simple organic compounds on platinum electrodes ....See Entry 103589

81.70 MATERIALS TESTING

(inc. sample preparation for examination, metallographic techniques, ion and electron microprobe techniques, Auger and photoelectron techniques, defectoscopy; for measurement in the mechanics of solids and rheology, see 46.30R)

103408 Ill-posed and well-posed problems in inverse elastodynamic scattering for nondestructive evaluation. D.A.Lee (USAF Inst. of Technol., Wright Patterson AFB, Dayton, OH, USA).
J. Nondestr. Eval. (USA), vol.2, no.3-4, p.161-72 (Dec. 1981).
The practical significance of ill-posedness in a data reduction problem is reviewed. Inverse elastodynamic scattering is shown to be ill-posed in general, although suitably restricted problems may be well-posed. These results underscore the need to analyze carefully the errors of data reduction problems in NDE, and to focus attention on final results of an NDE exercise, rather than on intermediate steps. (11 refs.)

103409 Computerized evaluation of acoustic images utilizing a method of averaging. G.C.Knollman, D.L.Hitzl, R.E.Bollinger (Lockheed Res. Lab., Palo Alto, CA, USA).
J. Nondestr. Eval. (USA), vol.2, no.3-4, p.173-88 (Dec. 1981).
A computerized technique is presented which has been developed for analyzing acoustic images of an inhomogeneous material. The acoustic imaging system is briefly described with emphasis on its adaptation to billets of graphite for atmospheric reentry body use. Ultrasonic images of such inhomogeneous material contain a nonuniform distribution of anomalies and few, if any, geometrically regular features which can be assessed to establish material integrity. Results obtained with the new algorithms show, for certain discriminants, a high degree of correlation between the numerical accept/reject values obtained from acoustic image processing and the time-to-failure of the graphitic material in simulated atmospheric reentry tests. (14 refs.)

103410 Treatment of false calls in evaluating nondestructive inspection proficiency. H.Sharp,Jr., W.H.Sproat.
J. Nondestr. Eval. (USA), vol.2, no.3-4, p.189-94 (Dec. 1981).
A test designed to evaluate nondestructive flaw detection proficiency by ultrasonic and eddy current methods has been conducted. Test data for each participant are reduced to contingency table format, and analysis of these tables via traditional measures of association is used to rank individual performances. The presence of false calls in an inspection record introduces a random inflation in flaw detection results. Measures are required which compensate for that fact. Proficiency rankings based on two such measures, Somer's *d* coefficient and the mean square contingency coefficient, show reasonable consistency with intuition-based rankings by experienced observers. Finally, a weighted generalization of Somers's *d* is suggested, although optimal selection of weights remains an open problem. (6 refs.)

103411 Parasitic voltages induced by artificial flaws when measured using the AC field technique. D.Mirshekar-Syahkal (Dept. of Mech. Engng., Univ. Coll., London, England), D.H.Michael, R.Collins.
J. Nondestr. Eval. (USA), vol.2, no.3-4, p.195-202 (Dec. 1981).
The development of a successful and accurate instrument for measuring surface-breaking cracks in metals using the AC field technique has raised several interesting theoretical problems. Measurements with the instrument, known as the Crack Microgauge, do not rely on any prior calibration against an artificial flaw such as a saw-cut in a test block, but some users accustomed to such a calibration from other devices have nevertheless wished to use the instrument in that fashion and have in some instances reported erroneous results. A simple theory was developed to explain and quantify this phenomenon. The parasitic voltages induced in the instrument probe due to the finite opening possessed by an artificial flaw are calculated and the results used to reinterpret the instrument readings. Controlled experimental measurements on artificial flaws of rectangular cross-section made in aluminum and in steel are found to be in good agreement with the theory. It is shown, however, that application of the theory requires additional information about the internal phase shift associated with the instrument. (7 refs.)

103412 Propagation of elastic waves in honeycomb panels for application to rapid inspection techniques. H.L.Bertoni, S.K.Park (Dept. of Electrical Engng. & Computer Sci., Polytech. Inst. of New York, Brooklyn, NY, USA).
J. Nondestr. Eval. (USA), vol.2, no.3-4, p.209-17 (Dec. 1981).
Considers the properties of elastic waves guided by an aluminum plate bonded to a honeycomb core for application to rapid inspection of honeycomb panels. Current acoustic inspection techniques involve the transmission of a signal between a pair of small transducers located on opposite sides of the panel. Scanning the transducers in raster fashion results in a high resolution inspection of the panel, but is very time consuming. An alternative technique would simultaneously inspect all points along a line between two widely spaced transducers located on the same side of the panel. Scanning the pair once over the panel permits rapid inspection, although the decreased resolution. Studies presented here indicate that such a method of inspection is feasible and that the flexural mode is probably the most useful. (6 refs.)

103413 Surface acoustic wave measurements of surface cracks in ceramics. J.J.W.Tien, B.T.Khuri-Yakub, G.S.Kino (Edward L. Ginzton Lab., Stanford Univ., Stanford, CA, USA).
J. Nondestr. Eval. (USA), vol.2, no.3-4, p.219-29 (Dec. 1981).
An investigation of scattering from surface cracks has been conducted. In particular, the change in the reflection coefficient of a Rayleigh wave incident on a surface indentation crack has been measured as the sample is stressed to fracture. The acoustic measurements have been correlated with the stable crack extension that precedes final failure. The crack extension behavior of as-indented specimens was found to differ appreciably from that of annealed specimens. Cracks in the annealed samples exhibited partial crack tip closure, but little stable extension, whereas cracks in the as-indented samples, displayed both crack closure and irreversible crack growth. This behavior has been rationalized by invoking concepts based upon the residual stresses created by indentation. (18 refs.)

103414 Application of metal single crystal wedges to high frequency Rayleigh wave propagation. E.S.Fisher (Argonne Nat. Lab., Argonne, IL, USA), D.Zwick, D.VanHook, G.Henkleman, B.Smith.
J. Nondestr. Eval. (USA), vol.2, no.3-4, p.231-9 (Dec. 1981).
Techniques for propagating Rayleigh waves with frequencies varying from <1 to 270 MHz were developed for the purpose of nondestructive evaluation of composition or defect gradients near the surface of nonpiezoelectric solids. The surface waves with frequencies greater than 15 MHz were obtained from a novel technique using single crystal wedges, whereas the low frequency waves were produced by a previously used high voltage impulse. Measurements of Rayleigh wave velocities on single crystals of Ge and Al were performed as a test of accuracy and precision and are compared with calculated values. (11 refs.)

103415 Particle-size effects in non-destructive material assay by gamma-ray absorptiometry. I. Theoretical model. H.L.The, W.Michaelis, H.-U.Fanger (Inst. fur Phys., GKSS Forschungszentrum Geesthacht, Germany).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.445-61 (1 July 1983).
Gamma-ray absorptiometry has become a widely used method in non-destructive material assay. The procedure implicitly presumes a homogeneous, fine-grained distribution of the solid components of the material and is well described by a 'sandwich' model. However, due to the nonlinearity of the attenuation law, systematic errors arise if finite grain sizes are involved. The present paper deals with the influence of particle size and gives a thorough theoretical treatment of these effects, which allows the extension of the method to mixtures containing one or even several coarse-grained constituents. The derivation of suitable generalized transmission equations requires the construction of a particle-size dependent attenuation law. This is achieved by means of a 'cell' model which subdivides the irradiated volume into smallest possible 'cells' with representative parts by volume of the material components. Correction functions are deduced that can be used to take into account particle-size effects by properly modifying one of the relevant physical quantities in the conventional transmission equations. The properties of these functions are discussed with respect to their applicability in practice. (12 refs.)

103416 Thermal contact under a diamond indenter. R.Danell, H.J.Goldsmid (School of Phys., Univ. of New South Wales, Kensington, NSW, Australia).
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.413-14 (Aug. 1983).
The authors have determined the apparent region of contact by measuring the thermal resistance between a conical diamond indenter and samples of steel and gold under a range of loads. All the experiments were performed at temperatures of about 40°C. (2 refs.)

103417 Determination of the behaviour of composite materials under dynamic conditions. A.Cardon (Vrije Univ. Brussel, Brussels, Belgium), C.Hiel.
Cah. Groupe Fr. Rheol. (France), vol.5, no.6, p.283-91 (Feb. 1982). In French. [received: July 1983]
Commercially available equipment (IMASS and METRAVIB), connected with an active interface to a minicomputer HP 1000, permits one to measure the components of the complex modulus of composite materials. The measurements were obtained in a frequency range 0.1 to 10 Hz ($\rightarrow$1000 Hz) and a temperature range from 25 to 200°C. The method is a macro- and micromechanical approach and needs the measure of only one viscoelastic characteristic. The experimental control results agree with the calculated data. (9 refs.)

103418 An autoradiographic technique for studying the segregation of hydrogen absorbed into carbon and low alloy steels. D.Le.Tuyen, B.E.Wilde (US Steel Corp., Res. Lab., Monroeville, PA, USA).
Corrosion (USA), vol.39, no.7, p.258-65 (July 1983).
The technique described preserves the microstructural features of the easily corroded carbon and low alloy steel without the need for protective films by inhibiting the photographic processing solutions with sodium nitrite. Tritium segregation can then be directly related to the microstructural features of a metallographically polished and etched specimen by observing the resulting silver clusters with a scanning electron microscope, equipped with automatic image analysis up to magnifications of 10^4 diameter. Examples are presented by using a quenched and tempered casing steel showing tritium segregation

to: (1) manganese-sulfide inclusions, (2) glassy silicate particles, and (3) flobular aluminum oxide inclusions. (18 refs.)

103419 A novel corrosion monitor based on the Faradaic rectification technique. J.S.Gill, L.M.Callow, G.A.M.Sussex, J.D.Scantlebury (Univ. of Manchester Inst. of Sci. & Technol., Manchester, England).
Corrosion (USA), vol.39, no.7, p.293 (July 1983).
Presents a simplified circuit for a corrosion monitor previously described by the authors (see ibid., vol.39, p.61, 1983). (2 refs.)

103420 Thermographic technique for the nondestructive evaluation of graphite composite structures. C.W.Souder, G.E.Singleton (Northrop Res. & Technol. Center, One Research Park, Palos Verdes Peninsula, CA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.366, p.80-7 (1983). (Modern Utilization of Infrared Technology VIII, San Diego, CA, USA, 26-27 Aug. 1982).
The extensive use of advanced composite materials on aircraft has increased the need for improved inspection techniques. Presently, graphite composite structures for high performance military aircraft require extensive ultrasonic and X-ray inspection for the detection of porosity, delaminations and disbonds. Thermographic inspection offers the potential for a lower cost alternative to these techniques. Much of the work on the application of thermographic techniques as an alternative to the above means of inspection has been qualitative and limited to laboratory use. The transient thermal response of graphite composite structures has been shown to be useful in detecting porosity, delamination and disbonds, and the use of image processing simplifies operator interpretation of the resulting data. The authors describe further research on this subject and propose systems for production use and field inspection of advanced composite structures. (3 refs.)

103421 Investigation of the formation of flaking in steel using the acoustic emission method. V.O.Gol'tsov, M.O.Ishchenko, A.D.Slabolits'ka.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.6, p.71-4 (1983). In Ukrainian.
The amplitude distribution of acoustic emission (AE) is studied during flaking in the hydrogen-charged steel. The maximum of the AE amplitude distribution shifts to higher amplitudes as the level of internal stresses in steel increases. The best correlation is stated between the total number of impulses of the AE events and the acoustic emission integral parameter, on the one hand, and the total length of flakes on a macrosection (i.e. their total surface in the metal body), on the other hand. (5 refs.)

103422 Reflected-light microscopy for examining hard ferrites with the Amplival pol.u microscope. G.Sansoni (Res. Inst. for Ore Dressing, Acad. of Sci., Freiberg, Germany).
Jena Rev. (Germany), vol.28, no.2, p.72, 75 (1983).
Hard ferrites are oxide-ceramic substances which, on account of their permanent-magnetic properties and their low-cost production, are increasingly used in electronics and electrical engineering. The author's endeavours aim at opening up further fields of application of this oxide ceramic by the substitution of metal magnets. After a grinding time of about 6 hours, the preparations contain 2 to 30 grain percents above the one-domain grain size. This fact suggests checking once more the possibilities held out by light-microscopic methods for this specific application. The best results were obtained in this case by bright-field incident-light microscopy, using the Amplival pol.u microscope of VEB Carl Zeiss Jena. (9 refs.)

103423 The examination of grain collectives with the aid of microscopes. M.Mohr (VEB Kombinat KALI, Sondershausen, Germany).
Jena Rev. (Germany), vol.28, no.2, p.73-5 (1983).
Deals with examination methods on structural-morphological phenomena such as intergrowth, agglomeration, shape and size of grains etc. The instruments employed for this purpose are polarizing microscopes of the type Amplival pol, a Technival stereomicroscope for incident-light examinations and the mf photomicrographic equipment. (5 refs.)

103424 Possibilities and limits of the interference microscopic phase analysis. H.-H.Seyfarth, U.Fickel, H.Keune, J.Bergner (Teachers Training Coll. 'Dr Theodor Neubauer', Erfurt/Muhlhausen, Germany).
Jena Rev. (Germany), vol.28, no.2, p.76-7 (1983).
For the phase analysis of solid aggregates with grain sizes between 1 and 40 μm, polarization-microscopic measuring methods may be employed to advantage. The most important quantity is the refractive index. Advances made in interference microscopy made the authors hope that, when using linearly-polarized light, methodical possibilities would be found to determine the n_α' and n_γ' values with but one embedding medium for each grain. Thus, the path would be open for statistical determination of the principal refractive indices in a grain collective and also in those chemical solids, which may be preserved only in specific embedding media. To test the method, the refractive indices were determined by measuring, interferometrically, the path difference R between specimen and embedding medium in the Amplival pol interphako research microscope. (no refs.)

103425 Non-destructive testing and acoustic microscopy of diffusion bonds. B.Derby (Dept. of Metall. & Materials Sci., Univ. of Cambridge, Cambridge, England), G.A.D.Briggs, E.R.Wallach.
J. Mater. Sci. (GB), vol.18, no.8, p.2345-53 (Aug. 1983).
Despite successful applications of diffusion bonding, there is a lack of good quality assessment methods. A survey of published results shows non-destructive testing techniques (NDT) developed for fusion welds to be ineffective in indentifying the much smaller defects found in diffusion bonds. An investigation into the possibilities of using electrical resistance measurements for NDT shows the requirement of equipment with a very high stability and sensitivity. Finally the use of very high frequency ultrasonic sound in an acoustic microscope is considered as a method of defect investigations. This acoustic microscopy proved to be a highly encouraging new line of investigation for the examination of diffusion bonds. (14 refs.)

103426 The potential drop across an imperfect diffusion bond. K.W.Lodge, G.A.D.Briggs (Dept. of Metall. & Sci. of Materials, Univ. of Oxford, Oxford, England).
J. Mater. Sci. (GB), vol.18, no.8, p.2354-60 (Aug. 1983).
In the non-destructive evaluation of diffusion bonds, a possible technique is to measure the potential drop for a given current flow. Using evidence from optical and acoustic microscopy, the geometrical details on an incomplete diffusion bond are represented by an idealized mathematical approximation. This is solved exactly using conformal mapping by a Schwarz transformation. The result for the change in resistance as a function of bond development is given as an analytic expression. (5 refs.)

103427 Acoustic emission from graphite/epoxy composite laminates with special reference to delamination. L.Carlsson, B.Norrbom (Aeronautical Res. Inst. of Sweden, Bromma, Sweden).
J. Mater. Sci. (GB), vol.18, no.8, p.2503-9 (Aug. 1983).
Acoustic emission (AE) techniques were used for the detection of progressive damage in graphite/epoxy composite laminates. The AE signals were monitored during the uniaxial loading of symmetrical eight-ply laminates with three different stacking sequences. The peak value and the weighted cumulative count were determined as a function of applied axial stress. Both the peak value data and the cumulative count data are characterized by a pronounced increase at first-ply failure as determined by the Tsai-Hill anisotropic strength criterion, followed by a continuous emission until delamination or final fracture occurs. At the onset of delamination, a pronounced deflection was noted in the accumulated AE signal. Plastic deformation of the matrix generated no significant AE. (15 refs.)

103428 Some optical techniques of displacement and strain measurements on metal surfaces. F.P.Chiang (State Univ. of New York, Stony Brook, NY, USA), C.C.Kin.
J. Met. (USA), vol.35, no.5, p.49-54 (May 1983).
Discusses the use of in-plane moire, shadow (or projection) moire, and laser speckle techniques of displacement and strain measurements on metal surfaces. Both in-plane and out-of-plane deformation can be obtained. Examples include elastic and plastic deformations and metal forming problems. (13 refs.)

103429 Simulation model of acoustic emission due to microscopic fracture in metals. T.Ohira (Faculty of Engng., Univ. of Tokyo, Tokyo, Japan), T.Kishi.
J. Jpn. Inst. Met. (Japan), vol.47, no.7, p.575-81 (July 1983). In Japanese.
A simulation of acoustic emission signals due to fracture events was carried out in order to investigate the temporal inhomogeneity of fracture processes. In the simulation process, two types of source function $D(t)$, the product of crack volume-time history and elastic modules, were assumed, and output signals from piezoelectric transducer $V(t)$ were calculated from the convolution of $D(t)$ with $R(t)$, which is a combined response function of specimen and transducer obtained experimentally by the use of breaking pencil lead. It was shown that the amplitude of $V(t)$ was proportional to the crack volume and the longer the lifetime of cracking, the smaller the amplitude. From these results, it was proved that only the fracture events with large cracking volume and short lifetime were detectable as an acoustic emission and that burst type emissions during macroscopic subcritical crack growth were attributed to the instantaneous fast fracture in the microscopic sense. (19 refs.)

103430 Non-destructive detection of creep damage for Cr-Mo-V steel forgings. T.Goto (Takasago Tech. Inst., Mitsubishi Heavy Industries Ltd., Takasago, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.356, p.563-9 (May 1983). In Japanese.
In order to develop a non-destructive method to detect the creep damage and estimate the residual life for the machine parts used at high temperatures, the changes in material properties caused by long-term heating and by creep were observed with the test methods of X-ray diffraction, eddy current, and hardness. The material tested was tempered Cr-Mo-V steel. Hardness test was found the most suitable method to detect the material property change for Cr-Mo-V steel. The change in hardness during long-term heating was expressible by a simple curve in the plotting against the Larson-Miller parameter. Softening was caused by heating above a certain temperature but below the temper temperature. The softening was accelerated by the stress larger than 11 kg/mm^2. The change in hardness during creep under the stress of σ (kg/mm^2) was correlated with those of long-term heating. (12 refs.)

103431 Radiation pattern of acoustic emission. M.Ohtsu (Faculty of Engng., Kumamoto Univ., Kumamoto, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.356, p.577-83 (May 1983). In Japanese.
Fundamental studies in regard to radiation patterns of AE wave motions are reported. Such patterns are verified in the experiments. In the source location experiments, the types of sources can be classified into two groups from AE characteristics based on the radiation pattern. They are associated with tensile cracks and others. From the relation between the radiation pattern and the dislocation model, in addition, the orientations of dislocation models may be determined. The improved source location technique is developed and applied in the experiments. The results show that the determination of source kinematics by the aid of the radiation pattern is promising in concrete. (8 refs.)

103432 On the preparation of specimens from multifilamentary Nb_3Sn superconducting wires for transmission electron microscopy. Y.S.Hascicek, S.Nourbakhsh, M.J.Goringe (Dept. of Metall. & Sci. of Materials, Univ. of Oxford, Oxford, England).
J. Microsc. (GB), vol.131, pt.1, p.55-61 (July 1983).
A set of techniques for preparing transmission electron microscope specimens from sections of thin (≲1 mm overall diameter) multifilamentary wires (filaments being approximately 5 μm diameter) are described. Results illustrating the successful uniform thinning of the several phases present in 'bronze-route' Nb_3Sn are shown. (11 refs.)

103433 Echo response of crack-like reflectors in focused ultrasound fields. II. F.Walte, W.Muller.
Mater. Test. (Germany), vol.25, no.7, p.235-7 (July 1983). In German.
Curves representing half-value amplitudes and spacings are given for echo signals as a function of crack angle for both medium and strongly focused ultrasonic fields. The edge distortion effect is shown to produce amplitude/angle response curves within a trapezium-shaped envelope. In a particular example, signal response curves are given for the ultrasonic edge pressure P(k) in dB, as a function of the angle for each of three field focusing radii (R) of 22 mm., 47 mm., and infinity, representing strong focus, moderate focus and a plane oscillator, respectively. *G.C.*

103434 Separation and symmetrizing of K-alpha doublets using a computer when measuring stresses by X-rays. V.Hauk, W.K.Krug.
Mater. Test. (Germany), vol.25, no.7, p.241-3 (July 1983). In German.
The K-alpha interference spectra between the alpha-1 and alpha-2 lines are given for single slot X-radiation for material in four different conditions, (1), iron powder, (2) steel 54 Ni Cr Mo V 6 heat treated in an Argon atmosphere for 2 hours at 700°C, (3) as (2) at 500°C, and (4) as (2) untreated. Curves are also illustrated for material (3) for single and double slot radiation and for the separation and symmetrization conditions as derived from a computer analysis of the intensities. The characteristic features of different methods of interference evaluation are discussed. (5 refs.) *G.C.*

103435 Development of methods of nondestructive quality control for ferrofluids. D.V.Orlov, Yu.A.Mit'kin, N.I.Dyupovkin.
Magnetohydrodynamics (USA), vol.18, no.4, p.429-32 (Oct.-Dec. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.4, p.113-16 (Oct.-Dec. 1982).
The authors present the results of studies pertaining to the electrical characteristics of various ferrofluids on silicone base in a magnetic field. For the study of electrical volume resistivity, electric strength, dielectric permittivity, and dielectric loss tangent, ferrofluids with various degrees of stability were used. (9 refs.)

103436 Flaw classification by a spectral division of ultrasonic echoes. H.Seiger, J.Wagner (Krautkramer GmbH, Koln, Germany).
NDT Int. (GB), vol.16, no.4, p.195-200 (Aug. 1983).
An ultrasonic method to differentiate between isolated flat and voluminous flaws (flaw classifying) is described. The technique, developed using artificial reflectors, uses a form of frequency spectrum analysis in which the spectrum is divided into bands. Knowing the positional dependence of only a few data obtained from the amplitude spectrum of the echo, a value can be calculated which lies in an interval that is characteristic of a particular type of flaw. The method was tested on 29 natural weld flaws, and results support the feasibility of the technique. (4 refs.)

103437 A Fourier transform technique that measures phase delays between ultrasonic impulses with sufficient accuracy to determine residual stresses in metals. D.R.Allen, W.H.B.Cooper (Materials Phys. Div., AERE Harwell, Didcot, England).
NDT Int. (GB), vol.16, no.4, p.205-17 (Aug. 1983).
A Fourier transform technique is described which measures phase delay using short duration pulses or impulses. The method of data analysis is detailed and some simple test functions are used to estimate the accuracy and reliability of the resulting phase delays. It appears that the inherent accuracy associated with this technique is not much different from that of a zero cross-over technique using a chopped CW source and narrowband receiver. Measurements of ultrasonic phase delays for a 50 mm thick mild steel plate using the Fourier transform technique are given for compressional and shear waves with frequencies around 2 MHz and 5 MHz. Both EMA and piezoelectric transducers have been used. Corresponding measurements of phase delay using a chopped CW stimulus are shown to be in good agreement. (6 refs.)

103438 Location and estimation of the defective area in a diaphragm: an a posteriori moire method. C.Shakher, A.K.Aggarwal (Holography Lab., Central Sci. Instruments Organization, Chandigarh, India).
Opt. & Laser Technol. (GB), vol.15, no.4, p.206-8 (Aug. 1983).
A moire method based on holographic interferometry is shown to be a powerful tool for non-destructive testing of diaphragms. (6 refs.)

103439 Contrast techniques for phase separation in the scanning electron microscope. J.Paul, B.Bauer (Max-Planck-Inst. fur Metallforschung, Inst. fur Werkstoffwissenschaften, Stuttgart, Germany).
Prakt. Metallogr. (Germany), vol.20, no.5, p.213-21 (May 1983). In German, English.
Two methods of contrasting by imaging flat surfaces in the SEM are presented One method utilises the increase in atomic number difference of the phases to be measured metallographically by selective coating with a chemical layer. This gives a sufficient contrast even with phases of low atomic number difference. With very fine structures such that back scattered electrons give a poor resolution, low-energy secondary electrons were used to form an image. Here the different microroughnesses of the different phases of a freshly polished sample were used. With these methods quantitative measurements were possible of very fine structured elements, which normally can not be studied due to poor contrast and low resolution. (9 refs.)

103440 Load fixture for uniform plastic deformation of single crystals. G.Georgeson, F.Milstein (Univ. of California, Santa Barbara, CA, USA).
Rev. Sci. Instrum. (USA), vol.54, no.8, p.1026-30 (Aug. 1983).
In conventional tensile or compressive tests of single crystals, plastic deformation by slip occurs nonuniformly owing to a slip plane rotation and constraint of the specimen's ends. To minimize these problems, a 'load fixture' (LF) that employs an air bearing and magnetic field (to provide for free rotation of the ends of the specimen) has been designed and built. The frictionless air bearing minimizes the tendency of the system to develop internal torques during the deformation of single crystals, particularly those with low critical resolved shear stresses. The LF has been of rotation on the 'boundary of slip' (i.e. on the slip plane that separates slipped from unslipped material in the plastically deformed crystal), the line of action of the applied force is maintained coincident with the samples' central axis. The LF is particularly useful for testing small ductile crystals and for studying mechanical hysteresis. (17 refs.)

103441 The gel electrode: a new method of detecting fatigue cracks. W.J.Baxter (Phys. Dept., General Motors Res. Labs., Warren, MI, USA).
Scr. Metall. (USA), vol.17, no.7, p.815-16 (July 1983).
Introduces a new electrochemical technique which can detect and image surface fatigue cracks in metals in a very simple manner. It is based upon two factors: (i) the rupture of surface oxide films during fatigue of the substrate metal and (ii) a modified version of a printing technique developed by Klein (1966) for the study of defective sites of high electrical conductivity in anodic oxide films. The technique is illustrated by an image of a fatigue crack in 7075-T6 aluminum. (3 refs.)

103442 Methods of determining crack growth rate in cyclic crack resistance tests of materials. S.Ya.Yarema (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Sov. Mater. Sci. (USA), vol.18, no.5, p.408-12 (Sept.-Oct. 1982). Translation of: *Fiz.-Khim. Mekh. Mater. (USSR)*, vol.18, no.5, p.45-51 (Sept.-Oct. 1982).
It is shown that in order to determine the optimum method of determining crack growth rate further investigations of existing methods are necessary. As the basis of a standardised method it is suggested that one uses a method which does not smooth the original data, that is, the method of finite differences and its modification. This provides the possibility of determining not only certain average values of the fatigue crack resistance characteristics of a material but also of describing them from standpoints of mathematical statistics. (14 refs.)

103443 Experimental checking of a model for calculating the scale factor in fracture of large samples with cracks. I.P.Gnyp, B.K.Ganulich, V.I.Pokhmurskii (G.V. Karpenko Physicomech. Inst., Acad. of Sci., L'vov, Ukrainian SSR).
Sov. Mater. Sci. (USA), vol.18, no.5, p.413-17 (Sept.-Oct. 1982). Translation of: *Fiz.-Khim. Mekh. Mater. (USSR)*, vol.18, no.5, p.51-7 (Sept.-Oct. 1982).
The authors show how in fracture of plastic materials almost all of the energy is consumed in plastic deformation at the crack tip, and, therefore, a force approach has to be made to determine the degree of influence of the scale factor on crack resistance. Experimental evidence is presented to illustrate the above. (7 refs.)

103444 Acoustic emission during thermal cycling of heat-resistant steel. R.Zuchowski, A.Pshonka (Wroclaw Polytech. Inst., Wroclaw, Poland).
Strength Mater. (USA), vol.14, no.6, p.828-33 (June 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.6, p.97-101 (June 1982).
A study of specimen acoustic properties during thermal cycling was carried out using steel 12HMF. The results showed: the existence of a relationship between the amount of energy absorbed by a specimen and the intensity of AE signals; the periodic nature of AE during thermal cycling probably caused by the sudden nature of deformation observed during thermal cycling; extinction of emission during the few cycles before failure. Similar indication may be observed during static tensile tests on metals, and consequently AE may be used to study and determine the failure mechanism also during thermal cycling; and a marked difference between AE intensity in the specimen heating and cooling periods. The AE intensity during specimen heating was an order of magnitude greater than during cooling, and this probably indicates a greater amount of damage initiated during specimen heating. (3 refs.)

103445 Effect of the stiffness of testing machines on the relationships of deformation and fracture of materials with a heterogeneous structure. A.A.Lebedev, V.P.Lamashevskii, P.T.Alfimov (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.7, p.930-5 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.64-7 (July 1982).
Attention is given to the relationships governing the deformation and fracture of the material taking into account the reserve of elastic energy accumulated in the testing machine-specimen system. The investigations were conducted with special reference to structurally heterogeneous quasibrittle materials. (8 refs.)

103446 Tensile tests with rates up to 10^2 sec^{-1}. G.V.Stepanov, V.M.Tokarev (Inst. of the Strength of Materials, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.7, p.951-4 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.81-4 (July 1982).
Tests in the intermediate range of strain rates ($\dot{\epsilon}=10^{-1}$-10^2 sec^{-1}) encounter serious difficulties: series-produced testing machines cannot be used for them because of insufficient power of the drive. To eliminate the difficulties of testing in the range of these higher strain rates, a special installation was worked out. Loading of the specimen is effected with the aid of the kinetic energy of the ram of a vertical impact testing machine with relatively small mass whose inertial motion is transmitted to the specimen through a screw-type loading mechanism. (7 refs.)

103447 Machine for testing polymer materials in the three-dimensional stressed state at various temperatures. N.P.Demenchuk, A.Ya.Gol'dman (Leningrad Refrigeration Industry Technol. Inst., Leningrad, USSR).
Strength Mater. (USA), vol.14, no.7, p.980-4 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.105-9 (July 1982).
The machine described provides quite simple solutions of certain problems of testing under pressure at various temperatures which have been checked in service for five years. It is an improved variation of earlier developed machines. The machine makes it possible to load a sample with a purely hydrostatic pressure to investigate compressibility, tension-compression, and torsion with the application of pressure under simple and programmed loads and provides the capability of obtaining the following relationships: deformations to stresses with a constant strain rate; deformations to time in creep; stresses to time in relaxation with different values of hydrostatic pressure and temperature. (8 refs.)

103448 Equipment 'VAIR' for mechanical tests on materials in a nuclear reactor. V.I.Moseev, M.G.Bul'kanov, A.S.Kruglov, Yu.M.Pevchikh, V.A.Fazkullin.
Strength Mater. (USA), vol.14, no.7, p.989-92 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.114-16 (July 1982).
Comprehensive equipment for studying material reactor mechanical properties was developed. It consists of a test unit placed in the channel of a reactor, a measuring and recording complex a system for monitoring and controlling the equipment, and a control panel. The test unit provides deformation of each specimen in a schedule determined by the experimental program. (3 refs.)

103449 Surface crack depth-bursting strength relation of glass containers. S.Yokokura, A.Yoshida (Brewing Sci. Lab., Kirin Brewery Co. Ltd., Takasaki-shi, Japan).
Yogyo-Kyokai-Shi (Japan), vol.91, no.4, p.196-8 (1983). In Japanese.
A method of measuring crack depth on the outer surface of a glass was proposed. From a container sample, a ring section was cut using a diamond cutter, and the cut surface was then polished using an abrasive of 800 mesh. The ring section was then immersed in a liquid, the refractive index of which was about 1.5. The depth of the surface crack of the polished ring section was measured with a stereomicroscope in oblique lighting. The measured values agreed with values which were calculated from the measured bursting strength and K_{Ic} of samples. (3 refs.)

103450 Basic principles of thermal neutron radiography. M.R.Hawkesworth, J.Walker (Dept. of Phys., Univ. of Birmingham, Birmingham, England).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.5-21
This review concentrates on the basic principles of radiography with beams of thermal neutrons. First, the principles of neutron beam production are discussed since the generation of a 'radiographic quality' beam is of primary importance whatever the neutron source or image detector available. This is followed by a summary of the neutron sources available for radiography to highlight the basic principles involved and their advantages and disadvantages in this application. The various image detectors available are then discussed with emphasis on screen-film detectors as these are by far the most widely used in thermal neutron radiography at present. (41 refs.)

103451 Physics of neutron radiography using selected energy neutrons. W.L.Whittemore (General Atomic Co., San Diego, DA, USA), H.Berger.
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.23-33
A wide variety of neutron radiographic problems are best solved using specially selected neutron energies. These energies can range from very cold neutrons (<0.001 eV) to 14 MeV. The production, utilization, and detection of neutrons with these different energies frequently involve special considerations discussed in this report. Examples of neutron radiography are given for each of the energy regions except thermal which is treated in another report presented in this Conference. (45 refs.)

103452 Nuclear industry application of neutron radiography in Europe. J.C.Domanus (Riso Nat. Lab., Roskilde, Denmark), P.von der Hardt.
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.35-46
The introduction of nuclear energy in Europe has considerably remained behind predictions made 10 years ago. But even the revised, more cautious predictions indicate that the installed generating capacity inside the European Community will double over the next five years. Among the numerous tools available to the underlying R&D programmes, neutron radiography has acquired a solid position as an inexpensive, flexible, and reliable non-destructive testing method. Nearly all European neutron radiography installations are based at government-owned research centres, with a majority using reactor beams. Nuclear industries operate mainly as co-sponsors of R&D programmes using these installations. (38 refs.)

103453 Application of neutron radiography in Japan. M.Kobayashi (JAERI, Gumma-ken, Japan), N.Wada, J.Sekita.

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.47-50

The history and the present state of neutron radiography in Japan are reviewed. Three types of neutron sources, namely nuclear reactors, accelerators and radioisotopes are now used. The interests on the application on neutron radiography become greater and greater in the industries, such as atomic energy, aeronautics and space, etc. (7 refs.)

103454 Neutron radiography facilities using neutron beams from nuclear reactors. E.R.Kartashev (All-Union Res. Inst. of Radiation Engng., Moscow, USSR).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.51-7

The author presents diagrams, descriptions and main technical characteristics of a number of Soviet neutron radiography facilities. The facilities utilize neutron beams from the swimming pool type reactors RBT-6 and MR, fast reactor BR-5, from the water-cooled and water-moderated reactor VVR-K and heavy-water reactor TVR. (7 refs.)

103455 Review of neutron radiography development activities at Argonne National Laboratory. A.DeVolpi (Reactor Analysis & Safety Div., Argonne Nat. Lab., Argonne, IL, USA).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.59-65

Argonne National Laboratory developments and applications in neutron radiography have focused on nondisruptive examination of nuclear-reactor fuel under a variety of conditions, including fresh and irradiated single- and multiple-pin samples that are contained in capsules and coolant loops, some of which have thick walls or thermal-neutron filters. The developments, which began in the early 1960s, include special techniques for energy, time, and dimensional resolution, as well as accommodation of unique radiographic conditions. The applications have been designed to match the capabilities of TREAT, HFEF, and IPNS reactor and accelerator sources. (19 refs.)

103456 A review of ten years of operation of the industrial neutron radiography facilities associated with the Triton reactor at the Fontenay aux Roses nuclear research center. G.Bayon, L.Laporte, J.Le Gail (CENS, Gif-sur-Yvette, France).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.67-76

The authors make a brief presentation of the two facilities which were in operation until the second half of 1981, an overall review is compiled, showing the progress in activities in the area of the inspection of inactive parts from industry. Slides reproduce concrete cases of neutron radiographic inspection, the main fields of application are clarified, including pyrotechnics, plastics and similar materials, fuels, lubricants, metallurgy, biology and the arts. (no refs.)

103457 Applications and trends of industrial neutron radiography. R.L.Newacheck (Aerotest Operations Inc., San Ramon, CA, USA).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.77-82

Industrial applications of neutron radiography have expanded over the last 10 to 12 years as this relatively new nondestructive testing technique has been accepted as a necessary and routine test procedure. In the late 1960s, neutron radiography was considered only for inspection of space systems components and other high reliability and/or man-rated systems. As the Space program slowed, applications narrowed to inspection of components for military aircraft and missiles. In most cases, the principal use was for inspection of explosive-actuated devices such as shielded mild detonating cord, separation bolts, severance assemblies, gas cartridges and power devices. In recent years, although the explosive device inspection applications have continued to grow, other applications have expanded to share equally in the use of neutron radiography for routine inspection. These applications include inspection of ceramic capacitors and electronic filters along with other electronic devices, complex mechanical assemblies, and detection of contaminants or residual core material in complex machined assemblies and gas cooled aircraft turbine blades. (no refs.)

103458 Neutron radiography at Lucas Heights. P.A.Gillespie, T.Wall (Australian Atomic Energy Commission, Lucas Heights Res. Labs., Lucas Heights, New South Wales, Australia).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.85-92

The development and progress of neutron radiography at the Australian Atomic Energy Commission is described for the period 1972 to the present. The early work involved standardisation of sensitometric data for the indium transfer-foil techniques. The superiority of direct methods using gadolinium converter screens was recognised, and subsequent work was carried out using this process of imaging the neutron beam. More recently, the use of fluorescent intensifier screens has been investigated. Successful applications, in terms of regular and routine service work, have been limited to projects in the aircraft industry. Specific problems have been solved in the explosives, electronics and nuclear industries, and a successful research program involving the monitoring of in vivo plant root growth has been supported. Although the AAEC offers a routine commercial service in neutron radiography, the logistics of using an immobile reactor neutron source to solve problems in non-nuclear related fields remains a barrier to many potential users of neutron radiography. (1 ref.)

103459 Neutron radiography in Brazil. J.D.Rogers (Federal Univ. of Rio de Janeiro, Rio de Janeiro, Brazil).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.93-8

Neutron radiography studies being carried out in reactor centres in Brazil are discussed. These research projects are under way using the 5 MW swimming pool reactor at the Institute of Energy and Nuclear Research (IPEN) in Sao Paulo and the Argonaut reactor at the Institute of Nuclear Engineering (IEN) in Rio de Janeiro. (8 refs.)

103460 Use of a neutron guide in industrial neutron radiography. M.Zaccheo, J.Berthon, G.Uzureau, A.Laporte (CENS, Gif-sur-Yvette, France).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.99-106

The authors describe the neutron radiography facility associated with the Orphee high flux reactor at the Orphee high flux reactor at the Saclay Nuclear Research Center. The authors discuss: The presentation of the facility, with emphasis on all the mechanical systems involved; Description of the control and monitoring console; A non-exhaustive list of the facility's potentialities; The advantages and drawbacks of the use of a neutron guide to carry out industrial neutron radiography. (no refs.)

103461 Status report on the activity of the neutron radiography group in Pusat Penelitian Teknik Nuklir Bandung. A.Kusnowo, Djajusian, D.Umar, F.P.Wattimury.

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.107-10

This report provides information concerning the current activity of neutron radiography group in Pusat Penelitian Teknik Nukir (Research Centre for Nuclear Technique) in Bandung, Indonesia. The standardization (using transfer model) of neutron radiography is the main activity. Experiments were done and directed to support the need of reactor technology, metallurgy, and biology. (no refs.)

103462 Characteristics of neutron radiography systems using accelerators and a research reactor. E.Hiraoka, M.Fujishiro, Y.Tsujii, J.Furuta (Radiation Center of Osaka Prefecture, Sakai, Japan).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.111-18

The equipments for neutron radiography using a 1-MeV Van de Graaff type accelerator and a 18-MeV electron linac of the Radiation Center of Osaka Prefecture (ORC) and Kyoto University Research Reactor (KUR) were set up. The characteristics of neutron beam and the radiographic image qualities with various films available were measured by a Beam Purity Indicator and a Sensitivity Indicator approved by ASTM and a System Image Quality Indicator devised by Barton. (10 refs.)

103463 Development of a neutron radiography system at the TRIGA mark III reactor of the nuclear center of Mexico. J.Altamirano (Inst. Nacional de Investigaciones Nucleares, Mexico City, Mexico), N.Segovia, M.Monnin.

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.119-26

The TRIGA MARK III Reactor provides usable neutron yields for use in Neutron Radiography. Neutron Radiographs showing acceptable resolution obtainable with a simple set up can be produced in exposures as short as three minutes with efficient neutron converters and fast film. The facility used for thermal neutron radiography is described. The beam configuration for radiographic applications provided a total beam intensity of 3.85×10^6 n/cm^2-sec with a thermal neutron intensity of 2.89×10^5 n/cm^2-mR, a cadmium ratio of 3.65, and a γ-intensity of 30 R/hr over a useful beam coverage 8 inches diameter area. The collimation system was improved by constructing diaphragms of paraffin lead and cadmium, which had the functions of a diverging collimator; the L/A ratio is about 135. (4 refs.)

103464 Neutron radiography experiences at the low flux reactor. J.J.Veenema, D.Mesman, H.P.Leeflang (Netherlands Energy Res. Found., Petten, Netherlands).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.127-33

At the Low Flux Reactor from ECN at Petten, a neutron radiography installation is in use for the evaluation of neutron radiography techniques and the non-destructive testing of non-radioactive objects. For this purpose a vertical beam is used from this Argonaut-type reactor with a maximum power of 10 kW. In general the direct detection technique with gadolinium foil is applied. Application of neutron radiography for metal bonded specimens have shown very useful results. (3 refs.)

103465 Progress in NR techniques and applications at AWRE Aldermaston. P.H.White, A.F.Thomas, B.G.Holland, G.S.G.Tuckey (AWRE, Aldermaston, England).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.135-43

AWRE Aldermaston operates a small NR team on the HERALD 5 MW reactor. Most of the work is done for the UK Ministry of Defence but some work is undertaken for outside agencies. NR with either thermal or cold neutrons is used for ordnance, reactor and aircraft items. Dynamic neutron radiography of an internal combustion engine has been demonstrated. New techniques are incorporated as required. Under development are an anti-scatter grid for enhanced detection of small density differences and a two axis tilt table for enhanced crack detection. Alternative sources have been investigated and a D-T neutron source is used routinely for NR. (no refs.)

103466 Neutron radiography DIDO reactor. D.J.Taylor (AERE, Harwell, Didcot, England).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.145-51

Two facilities are described, a cold neutron beam which extends outside the reactor containment building where it is used for dynamic radiography, and a thermal neutron beam within a shielded handling cell suitable for both radioactive and inactive specimens. Examples of utilisation and techniques are described. The external beam is particularly valuable for radiographing potentially hazardous equipment, e.g. an operating gas turbine engine. The cell beam is suitable for a wide range of objects from highly radioactive experimental rigs and reactor control absorbers to turbine blades for aircraft jet engines. Safety aspects and the training of operators are considered. (6 refs.)

103467 Neutron radiography at the general electric nuclear test reactor. C.E.Leighty (General Electric Co., Pleasanton, CA, USA).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.153-62

Neutron Radiography is presently being performed on a routine production basis. The neutron source is the General Electric designed and constructed Nuclear Test React, a 100 kW (t) graphite-moderated and -reflected, light-water-cooled, thermal reactor at the Pleasanton, California, USA, Vallecitos Nuclear Center. The author discusses the facility design and unique capabilities including collimation, two beam ports, fixturing, irradiated nuclear fuel transfer neutrography, and a variety of aerospace, military, nuclear and commercial applications. (23 refs.)

103468 Neutron radiography facilities at Sandia National Laboratories, Albuquerque (SNLA). F.A.Hasenkamp (Nondestructive Testing Div., Sandia Nat. Labs., Albuqueque, NM, USA).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.163-71

SNLA has had a neutron radiography (NR) facility since 1964. The author describes the two reactor facilities at SNLA and their NR applications and developments. (7 refs.)

103469 Neutron radiography techniques at Sandia National Laboratories, Albuquerque (SNLA). F.A.Hasenkamp (Nondestructive Testing Div., Sandia Nat. Labs., Albuquerque, NM, USA).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.173-80

Previously existing neutron radiographic techniques at SNLA proved inadequate to resolve individual component layers within a thermal battery cell stack. The author describes the investigation that was successfully conducted to improve the technique and achieve the necessary resolution. Another improvement that has been investigated is the installation of a cold neutron capability. This investigation, conducted by an outside contractor, shows clearly that a greatly improved neutron radiography capability for some conditions would be gained. No determination has been made at this time whether or not it will be installed. (3 refs.)

103470 **Description and characterization of the BR1 neutron radiography facility.** H.Tourwe (SCK/CEN, Mol, Belgium).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.183-9
The SCK/CEN BR1 nuclear reactor is a natural uranium graphite reactor. This reactor is very well suited for neutron radiography because of the easy access and because of the adequate neutron flux level. The BR1 neutron radiography facility is a dry installation, installed at a tangential beam channel. It has a L/d ratio of 75 and is mostly used for non-destructive control purposes with the direct detection technique. (3 refs.)

103471 **Six years' experience with the double beam neutron radiography facility at the Riso National Laboratory.** P.Knudsen, J.Olsen (Riso Nat. Lab., Roskilde, Denmark).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.191-7
The Riso neutron radiography (NR) facility utilizes a homogeneous solution-type reactor (L-55, Atomics International) as the neutron source. The principal application of the Riso facility is the nondestructive examination of water reactor fuel, i.e. zircaloy clad uranium dioxide. The NR technique is useful for the characterisation of features which would otherwise normally require destructive examination. Examples are: pellet cracks and center voids, local hydriding of the cladding, and presence of water in defect fuel rods. The usefulness and the technique is very much increased by detailed correlation with other methods. The authors present typical and illustrative examples from the six years of NR experience at Riso. (4 refs.)

103472 **A ^{233}U fuelled reactor for neutron radiography.** C.S.Pasupathy, M.Srinivasan (Bhabha Atomic Res. Centre, Bombay, India), V.Anandkumar, N.Kannan.
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.199-207
A compact ^{233}U fuelled neutron source reactor is under construction at the Reactor Research Centre, Kalpakkam, India, to be used primarily for Neutron Radiography of fuel pins, subassemblies and other active components of the Fast Breeder Test Reactor. This compact source reactor is located underneath a hot cell where active fuel elements are to be visually examined. A leak tight tube extending down from the cell above permits active objects to be lowered for Neutron Radiography. Sequential pictures will be taken using casettes driven on a chain conveyor system. Besides the beam for active sample radiography an additional beam would be available for non active sample radiography. The beam tubes are to be provided with standard collimator, aperture control and beam shutter arrangements. (4 refs.)

103473 **Design and safety aspects of neutron radiography rig for examination of irradiated objects.** B.Raj, C.K.Iyer, P.Kalyanasundaram, P.Rodriguez (Radiometall. Lab., Reactor Res. Centre, Tamil Nadu, India).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.209-17
Neutron Radiography has emerged in recent years as an important non-destructive test method for post-irradiative test method for post-irradiation examination of irradiated objects. A swimming pool type reactor (30 kW) in the basement of hot cells, having neutron flux of 3×10^{10} at reflector surface is to be utilised for neutron radiography. The examination is carried out by lowering the objects in front of neutron beam from one of the cells through a containment and guide tube which is an integral part of the hot cell extending to the basement below it thus avoiding transfer of irradiated objects from hot cells for the purpose of neutron radiography. This approach has many advantages, but it puts severe constraints on the design and safety aspects of neutron radiography rig. A moving cage holds the object and is lowered in the containment and guide tube for neutron radiography. Cassette feed mechanism and controls have been devised such that it is possible to take six shots without human entry to the neutron radiography area. (no refs.)

103474 **Development of an online neutron radiography system of high resolution for nuclear materials.** K.Kanda, K.Yoneda, S.Fujine (Res. Reactor Inst., Kyoto Univ., Osaka, Japan).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.219-25
A neutron radiography system of high efficiency and of high resolution for non-destructive measurements of materials has been developed by using the E-2 experimental hole attached to the Kyoto University Research Reactor (KUR). Comparing with the ARRR, the E-2 hole has the following advantages; (i) high neutron density, 1.2×10^{6} n/cm^{2}.sec, (ii) large cadmium ratio of gold foil, 400, and (iii) low gamma ray contamination, 4.2 R/h. A high quality TV camera was installed, of which output is observed directly and visually, and connected to a computer system. The system has been successfully applied to identifying the location of burnable poison in side plates of reactor fuel. (3 refs.)

103475 **Neutron radiography installation in the HFR reactor pool.** J.Bordo (Commission of the European Communities, JRC Petten Establ., Petten, Netherlands), H.P.Leeflang, J.J.Veenema.
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.227-34
The ability of neutron radiography to provide high quality radiographs of highly radioactive specimens has led to its use in irradiation testing technology. Ten years ago a high flux radiography facility has been installed in the HFR at Petten. It is applied to carry out pre- and post irradiation examination of capsules being irradiated in the HFR. The author gives a description of the equipment available at present, the loading provisions and the detection technique. (4 refs.)

103476 **Neutron radiography installation for long fuel rods at the HFR Petten.** H.P.Leeflang, J.J.Veenema (Netherlands Energy Res. Found., Petten, Netherlands).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.235-40
In order to perform neutron radiographic examinations of spent fuel rods from power reactors with a length between 2 and 4 metres a new neutron radiography facility has been developed, using a neutron beam of the High Flux Reactor at Petten. This dry installation has a high collimation ratio. Long fuel rods can be inserted from a shielded transport container. The radiographs are recorded by the tracketch technique on cellulose nitrate film held in a specially designed camera. (2 refs.)

103477 **Cold neutron radiography applied to the study of hydrogen in palladium.** M.R.Hawkesworth, J.Walker (Dept. of Phys., Univ. of Birmingham, Birmingham, England), J.P.G.Farr.
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.291-302
The application of cold neutron radiography to metallurgical studies requiring high spatial resolution is illustrated with examples from a study of the palladium-hydrogen system. The now standard methods for direct technique radiography requiring good resolution were used and proved adequate, namely single emulsion films pressed firmly against a single (back) intensifier screen of polished gadolinium foil 25 μm in thickness, with neutron exposures in the range 2 to 6×10^{9} cm^{-2}. A relatively modest printing enlargement of 3 to 5X was found to be convenient for direct presentation of the results and a representative selection is included. (14 refs.)

103478 **Determination of hydrogen content in materials and products by neutron radiography method.** N.D.Tyufyakov (All-Union Res. Inst. of Radiation Engng., Moscow, USSR).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.303-7
When some materials and products made of them are placed in the hydrogenous medium the hydrogen in this medium is capable of accumulating in these materials to produce hydroxides, hydrides and other chemical compounds which induce the parameters of the corresponding products to become worse. The possibility and features of the quantitative determination of low contents of hydrogen in some materials and products by neutron radiography are discussed and relations for the evaluation of the method sensitivity and the results of the experimental studies presented. (4 refs.)

103479 **Optimization of a 'constant quality level control system'. The 'ORPHEE' industrial neutron radiography facility.** G.Bayon, A.Laporte (CENS, Gif Sur Yvette, France).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.309-14
The authors describe the operations that have been optimized to carry out neutron radiography on parts from industry. Transport and storage products, preparation of parts and marking, detector optimization, taking pictures, film treatment, quality control and administration. (2 refs.)

103480 **Neutron radiographic inspection of composite and composite-metal structures.** W.E.Dance (Vought Corp. Advanced Technol. Center, Dallas, TX, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.315-23
The use of neutron radiography for nondestructive inspection of a variety of composite and mixed composite/metal structures is being explored. Radiographic data are presented which illustrate the sensitivity of nonreactor neutron sources for imaging defects in laboratory specimens of complex, difficult-to-inspect structures. In some cases neutron radiography provides a direct complement to X-ray inspection, with resin porosity being imaged by the neutrons and the fiber distribution patterns being imaged by X-ray. In other cases, such as those involving complex adhesively bonded composite/metal structures, neutron radiography provides the only existing accurate and reliable method of imaging certain types of bondline deficiencies. (6 refs.)

103481 **Neutron radiography of Apollo ordnance.** K.G.Golliher (US Dept. of Energy, Albuquerque, NM, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.325-32
Neutron radiography played an important role in the successful Apollo missions. Neutron radiography was used, for the first time, on a production basis to examine the internal details of ordnance devices employed in the Apollo Program. Ordnance devices ranged from charges which separated the massive booster stages to those which triggered the release of re-entry parachutes. Discussed are the early developments in neutron radiography and the conversion of this infant nondestructive technology into production capabilities. (no refs.)

103482 **Contrast enhancement in neutron radiography using a gaseous penetrant.** B.G.Holland (AWRE, Aldermaston, England).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.333-7
The absorption cross section of ^{3}He is so great that even a few millimetres of gas at moderate pressures produce a significant change in the transmission of thermal and cold neutrons. This provides the possibility of a novel method for the detection of small leakage paths by neutron radiography. The paper first outlines the standard techniques for contrast enhancement and then illustrates the use of He with an account of an actual examination of electric bridge wire squibs, with some comment on sensitivity and cost. (no refs.)

103483 **Doping explosive materials for neutron radiographic enhancement.** K.G.Golliher (US DOE, Albuquerque, NM, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.339-46
Most ordnance materials that are inorganic mixtures neutron radiograph poorly, or not at all, particularly if contained within a thick metallic structure. Investigations were made relative to selecting a material(s) with high neutron absorbing property that when added to the explosive mixture enhanced the imaging of the material, and the quantity of the additive would not interfere with the proper reaction of the chemical mixture. The results are reported. (6 refs.)

103484 **Resonance neutron radiography.** R.A.Schrack, J.W.Behrens, R.G.Johnson, C.D.Bowman (NBS, Washington, DC, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.495-502
The production of images by the use of neutrons having energies in the resonance region is described. Two-dimensional position-sensitive neutron detectors are used to produce transmission images using neutron time-of-flight techniques at the National Bureau of Standards' electron linac facility. Two types of detectors are described. The first is a crossed-wire proportional counter using ^{3}He as the neutron-sensitive component. The second type utilizes a multichannel plate electron multiplier and a resistive anode readout. A lithium glass scintillator is the neutron-sensitive component in the latter detector. Resonance neutron radiography, using these detectors, has the capability of producing images with isotopic and chemical element discrimination in a complex matrix with a resolution of 1 mm or better. (11 refs.)

103485 **The influence of multiple refraction effects on the sharpness of neutron radiographs of ferromagnetic materials.** A.J.Allen, D.K.Ross (Dept. of Phys., Univ. of Birmingham, Birmingham, England).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.919-27
Cold neutron radiographs of ferritic steel components can show an unsharpness in the image of edges which would seriously affect inspection studies. It is shown that this unsharpness is due to multiple refraction effects at mag-

netic domain boundaries which combine so as to cause a broadening of the beam. On the other hand, small angle scattering due to smaller inhomogeneities, while being measurable, is unlikely to detract from the radiography. The variation of the multiple refraction broadening with neutron wavelength, sample thickness, magnetic domain size and other magnetic properties is considered as are various means of minimising the effect. In particular, the use of shorter wavelength neutrons is beneficial. Possible uses of the phenomenon for identifying ferromagnetic regions are discussed. Finally, complications introduced by having finite Bloch wall thicknesses are outlined. (12 refs.)

103486 Small angle neutron scattering complementing neutron radiography. J.Schelten (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.953-9
In neutron radiography inhomogeneities of sizes down to a few micrometers are detectable by an imaging technique. In small angle neutron scattering experiments inhomogeneities in the Å range up to 1000 Å diameter are observed by neutron scattering. The use of this technique for nondestructive testing of low-alloyed, high-alloyed and pressure vessel steels which are heat-treated, creep-tested, and neutron-irradiated is described. (3 refs.)

103487 Neutron radiography standards in the United States of America. J.J.Haskins (Aerotest Operations Inc., San Ramon, CA, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.985-91
Consensus standards for industrial neutron radiography are of very recent origin in the United States. Commercial applications of neutron radiography first began in 1967, with the first consensus standard issued in 1975. Clearly, much work preceeded the issuance of this first standard, but even that is of recent history when compared with several other NDT methods. Standards work in the United States today is divided into three major areas—commercial standards, nuclear standards, and personnel qualifications. The author considers the history, current status, design philosophy, and projections for the future in these three areas. (no refs.)

103488 Work on the characterization of sensitive surfaces used in neutron radiography, conducted under the auspices of AFNOR. G.Bayon, A.Laporte (CENS, Gif-sur-Yvette, France).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.997-1001
In industrial neutron radiography, the sensitive surfaces routinely used are silver films combined with a gadolinium converter. To meet requests from industry concerning the choice of emulsions, standardization work was undertaken under the auspices of AFNOR, jointly with Commission No.2 of COFREND. The authors discuss these activities, and describe the equipment and standard source used for irradiations, with an explanation of the results obtained. The irradiation source is a C^{14} source, and many types of film marketed by Agfa-Gevaert and Kodak-Pathe have been tested to determine their sensitivity and average contrast. (1 ref.)

103489 Methodology used to characterize an industrial neutron radiography facility; use of the specific image quality indicator. G.Bayon, A.Laporte (CENS, Gif-sur-Yvette, France).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.1003-11
The user of nondestructive testing by neutron radiography for perfectly reliable parts needs assurances concerning the results obtained, both in terms of quality and of reproducibility. Work on standardizing procedures has therefore been carried out, and the results of these deliberations are discussed. A simple method for the characterization of a facility requires the measurement of detector unsharpness, measurement of geometric unsharpness, measurement of gamma background, and beam characterization from the standpoint of neutron attenuation. Also described are the specific image quality indicators used for many tests performed to identify clearances or cracks, as well as material deficiencies. (5 refs.)

Modern Utilization of Infrared Technology VIII .... See Entry 98624

Neutron Radiography. Proceedings of the First World Conference .... See Entry 98644

The extremum-slope criterion for precise dimensional measurements in neutron radiography .... See Entry 99083

Ellipsometric method of determining the quality of surface processing .... See Entry 99159

Neutron image intensifier tubes .... See Entry 99250

Fluorescent converter and neutron absorber being made of boron nitride .... See Entry 99251

MTF analysis of the near-real time neutron radiography facility at MURR .... See Entry 99252

Neutron radiographic image definition under a wide range of resolution conditions .... See Entry 99253

Inverse contrast in neutron radiography .... See Entry 99254

The neutron computer tomography .... See Entry 99255

The role of diffused beta radiation in imaging with beta emitting neutron radiographic converter screens .... See Entry 99256

Scattering point spread functions in neutron radiograph .... See Entry 99257

Neutron image simulation by Monte Carlo methods .... See Entry 99258

Digital neutron radiography using plane converters with multiwire proportional chambers .... See Entry 99259

Neutron radiography in Grenoble. I. A complementary means for inspecting nuclear fuels during irradiation .... See Entry 99628

TREAT neutron radiography facility .... See Entry 99629

Hot Fuel Examination Facility neutron radiography reactor design .... See Entry 99630

Operation and modification of the HEDL Neutron Radiography Facility (NRF) .... See Entry 99631

Design of the Fuels and Materials Examination Facility (FMEF) neutron radiography facility for irradiated fuel .... See Entry 99632

Examination of fuel rods by means of neutron radiography .... See Entry 99633

Neutron and gamma radiography of UO_2 and TRIGA fuel elements .... See Entry 99634

Inspection of Pu particle in UO_2-PuO_2 pellet by neutron radiography .... See Entry 99635

The application of neutron radiography for the testing and investigation of nuclear fuel elements .... See Entry 99636

Neutron radiography applications .... See Entry 99637

Application of epithermal neutron radiography to performance tests on advanced LMFBR fuel .... See Entry 99638

Neutron radiography of subassemblies or pins in a hot laboratory .... See Entry 99639

Feasibility of EPI-thermal neutron radiography of fast reactor fuel assemblies .... See Entry 99640

Ex-core neutron radiography of large fuel bundles .... See Entry 99641

Recent developments and capabilities in neutron radiography at HEDL .... See Entry 99642

Postirradiation examination using neutron tomography .... See Entry 99643

Neutron radiography applications and techniques at the Hot Fuel Examination Facility .... See Entry 99644

In pool neutron radiography of a BWR control blade .... See Entry 99645

Inspection of reactor fuel- and absorber-elements by means of neutron radiography with a small size antimony-beryllium neutron source ... See Entry 99646

Neutron radiography feasibility studies for steel examination for the liquid metal fast breeder reactor program .... See Entry 99647

Creep strain measurements on irradiated stainless steel samples by means of neutron radiography .... See Entry 99648

Reactor in-situ test-fuel neutron radiography .... See Entry 99649

Image restoration to increase resolution of the fast-neutron hodoscope .... See Entry 99650

Neutron resonance transmission analysis of reactor spent fuel assemblies .... See Entry 99651

Resonance neutron radiography .... See Entry 99652

Use of cellulose nitrate for neutron radiographic testing of burned fuel elements .... See Entry 99653

Track-etch radiography using $^{10}B_4C$ convertor .... See Entry 99654

Development of an enriched elemental boron-10 conversion screen for improved 'track-etch' image recording .... See Entry 99655

Development of enriched boron track-etch convertor screens for neutron radiographic applications .... See Entry 99656

On the underlying causes for the shape of the density trace of a round object . ... See Entry 99657

Neutron radiography in Grenoble. II. Its application in routine dimensional measurements on irradiated experimental fuel pins .... See Entry 99658

Application of neutron radiography in light water reactor fuel pin testing programs at the high flux reactor Petten .... See Entry 99659

On the problems relating to the accuracy of the measurement of fuel pin diameters by neutron radiography .... See Entry 99660

Measuring signal-to-noise ratio of typical neutron radiographs .... See Entry 99661

Dimensional measurements of the Petten calibration pin .... See Entry 99662

Search for adequate quality standards for neutron radiography of nuclear fuel .... See Entry 99663

Euratom test program for image quality and accuracy of dimensions .... See Entry 99664

On the development of a combined beam, sensitivity and measurement quality indicator for the neutron radiography of fuel pins .... See Entry 99665

Recommended practice for the neutron radiography of nuclear fuels .... See Entry 99666

Non-destructive control of plutonium oxide fuel pins by neutron radiography at the BR1 neutron radiography facility .... See Entry 99689

The application of indirect radiography to neutron field studies .... See Entry 99694

Cold neutron spectra of the general atomic TRIGA Mk. E neutron radiography facility .... See Entry 99695

Easy direct evaluation of NR images on cellulose nitrate films .... See Entry 100197

A study of the neutron radiographic parameters of some solid state nuclear track detectors .... See Entry 100198

Fission neutron radiography with etch-track detectors .... See Entry 100199

Allyl diglycol carbonate as a track detector material for boron autoradiography .... See Entry 100200

A model describing quantitative neutron autoradiography for boron in iron .... See Entry 100201

Zone plate encoded neutron holography .... See Entry 100647

Industrial applications of holographic testing .... See Entry 100683

Holographic nondestructive evaluation with on-line acquisition and processing .. .. See Entry 100689

Automatic computer analysis of double exposure hologram in industrial nondestructive control .... See Entry 100690

Holography in Europe .... See Entry 100694

Digital and optical moire detection of flaws applied to holographic nondestructive testing .... See Entry 100705

Industrial applications of acoustical holography .... See Entry 100978

Interior imaging using spatial frequency sampling .... See Entry 100989

The improvement of axial resolution in ultrasonic testing with controlled signals .... See Entry 100994

Acoustic lenses - Focusing in on defects .... See Entry 101000

A comparison of two theories of acoustoelasticity .... See Entry 101870

Relation between mechanical properties and spectrum for chrysotile asbestos .... See Entry 102874

Comparison of transition temperatures from instrumented impact tests with the Robertson crack-arrest-temperature .... See Entry 103259

High velocity indentation study of the brittleness of rigid PVC after ageing .... See Entry 103264

Evaluation of fatigue crack growth characteristics of SCM 435 steel by ultrasonic method .... See Entry 103297

Fracture toughness of Mn-Zn ferrite single crystal .... See Entry 103335

Neutron radiography and autoradiography at the J. Stefan Institute .... See Entry 104039

Fast neutron imaging by cellulose nitrate foils [biological application] .... See Entry 104153

82.00 PHYSICAL CHEMISTRY

82.20 CHEMICAL KINETICS

103490 Molecular structure and reaction mechanism: a topological approach to quantum chemistry. P.G.Mezey (Dept. of Chem., Univ. of Saskatchewan, Saskatoon, Canada).
THEOCHEM (Netherlands), vol.12, p.81-99 (Aug. 1983).
Reaction topology and the differentiable manifold model of the nuclear configuration space and potential energy hypersurfaces provide a mathematical framework for computer-aided quantum-chemical synthesis planning. Relations between the geometrical and topological models of molecules and reaction mechanisms are analysed and properties of induced topologies in various product spaces are discussed. (136 refs.)

103491 Reactivity in the spinel formation reaction in CuO/Al_2O_3, Fe_2O_3, Cr_2O_3 systems. [Influence of Jahn-Teller effect]. K.S.R.C.Murthy (Electron Devices Lab., Indian Inst. of Sci., Bangalore, India), J.Ghose, E.Nageswara Rao.
J. Mater. Sci. Lett. (GB), vol.2, no.8, p.393-4 (Aug. 1983).
An attempt has been made to identify the reactivity pattern in the formation of aluminate, ferrite and chromite of copper from the respective metal oxides. In an earlier study, F.S. Stone and R.J.D. Tilley (1965) reported that among aluminates, gallates and indates of magnesium, zinc, nickel and copper, the formation of copper aluminate was associated with maximum reactivity. They attributed this to the Jahn-Teller effect of Cu^{2+} ions on the surrounding oxide lattice in the product phase ($CuAl_2O_4$). The present study has been carried out on the formation of $CuCr_2O_4$, $CuFe_2O_4$ and $CuAl_2O_4$ in order to gain better insight into the influence of the Jahn-Teller effect on reactivity. (14 refs.)

103492 Orthogonal collocation for the analysis of immobilized enzyme systems. Young Sung Ghim, Ho Nam Chang (Dept. of Chem. Engng., Korea Advanced Inst. of Sci. & Technol., Seoul, Korea).
Comput. & Chem. Eng. (GB), vol.7, no.3, p.195-9 (1983).
Orthogonal collocation method is applied to the analysis of nonlinear ordinary differential equations containing Michaelis-Menten kinetics. The solution is expanded in a series of Lagrange interpolation polynomials and Gauss-Jacobi quadratures are used in calculating effectiveness factors. A set of nonlinear algebraic equations resulting from collocation approximation is conveniently solved by the Gauss-Seidel iterative method, but its convergence path is not monotonic. Although the rate of convergence depends on system parameters, orthogonal collocation is more efficient than the Runge-Kutta method in solving boundary value problems even at a high Thiele modulus. (15 refs.)

103493 The ideal law of mass action and first-order phase transition. M.Elwenspoek (Inst. fur Atom- und Festkorperphys., Freie Univ. Berlin, Berlin, Germany).
J. Phys. A (GB), vol.16, no.12, p.L435-7 (21 Aug. 1983).
The author shows that the ideal law of mass action for a chemical reaction $\mu A \rightleftharpoons A_\mu$ predicts a first-order phase transition if one allows μ to become large. (6 refs.)

103494 Incorporation of chemical kinetic models into process control. C.J.Herget, J.W.Frazer (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
24th Midwest Symposium on Circuits and Systems, Albuquerque, NM, USA, 29-30 June 1981 (North Hollywood, CA, USA: Western Periodicals 1981), p.130-5
An important consideration in chemical process control is to determine the precise rationing of reactant streams, particularly when a large time delay exists between the mixing of the reactants and the measurement of the product. A method is described for incorporating chemical kinetic models into the control strategy in order to achieve optimum operating conditions. The system is first characterized by determining a reaction rate surface as a function of all input reactant concentrations over a feasible range. A nonlinear constrained optimization program is then used to determine the combination of reactants which produces the specified yield at minimum cost. This operating condition is then used to establish the nominal concentrations of the reactants. The actual operation is determined through a feedback control system employing a Smith predictor. The method is demonstrated on a laboratory bench scale enzyme reactor. (4 refs.)

Intramolecular energy redistribution in polyatomic ions ....See Entry 100292

Kinetic studies of the bromine-oxygen system: a new paramagnetic particle, BrO_2 ....See Entry 101382

Electric properties of antimony oxide films formed by heating antimony films in air ....See Entry 102544

Spin non-conservation in low-energy molecular charge-transfer reactions ....See Entry 103496

Behaviour of a BZ oscillating system at low temperatures ....See Entry 103497

Reactions of He^+, Ne^+, and Ar^+ with CH_4, C_2H_6, SiH_4, and Si_2H_6 ....See Entry 103508

Laboratory measurements in the energy range 0.02-1 eV of the rate constants of ion-molecule reactions involving CS^+ ....See Entry 103509

A Fourier method solution for the time dependent Schrodinger equation: a study of the reaction $H^+ + H_2$, $D^+ + HD$, and $D^+ + H_2$ .... See Entry 103510

Prototropic charge migration in water. I. Rate constants in light and heavy water and in salt solution from oxygen-17 spin relaxation ....See Entry 103514

Prototropic charge migration in water. II. Interpretation of nuclear magnetic resonance and conductivity data in terms of model mechanisms ....See Entry 103515

Classical dynamics of the reaction of $S(^3P)$ $O_2(^3\Sigma_g^-)$ .... See Entry 103516

Determination of the absolute rate constant for associative ionization in crossed-beam collisions between $Na3^2P_{3/2}$ atoms ....See Entry 103517

Formation of free fluorine atoms by laser-collisional initiation of the $CH_3F + F_2$ reaction ....See Entry 103519

Quantum-chemical model for the photoisomerization of protonated Schiff bases of formaldehyde and acrolein ....See Entry 103542

High vibrational overtone photochemistry of cyclobutene ....See Entry 103548

Thermodynamic and kinetic descriptions of equilibrium ....See Entry 103574

Aqueous oxidation of SO_2 by hydrogen peroxide ....See Entry 104475

82.20K Potential energy surfaces for chemical reactions

(see also 31.70F -in atomic and molecular physics, 34.20 Intermolecular forces, 34.50L Atomic and molecular beam studies)

Molecular structure and reaction mechanism: a topological approach to quantum chemistry ....See Entry 103490

Classical dynamics of the reaction of $S(^3P)$ $O_2(^3\Sigma_g^-)$ ....Sec Entry 103516

Quantum-chemical model for the photoisomerization of protonated Schiff bases of formaldehyde and acrolein ....See Entry 103542

82.20M Nonequilibrium kinetics

Thermodynamics of stability of nonequilibrium steady states ..See Entry 98703

Behaviour of a BZ oscillating system at low temperatures ....See Entry 103497

Bifurcation diagrams for two substrate oscillatory systems ...See Entry 103501

Influence of turbulence on the formation of high nonequilibrium concentrations of atoms and free radicals in diffusion flames ....See Entry 103526

82.20R Energy distribution and transfer, relaxation

(see also 31.70H Time-dependent phenomena in atomic and molecular physics)

A pulse radiolysis study of the formation of the XeBr exciplex in electron beam irradiated xenon-bromine mixtures ....See Entry 103544

Nonequilibrated energy distribution in polyatomic molecules: the infrared MPD of cyclobutanone ....See Entry 103549

Photofragment spectroscopy and dynamics of the visible photodissociation of ozone ....See Entry 103550

Diffusion controlled reactions of gases with surfaces and state dependent reactivity. II. Diffusion slip and Knudsen corrections ....See Entry 103582

82.30 SPECIFIC CHEMICAL REACTIONS; REACTION MECHANISMS

103495 Study of dissociation and neutralization of the H_2^+ ion passing through a molecular hydrogen target in the energy range 10-100 keV. A.Bouliou, M.Sarret, P.Frere (Univ. de Rennes, Rennes, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.16, p.1217-19 (2 May 1983). In French.
An original method easy to realize, is proposed giving the composition of a beam obtained from fast H_2^+ ions passing through a molecular hydrogen target. (5 refs.)

103496 Spin non-conservation in low-energy molecular charge-transfer reactions. E.E.Ferguson (Lab. de Resonance Electronique et Ionique, Univ. de Paris-Sud, Orsay, France).
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.89-92 (29 July 1983).
The reaction $H_2O^+(^2B) + NO_2(^2A) \rightarrow H_2O(^1A) + NO_2^+(^1\Sigma)$ occurs at near the collision rate constant, 1.2×10^{-9} cm^3 s^{-1}, in spite of the fact that the reactants produce both a singlet and a triplet state and the products correlate only with the singlet state. This would be expected to yield a statistical weight factor of $^1/_4$ to be multiplied by the collision rate constant to obtain the maximum charge-transfer rate constant. The triplet products of the charge transfer are clearly endothermic. The singlet-triplet intersection has not been identified but the available information about the singlet and triplet states of the intermediate protonated nitric acid molecule is discussed. Four other examples of apparent 'spin violation' charge-transfer reactions have been noted, $H_2O^+ + NO$, $N_2O^+ + NO$, $CO^+ + NO$ and $CH_4^+ + O_2$. (16 refs.)

103497 Behaviour of a BZ oscillating system at low temperatures. A.K.Dutt, R.S.Banerjee (Dept. of Chem., Univ. Coll. of Sci., Calcutta, India).
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.186-8 (29 July 1983).
The BZ oscillating reaction has been studied at low temperatures and it was noted that strangely enough the oscillation period itself showed some sort of periodicity. (5 refs.)

103498 Br_2 light emission from CW CO_2-laser-induced CF_3Br pyrolysis. G.Luijks, W.Knippers, G.Petrocelli, S.Stolte, J.Reuss (Fysisch Lab., Katholieke Univ., Nijmegen, Netherlands).
Chem. Phys. Lett. (Netherlands), vol.99, no.3, p.232-7 (5 Aug. 1983).
A bright yellow-red glow is observed in a sample of CF_3Br gas (75 Torr) after CW CO_2-laser irradiation ($\leq$30 W). The spectrum of the electronic transition $Br_2(B \rightarrow X)$ is identified. The formation of vibrationally hot $Br_2(B)$ molecules via CF_3Br pyrolysis and Br recombination creates a strongly athermal distribution within the B state. (19 refs.)

103499 Infrared laser photoisomerization of 2-fluoroethanol in argon. W.F.Hoffman,III, J.S.Shirk (Dept. of Chem., Illinois Inst. of Technol., Chicago, IL, USA).
Chem. Phys. (Netherlands), vol.78, no.3, p.331-8 (1 Aug. 1983).
Different products result from single-photon IR photolysis of 2-fluoroethanol in solid argon depending upon the vibrational mode that is excited. Irradiation of the OH stretch causes an interconversion of the two most stable isomers T_t and $G_{g'}$. Irradiation of one CH stretch results in the formation of significant yields of the less stable G_t and T_g isomers. The isomers of 2-fluoroethanol can be photooriented in argon by IR irradiation. (15 refs.)

103500 State-selected molecular-beam reaction dynamics of K with HF (ν=1, j=5, 6 and 7). M.Hoffmeister, L.Potthast, H.J.Leosche (Facultat fur Phys., Univ. Bielefeld, Bielefeld, Germany).
Chem. Phys. (Netherlands), vol.78, no.3, p.369-80 (1 Aug. 1983).
The crossed-molecular-beam method has been used to measure relative integral cross sections σ_r ($\nu=1$, j; E) of the endothermic (0.75 eV) reaction K+F ($\nu=1$, j)$\rightarrow$KHF+H as a function of both the rotational quantum number j (j=5, 6 and 7) and the translational energy $E(0.55 \leq E \leq 1.32$ eV) of the reagents. The vibrational-rotational (ν,j) states of HF were populated by infrared pumping with the radiation of a properly tuned pulsed chemical HF laser. In addition, relative cross sections with $\nu=0$ but averaged with respect to the initial rotational-state distribution of the HF molecules were also determined. The results exhibit three remarkable features: (a) $\sigma_r(\nu=1, j; E)$ rises with increasing j, (b) the steepness of the ascent roughly decreases with increasig E, (c) at $E=0.98$ eV reagent vibrational energy is about a factor of 200 more efficient in promoting the reaction than reagent translational energy. An intuitive dynamical model suggests that observations (a) and (b) are to be expected for a reaction governed by a potential-energy surface with

a late barrier. This is consistent with the well-known interpretation of large vibrational effects as indicated by result (c). (22 refs.)

103501 Bifurcation diagrams for two substrate oscillatory systems. J.Maselko (Inst. of Inorganic Chem. & Metall. of Rare Elements, Tech. Univ. of Wroclaw, Wroclaw, Poland).
Chem. Phys. (Netherlands), vol.78, no.3, p.381-9 (1 Aug. 1983).
The bifurcation diagrams for the Mn^{2+}-malonic acid-H_2SO_4-$KBrO_3$ and Mn^{2+}-oxaloacetic acid-H_2SO_4-$KBrO_3$ systems have been studied in a stirred tank reactor. Complex oscillations associated with a period-doubling bifurcation were found. Bifurcation diagrams for the two substrate malonic-citric and malonic-oxaloacetic acid systems were also determined. (19 refs.)

103502 Production of hydrogen by direct thermal decomposition of water with the aid of a semipermeable membrane. B.Cales, J.F.Baumard (Centre de Recherches sur la Phys. des Hautes Temperatures, CNRS, Orleans, France).
High Temp.-High Pressures (GB), vol.14, no.6, p.681-6 (1982). [received: June 1983] (International Conference on Chemistry of Materials at High Temperatures, Harwell, Oxon., England, 7-10 Sept. 1981).
The direct thermal decomposition of water has been studied as a means of hydrogen production at high temperature. The evolved hydrogen and oxygen are separated with the aid of a zirconia membrane semipermeable to oxygen. The amounts of hydrogen collected at the reactor gas outlet appear to be controlled primarily by the electric characteristics of the semipermeable membrane. The experimental values of the hydrogen flow are compared to theoretical values calculated by a reactor simulation. (8 refs.)

103503 Effect of dielectric constant on EDTA-metal chelates—an ultrasonic study. G.L.N.Sastry (Dept. of Phys., TJPS Coll., Guntur, India).
Indian J. Pure & Appl. Phys., vol.21, no.5, p.320-2 (May 1983).
Employing a single-crystal, variable-path interferometer, five EDTA-metal chelates, viz. EDTA+$CrCl_3$, EDTA+$ZnSO_4$, EDTA+$CoCl_2$, EDTA+$SrCl_2$, and EDTA+KNO_3 have been studied at 30°C and pH=3.5 using 90%-10% water-dioxane mixture as solvent. The condition for a metal ion to form a chelate with EDTA under experimental conditions has been deduced in terms of radius of the metallic cation and valency of the cation. The experimental results have been discussed on the basis of Bjerrum's theory of ion association. The results on these chelates in water-dioxane mixture have been compared with those obtained when water was used as solvent. The present studies have been found to be in agreement with those obtained in the case of six other EDTA-metal chelates studied earlier by the author. Lower dielectric constant of the medium has been found to be favourable for the extent and scope of chelation. (12 refs.)

103504 A study of the temperature dependences of the $N_2^+ + N_2 \rightarrow N_4^+$ and $O_2^+ + O_2 \rightarrow O_4^+$ association reactions using the selected-ion flow-tube and drift-tube techniques. H.Bohringer, F.Arnold (Max-Planck-Inst. fur Kernphys., Heidelberg, Germany), D.Smith, N.G.Adams.
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.1, p.25-41 (1 Aug. 1983).
The three-body ion/molecule association reactions $N_2^+ + N_2 + He – k_1 \rightarrow N_4^+ + He$ and $O_2^+ + O_2 + He – k_2 \rightarrow O_4^+ + He$ have been studied in a variable-temperature selected-ion flow tube (SIFT) and a variable-temperature ion drift tube (DT). The rate coefficients k_1 and k_2 were determined using both apparatuses over uniquely wide temperature ranges, i.e. 45-520K for k_1 and 48-200K for k_2. Accurate measurements of k_2 at higher temperatures could not be made because of thermal break-up of the weakly bonded O_4^+ ion. The magnitudes and temperature dependences of k_1 and k_2 determined in the SIFT and DT experiments are in very good agreement, and can be represented by the analytical expressions $k_1 = 1.8 \times 10^{-29} (300/T)^{2.3 \pm 0.2}$ $cm^6\ s^{-1}$, $k_2 = 5.5 \times 10^{-31} (300/T)^{2.7 \pm 0.3}$ $cm^6\ s^{-1}$. However, noticeable deviations from these power-law dependences occur at the lowest temperatures. The results are compared with those obtained from previous studies of these reactions and for the analogous association reactions involving N_2 and O_2 third bodies. (38 refs.)

103505 Pyrolysis effects on the reactions of alkoxide anions. G.Boand, R.Houriet, T.Gaumann (Inst. de Chimie Phys., EPFL-Ecublens, Lausanne, Switzerland).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.1, p.95-103 (1 Aug. 1983).
The distribution of products in negative chemical-ionization spectra of alcohols are shown to remain unaffected (<1%) by pyrolytic reactions. On the other hand, it is shown that slow ion/molecule reactions can be obscured by fast processes implying impurities formed by pyrolysis. The importance of pumping speed in ion cyclotron resonance (ICR) spectrometers is also discussed. (11 refs.)

103506 Ab initio study of the hydration of ketenimine ($CH_2=C=NH$) by water and water dimer. Minh-Tho Nguyen (Dept. of Chem., Univ. of Leuven, Heverlee, Belgium), A.F.Hegarty.
J. Am. Chem. Soc. (USA), vol.105, no.12, p.3811-15 (15 June 1983).
The detailed reaction pathway for the hydration of the ketenimine $CH_2=C=NH$ by H_2O and by $(H_2O)_2$ has been investigated by ab initio methods using STO-3G, 4-31G, and 6-31G** basis sets. The optimized geometries of the points on the reaction surface were determined by the gradient method. The preferred reaction pathway is with the water dimer through a 'preassociation' mechanism where a small amount of initial bonding occurs via attack (by oxygen) at the central carbon of the ketenimine. Proton transfer (to the β-carbon) then occurs at or just after the transition state without any appreciable changes in the C-O bond distance. The reaction (which is calculated to have an activation barrier of 22 kcal mol^{-1} in 4-31G) is therefore concerted but highly asynchronous. (22 refs.)

103507 A transition state theory of nonadiabatic unimolecular reactions controlled by a conical intersection. Application to the $C_2H_4^+$ ion. M.Desouter-Lecomte, C.Sannen, J.C.Lorquet (Dept. de Chimie, Univ. de Liege, Liege, Belgium).
J. Chem. Phys. (USA), vol.79, no.2, p.894-904 (15 July 1983).
The authors propose an extension of the RRKM method to nonadiabatic reactions. The basic ideas were suggested by Zahr, Preston, and Miller (1975) in the simpler case of a spin-orbit interaction for which the coupling matrix element remains constant over the configuration space. These ideas have been adapted to the more complicated case of a conical interaction. The rate constant is then expressed as a product of a RRKM rate term times an average probability of staying in a given electronic state which is evaluated from the Landau-Zener-Nikitin linear model. The method is applied to the dissociation of the $C_2H_4^+$ ion, whose reaction mechanisms have been previously determined by ab initio calculations, and for which convincing experimental observations suggest that the system can be represented by a microcanonical ensemble. The relevant rate constants are calculated as a function of energy and fragmentation yields derived therefrom. This gives rise to a mass spectrum calculated from first principles. Agreement with experiment is satisfactory. (46 refs.)

103508 Reactions of He^+, Ne^+, and Ar^+ with CH_4, C_2H_6, SiH_4, and Si_2H_6. H.Chatham, D.Hils, R.Robertson, A.C.Gallagher (Joint Inst. for Lab. Astrophys., Univ. of Colorado, Boulder, CO, USA).
J. Chem. Phys. (USA), vol.79, no.3, p.1301-11 (1 Aug. 1983).
The rate coefficients and product-ion distributions for the reactions of He^+ and Ar^+ with silane and disilane have been measured in a drift tube, typically for collision energies of 0.01-1 eV. The total charge-exchange rate coefficients are found to be roughly independent of E/N, or collision energy, and are about equal to the Langevin values for the reactions of He^+ with SiH_4 and C_2H_6 and Ar^+ with CH_4 and C_2H_6. The He^+ rate coefficients on CH_4 and Si_2H_6, and the Ne^+ rate coefficients on SiH_4 and Si_2H_6 are 50% to 80% of the Langevin values, while the Ar^+ rate coefficients on SiH_4 and Si_2H_6 are much smaller. Product ions tend to be hydrogen poor with very infrequent breaking of the C-C or Si-Si bonds. Furthermore, hydrogen stripping is more severe for the silanes than the alkanes. These product-ion distributions bear no resemblance to the product-ion distributions of either photoionization or electron collisional ionization. (35 refs.)

103509 Laboratory measurements in the energy range 0.02-1 eV of the rate constants of ion-molecule reactions involving CS^+. J.Barassin, R.Thomas, A.Barassin (Lab. de Phys. et Chimie de l'Environment, CNRS, Orleans, France).
J. Chem. Phys. (USA), vol.79, no.3, p.1546-8 (1 Aug. 1983).
The authors have studied the kinetics of exothermic reactions of CS^+ with molecules which are abundant in the interstellar medium and which have low boiling points in order to obtain low temperature data. The experiments were performed in a drift tube mass spectrometer apparatus. The buffer gas was helium at a pressure of 0.15 Torr. The CS^+ ions were produced in an electron impact ion source containing CS_2. The mass filter selected the CS^+ ions from the other fragment ions produced in the source and the CS^+ ions were introduced at low energy into the drift tube. The drift ion velocities in helium were measured over the energy range concerned. (11 refs.)

103510 A Fourier method solution for the time dependent Schrodinger equation: a study of the reaction $H^+ + H_2$, $D^+ + HD$, and $D^+ + H_2$. R.Kosloff (Dept. of Phys. Chem., Hebrew Univ., Jerusalem, Israel), D.Kosloff.
J. Chem. Phys. (USA), vol.79, no.4, p.1823-33 (15 Aug. 1983).
A new quantum mechanical time dependent integrator was used in the study of wave packet dynamics on potentials which include a deep well. The purpose of the study was to find the conditions, if any, for complex formation. The integrator, which is stable, conserves energy and norm and was used on the $H^+ + H_2$ system whose classical trajectory had been previously worked out. Almost no complex formation is found for the $H^+ + H_2$ system and its isotopic analogs. For high translational energies there was a good correspondence with the classical trajectory results, while for low translational energies where the classical trajectories become complex, the quantum calculations still show nonstatistical behaviour. For even lower energies, a quantum effect took place leading to zero reactivity. (26 refs.)

103511 Non-nearest neighbor random walks in reaction-diffusion processes. M.K.Musho, J.J.Kozak (Dept. of Chem., Univ. of Notre Dame, Notre Dame, IN, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.1942-7 (15 Aug. 1983).
In the paper, the authors consider reaction-diffusion processes in which it is assumed that a migrating species (A) is subject to an interaction potential and may undertake nonnearest neighbor jumps in its diffusion towards a reaction center (B). For the case that the species A and B react irreversibly upon first encounter, the authors show how the efficiency of the process $A + B \rightarrow C$ is influenced by the nature of the interaction potential [a power law of the form $V(r) = r^{-s}$ with $r > 0$ and $1 \leq s \leq 12$] and the geometry (dimensionality and spatial extent) of the reaction space assumed. Their approach is based on a recently introduced, exact theory of d-dimensional walks on finite and infinite (periodic) lattices with traps and, accordingly, the results presented in the study provide an exact quantitation of the interplay between potential interactions and system geometry for the reaction-diffusion problems considered. The results reported may have considerable relevance to the problems of exciton migration in crystals, photosynthesis, and the surface diffusion of adatoms. (12 refs.)

103512 Effect of atomic spin-orbit state on reactivity: reaction of state-selected $Ca(^3P_j^0)$ with Cl_2. Huoy-Jen Yuh, P.J.Dagdigian (Dept. of Chem., Johns Hopkins Univ., Baltimore, MD, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.2086-8 (15 Aug. 1983).
The authors report a substantial dependence of the chemiluminescence cross sections on reactant atomic spin-orbit state in the $Ca(^3p_j^0) + Cl_2 \rightarrow CaCl + Cl$ reaction, for which the $Ca(4s4p\,^3P^0)$ splitting is small: $E(^3P_2^0\text{-}^3P_1^0) = 106$ and $E(^3P_1\text{-}^3P_0) = 52\ cm^{-1}$. This reaction was chosen for initial study since its large reactive cross section might be expected to minimize scrambling of the spin-orbit states in the entrance channel. (16 refs.)

103513 Why are perturbations of HCl by N_2 and CO so different? II. Matrix isolation experiments. J.Perchard, J.Cipriani, B.Silvi, D.Maillard (Lab. de Spectrochimie Moleculaire, Univ. Pierre et Marie Curie, Paris, France).
J. Mol. Struct. (Netherlands), vol.100, p.317-39 (July 1983).
For pt.I see J. Chem. Phys., vol.67, p.3917 (1977). The infrared and Raman spectra of hydracids (HCl, DCl, $H^{35}Cl$, $D^{35}Cl$, HBr) codeposited with dopants P(Co, ^{13}CO, $^{13}C^{18}O$, N_2) in argon matrices are presented. Studies have been carried out over a wide concentration range for matrix/dopant ratios from 1000 to 10 which, together with H/D isotopic dilutions, allow identification of several $(HX)_m(P)_n$ aggregates (P=Co, N_2) such as $m=1$, $n=1, 2, 3$ (CO case), and $m=2$, $n=1, 2$(CO and N_2 cases). The straightforward identification of the bands assignable to the HCl-CO codimer for six isotopic species allows an accurate force field calculation to be done. For the $(HCl)_2(P)_n$ aggregates, intensity and frequency measurements are used for a comparison between the HCl molecules which are nonequivalent. From the whole data a comparison is drawn between the perturbing power of CO and N_2; this second molecule is a poorer electron donor than CO but is able, however, to destroy the HCl dimer structure. Finally, the relative stability of the various copolymers $(HCl)_m(P_n)$ is discussed using the results of careful diffusion experiments. It is shown that stability generally increases with m and decreases with n. (14 refs.)

103514 Prototropic charge migration in water. I. Rate constants in light and heavy water and in salt solution from oxygen-17 spin relaxation. B.Halle, G.Karlstrom (Dept. of Phys. Chem., Univ. of Lund, Lund, Sweden).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.7, p.1031-46 (July 1983).
Oxygen-17 scalar relaxation data from light and heavy water and from KCl solutions are reported. From the pH dependence of the relaxation, the authors extract the rate constants for proton transfer between H_2O and H_3O^+ (k_+) and between H_2O and OH^- (k_-). In H_2O at 28°C, the authors find $k_+ = (7.1 \pm 0.4) \times 10^9\ dm^3\ mol^{-1}\ s^{-1}$ and $k_- = (3.4 \pm 0.2) \times 10^{-9}\ dm^3\ mol^{-1}\ s^{-1}$. The kinetic H/D isotope effect is 1.6 ± 0.2 for k_+ and 2.7 ± 0.4 for k_-. The $^1H\text{-}^{17}O$ spin-spin coupling constant (J_{OH}) in H_2O, which is needed for the calculation of the rate constants, was redetermined and the authors

obtained $J_{OH}=81.1$ Hz, in good agreement with previous direct measurements but differing from the commonly adopted value. (46 refs.)

103515 Prototropic charge migration in water. II. Interpretation of nuclear magnetic resonance and conductivity data in terms of model mechanisms. B.Halle, G.Karlstrom (Dept. of Phys. Chem., Univ. of Lund, Lund, Sweden).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.7, p.1047-73 (July 1983).
For pt.I see ibid., vol.79, pt.7, p.1031-46 (1983). The mechanism of prototropic charge migration (p.c.m.) in water is investigated theoretically, employing topological concepts as well as continuum theory. A system for classification of p.c.m. models is presented. Two models are explored in detail: a one-step model and a concerted model, both of which include non-Markovian features. The two main sources of experimental data on p.c.m. are (1) nuclear spin relaxation, which monitors proton dynamics, and (2) electric conductivity measurements, which probe charge transport. The complementary nature of the information from the two methods makes it possible to test the consistency of postulated p.c.m. models. However, a number of interpretational problems must first be solved. Thus the authors consider the questions of n.m.r.-inactive proton exchanges and water molecule-prototropic charge reencounters, both of which are crucial for a correct interpretation of n.m.r. data. The interpretation of conductivity data hinges on the separation of the prototropic and the diffusive contributions. The authors argue that these contributions are not independent: there is also a significant contribution from cross correlations. The origin of these cross correlations is the non-equilibrium polarization of the aqueous solvent. Several other consequences for the p.c.m. process of non-equilibrium polarization are discussed. A concerted p.c.m. mechanism requires hydrogen-bonded chains of the appropriate polarity. A topological model is presented and the length distribution of such chains is calculated in terms of this model. (62 refs.)

103516 Classical dynamics of the reaction of $S(^3P)$ $O_2(^3\Sigma_g{}^-)$. J.N.Murrell, W.Craven (School of Chem. & Molecular Sci., Univ. of Sussex, Brighton, England), S.C.Farantos.
Mol. Phys. (GB), vol.49, no.5, p.1077-84 (10 Aug. 1983).
Quasiclassical trajectory calculations have been used to analyse the exchange reaction $S(^3P)$ with $O_2(^3\Sigma_g{}^-)$ using a recently reported potential energy surface for ground state SO_2. The calculated macroscopic rate constants are 1.26×10^{-12} cm^3 molecule^{-1} s^{-1} at 300K and 4.97×10^{-12} cm^3 molecule^{-1} s^{-1} at 450K. These values span the experimental value 2.24×10^{-12} cm^3 molecule^{-1} s^{-1} which was found to be independent of temperature in this range. An alternative method of calculation gives slightly higher values. The finding of a positive activation energy suggests that the potential surface used is imperfect in the long range interaction region. (13 refs.)

103517 Determination of the absolute rate constant for associative ionization in crossed-beam collisions between $Na3^2P_{3/2}$ atoms. R.Bonanno, J.Boulmer, J.Weiner (Dept. of Chem., Univ. of Maryland, College Park, MD, USA).
Phys. Rev. A (USA), vol.28, no.2, p.604-8 (Aug. 1983).
The authors report the determination of the absolute rate constant of $Na_2{}^+$ production by associative ionization collisions between crossed beams of $Na3^2P_{3/2}$ atoms. New measurement techniques greatly improve the accuracy of rate-constant determinations in crossed-beam experiments. They find the rate constant to be $(1.8\pm0.7)\times10^{-11}$ cm^3 sec^{-1}. This value is appreciably larger than many of those previously reported. (14 refs.)

103518 Intermediate product identification for ammonia decomposition at Ni(110). M.Huttinger, J.Kuppers (Inst. fur Phys. Chem., Univ. Munchen, Munchen, Germany).
Surf. Sci. (Netherlands), vol.130, no.1, p.L277-82 (July 1983).
Ammonia decomposition at Ni(110) has been identified to proceed via $NH_3(ad)\rightarrow NH_2(ad)\rightarrow NH(ad)\rightarrow N+H$. The decomposition activation of NH is determined to be 47 kcal/mol, suggesting an amazing stability of the Ni-NH bond. Decomposition of NH_2 occurs up from about 350K; no kinetic data can be given yet. NH_3 decomposition is found to proceed slower than NH_3 desorption at least below 300K. (12 refs.)

103519 Formation of free fluorine atoms by laser-collisional initiation of the CH_3F+F_2 reaction. V.I.Igoshin, S.Yu.Pichugin (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.205-8 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.370-6 (Feb. 1983).
A kinetic model is developed and analyzed numerically for the reaction CH_3F and F_2 initiated by laser radiation in a mixture having a complex component composition typical of a $DF\text{-}CO_2$ chemical laser. It is shown that an appreciable concentration of free F atoms ($\sim10^{16}$ cm^{-3}) may be formed within a fairly short time (~1 μ sec) at moderate laser pulse intensities (~1 MW/cm^2). These results indicate that this reaction is potentially useful for the development of chemical laser amplifiers initiated by infrared radiation. (7 refs.)

103520 Transient conduction with pyrolysis (approximate solutions for charring of wood slabs). A.M.Kanury (Dept. of Aerospace & Mech. Engng., Univ. of Notre Dame, Notre Dame, IN, USA), D.J.Holve.
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.338-43 (May 1982).
The rate of charring of a heated one-dimensional, wood-like solid slab is predicted by solving the transient conduction equation with a phase-change energy sink term. This solution procedure uses an integral method with spatially-linear-temperature profiles. Two types of front-face boundary conditions are considered—prescribed temperature and prescribed heat flux. The back-face is insulated. The prescribed temperature condition leads to the conclusion that for all reasonable exposure temperatures, the slab would only partially char. The maximum char depth is most sensitive to the char conductivity and exposure temperature and less sensitive to the char specific heat and charring endothermicity. Results of the constant flux are in reasonable agreement with the available experimental data both qualitatively and quantitatively. (18 refs.)

Can the H_5 molecule be observed? .... See Entry 100235

An experimental and ab initio study of the addition of atomic carbon to water .... See Entry 100239

Spectroscopic evidence for proton transfer within the bimolecular complex $HI\text{-}NH_3$ trapped in cryogenic matrices .... See Entry 100378

IR spectroscopic study and characterisation of chlorine oxides, $(ClO)_2$, ClO_2, Cl_2O_4 and Cl_2O_3 produced in the chlorine-ozone reactions ..... See Entry 100382

Infrared spectroscopic studies of hydrogen bonding in triethylammonium salts. II. Association of triethylammonium salts with bases .... See Entry 100398

Enthalpies of the association of pentachlorophenol and several carboxylic acids with bases .... See Entry 100400

^{19}F NMR study of direction of opening of epoxide ring in non-catalytic interaction of α-oxides with phenols and alcohols .... See Entry 100427

Kinetics of excited-state proton transfer of doubly protonated 3-aminoacridine .... See Entry 100440

Ultrafast physical effects in cyanine dyes subjected to tunable picosecond excitation .... See Entry 100464

Dissociation dynamics of vibrationally excited van der Waals clusters: $I_2XY\rightarrow I_2X+Y$ (X, Y=He, Ne) .... See Entry 100476

Intramolecular unsymmetrical OHO bonds. Thermochemistry [NMR in acetylacetones] .... See Entry 100497

Metastable decomposition of $Ar_3{}^+$ cluster ions into $Ar_2{}^+$ and Ar^+ .... See Entry 100571

Hydrogen and deuterium atoms, stabilized by condensation of an atomic beam in superfluid helium .... See Entry 100581

Use of the photochromic properties of mercury dithizonate in hydrodynamics .... See Entry 101365

Kinetic studies of the bromine-oxygen system: a new paramagnetic particle, BrO_2 .... See Entry 101382

Response of liquid carbon disulfide to shock compression: equation of state at normal and high densities .... See Entry 101857

Ultrasonic absorption measurements near the critical point of a reactive binary mixture .... See Entry 101863

Transition electron microscopic study of reduced Ca_2UO_5 ..... See Entry 101950

Optical and electron spin resonances studies of copper(II), nickel(II) and oxovanadium(IV) complexes of water-soluble phthalocyanine and porphyrazine chelates absorbed on Sephadex resins, and the effect of added dithionite .... See Entry 102735

Nuclear quadrupolar relaxation and association in liquid In-Sb .... See Entry 102772

On the optical properties of trans-polyacetylene .... See Entry 102865

Synthesis of a new ramsdellite-like phase of approximate composition, $Li_2MgSn_3O_8$ .... See Entry 103045

Reactivity in the spinel formation reaction in CuO/Al_2O_3, Fe_2O_3, Cr_2O_3 systems. [Influence of Jahn-Teller effect] .... See Entry 103491

Orthogonal collocation for the analysis of immobilized enzyme systems .... See Entry 103492

Chemiluminescent reaction between alkali dimers and oxygen molecules .... See Entry 103532

Quantum-chemical model for the photoisomerization of protonated Schiff bases of formaldehyde and acrolein .... See Entry 103542

A pulse radiolysis study of the formation of the XeBr exciplex in electron beam irradiated xenon-bromine mixtures .... See Entry 103544

Kinetic models for stilbene photoisomerisation: comparison of theory and experiments .... See Entry 103547

High vibrational overtone photochemistry of cyclobutene .... See Entry 103548

Concerning a decrease in penetration by oxygen of polymer layers with azides during irradiation with light .... See Entry 103561

Lattice model for nonrandom pairing and the determination of 'sociation' constants of organic complexes .... See Entry 103575

Molecular structure of liquid alcohols .... See Entry 103577

The CdS-$CuInSe_2$ solar cell interface: thermodynamic considerations .... See Entry 103696

Thermal efficiency of the magnesium-iodine cycle for thermochemical hydrogen production .... See Entry 103732

Production of hydrogen by direct thermal decomposition of water .... See Entry 103735

Aqueous oxidation of SO_2 by hydrogen peroxide .... See Entry 104475

82.35 POLYMER REACTIONS AND POLYMERIZATION

103521 Exact correspondence between equilibrium polymerization and multispin Ising models. M.V.Jaric (Phys. Dept., Montana State Univ., Bozeman, MT, USA).
Phys. Rev. A (USA), vol.28, no.2, p.1179-81 (Aug. 1983).
Exact and explicit formulas relating equilibrium polymerization (with excluded volume and polymer rings) and Ising models with even multispin interactions in any dimension are given. It is concluded that equilibrium polymerization either belongs to the Ising universality class or is a first-order transition. Numerical, mean-field evaluations disfavor the latter. (17 refs.)

103522 Long-lived polymer radicals. V. Synthesis of block copolymer by the reaction of living poly(*N*-phenylmethacrylamide) radical with vinyl monomers. T.Sato, Y.Yutani, T.Otsu (Dept. of Appl. Chem., Osaka City Univ., Osaka, Japan).
Polymer (GB), vol.24, no.8, p.1023-30 (Aug. 1983).
When *N*-phenylmethacrylamide (MPMAm) was photopolymerized at room temperature in benzene by using di-*tert*-butyl peroxide as sensitizer, the resulting heterogeneous polymerization mixture was found to contain very stable propagating poly (NPMAm) radical. An ESR study revealed that the living polymer radical reacted easily at room temperature with methyl methacrylate (MMA) yielding persistent poly(MMA) radical. Block copolymer was prepared by the reaction of living poly(NPMAm) radical with MMA and methyl acrylate. Block copolymer constituted 30-60% of the resultant total polymer. Block copolymer was characterized by GPC IR spectroscopy and electron microscopy. (24 refs.)

103523 Polymerization resulting from ultrasonic cavitation. P.Kruus (Dept. of Chem., Carleton Univ., Ottawa, Canada).
Ultrasonics (GB), vol.21, no.5, p.201-4 (Sept. 1983).
Polymerization due to ultrasonically induced cavitation is reported for a number of compounds: bromobenzene, styrene, isoprene, and methyl methacrylate. The molecular weight of the polymethylmethacrylate produced through ultrasound is considerably lower than that due to normal aging. The bromobenzene and styrene products are dark friable solids. The isoprene product has an ultra-violet absorption suggesting a conjugated system of about ten carbon-carbon bonds in length. (12 refs.)

The one-dimensional $n\rightarrow0$ vector model and the helix-coil transition .... See Entry 100613

Influence of molar mass and catalysts on the kinetics of crystallization and on the orientation of poly(ethylene terephthalate) .... See Entry 101596

Electrical conductivity of doped poly(1-methyl 2,5-pyrrolylene) .... See Entry 102368

A ^{13}C-NMR study of the microstructure of polyphenylacetylenes prepared with $MoCl_5$ and WCl_6 .... See Entry 102761

^{13}C-NMR studies of thermally isomerized polyphenylacetylenes prepared with $MoCl_5$ and WCl_6 catalysts .... See Entry 102762

Thin films prepared by plasma polymerization of methyl-methacrylate and their properties as an electron beam resist .... See Entry 103077

Polyisobutylene model elastomers prepared using demonstrably complete end-linking reactions. I. Elongation moduli of the trifunctional and tetrafunctional networks prepared from the linear polymers .... See Entry 103198

Relationship between polymerization conditions and rheological properties for styrene-acrylonitrile copolymers .... See Entry 103201

Resonance Raman spectra of benzene adsorbed on Cu^{2+}-montmorillonite. Formation of poly(*p*-phenylene) cations in the interlayer of the clay mineral .... See Entry 103581

Existence and properties of post-gel solutions for the kinetic equations of coagulation .... See Entry 103599

Coagulation equations with gelation .... See Entry 103601

82.40 CHEMICAL KINETICS AND REACTIONS: SPECIAL REGIMES

103524 Boron particle ignition in a restricted thermodynamical equilibrium. D.Meinkohn, J.W.Bergmann (DFVLR, Hardthausen, Germany).
AIAA J. (USA), vol.21, no.7, p.1006-7 (July 1983).
Published experimental evidence leads to the conclusion that a certain particle temperature is the most important prerequisite for boron particle ignition. For particle heating, a model concept of a hybrid gas generator is chosen. The resulting thermal state of the boron particles is characterized by a T^* temperature which is derived for a restricted thermodynamical equilibrium defined by the suppression of chemical contact between the reacting substances of the gas generator and the boron fuel, which is set to be in thermal contact only. A temperature diagram is derived with the help of an existing computer program for thermochemical calculations, in which the ignition readiness of the boron fuel is displayed in terms of a T^* temperature depending on a varied fraction of the boron fuel, which is set to be combusted in the primary process in order to achieve the temperature necessary for ignition of the remainder of the boron. (3 refs.)

103525 Application of fast infrared detectors to detonation science. W.G.Von Holle, R.A.McWilliams (Chem. & Materials Sci. Dept., Univ. of California, Livermore, CA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.366, p.19-26 (1983). (Modern Utilization of Infrared Technology VIII, San Diego, CA, USA, 26-27 Aug. 1982).
Infrared radiometers have been used to make time-resolved emission measurements of shocked explosives. Instruments of moderate time resolution were used to estimate temperatures in shocked but not detonated explosives. The heterogeneity of the shock-induced heating was discovered in pressed explosives by two-band techniques, and the time-resolved emittance or extent of hot spot coverage indicated a great dependence on shock pressures. Temperatures in moderately shocked organic liquids were also measured. Faster response radiometers with 5 ns rise times based on InSb and HgCdTe photovoltaic detectors were constructed and tested. Preliminary data on reactive shocks and detonations reveals a resolution of the heating in the shock wave and the following reaction. (15 refs.)

103526 Influence of turbulence on the formation of high nonequilibrium concentrations of atoms and free radicals in diffusion flames. V.R.Kuznetsov.
Fluid Dyn. (USA), vol.17, no.6, p.815-20 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.6, p.3-9 (Nov.-Dec. 1982).
In the description of chemical reactions between previously unmixed reacting substances, it is frequently assumed that the reaction rate is very large, so that thermodynamic equilibrium is realized at every point of the flow. This assumption makes it possible to reduce the solution of the problem to the description of the concentration field of the inert (not reacting) component. In a number of cases an assumption is inadequate, as small deviations from equilibrium in the temperatures and concentrations of the main combustion products lead to a large change in the concentrations of the free atoms and radicals. Similar problems arise in the analysis of the ignition of fuel by a jet of combustion products. The list of such examples can be extended. Since reactions in a turbulent flow have the main interest, it is natural to consider how the characteristics of turbulence influence the deviations from thermodynamic equilibrium. The present paper is devoted to examination of this question. (7 refs.)

103527 Picosecond laser-spectroscopy measurement of hydroxyl fluorescence lifetime in flames. N.S.Bergano, P.A.Jaanimagi, M.M.Salour (Computer Sci. Dept., MIT, Cambridge, MA, USA), J.H.Bechtel.
Opt. Lett. (USA), vol.8, no.8, p.443-5 (Aug. 1983).
Data are reported for the first known application of picosecond laser spectroscopy to the measurement of collisional quenching rates by time-resolved laser-induced fluorescence in flames. Collisional quenching rates are important for the determination of species concentrations by laser-induced fluorescence. The collisional quenching lifetime following excitation of the $R_2(4)$ $A^2\Sigma^+$ $(\nu'=0)\leftarrow X^2\Pi$ $(\nu''=0)$ transition was measured to be 1.8 nsec in the burned-gas region of an atmospheric-pressure, premixed methane-air flame. (17 refs.)

103528 A theoretical study of ignition in the laminar mixing layer. C.K.Law, H.K.Law (Dept. of Mech. & Nuclear Engng., Northwestern Univ., Evanston, IL, USA).
Trans. ASME. J. Heat Transfer (USA), vol.104, no.2, p.329-37 (May 1982).
The structure of the weakly reactive states leading to ignition in the laminar mixing layer flow is studied both analytically and numerically. It is shown that the flow consists of a reactive region and a self-similar frozen region separated by a transitional, nonsimilar frozen region, that the reactive region is intrinsically nonsimilar because of its excessively slow diffusion rate, and that the ignition characteristics are primarily governed by the velocity of the hot stream and therefore minimally dependent on the velocity distribution. Fundamental functional groups are identified, and an explicit prescription is presented, for large activation energy reactions, for the evaluation of the minimum stream-wise distance to achieved ignition. (10 refs.)

103529 The acceleration of fast deflagration waves. D.S.Stewart, G.S.S.Ludford (Dept. of Theoretical & Appl. Mech., Talbot Lab., Univ. of Illinois, Urbana, IL, USA).
Z. Angew. Math. & Mech. (Germany), vol.63, no.7, p.291-302 (1983).
Stewart and Ludford gave a theory of steady deflagration waves based on an ignition-temperature model obtained from Arrhenius kinetics. They were able to describe analytically the structure of deflagration waves for the entire range of wave speeds between zero and the maximum (Chapman-Jouget) value. In this paper the authors construct a quasi-steady theory of flame acceleration based on that work, which can predict the acceleration response of a preexisting flame to quite arbitrary hydrodynamic disturbances in the limit of small heat release during the combustion. Explicit formulas and criteria are developed. In particular, they find that an unsteady deflagration wave can travel at speeds in excess of the Chapman-Jouget value, and even at arbitrarily large supersonic values. (7 refs.)

103530 Design of a microcomputer-based data acquisition system for pulse combustion research. G.Border, D.Border (Digital Automation Associates Inc., Bowling Green, OH, USA), W.H.Thrasher.
23rd Midwest Symposium on Circuits and Systems, Toledo, OH, USA, 4-5 Aug. 1980 (North Hollywood, CA, USA: Western Periodicals 1980), p.132-6
Pulse combustion technology appears to offer the potential for significant fuel savings in residential heating systems. Utilizing natural gas as a fuel, the pulse combustion furnace replaces a conventional upflow furnace with dramatically improved efficiency. Long-term field studies of pulse combustion furnace operation are made particularly difficult, however, by the relatively sophisticated nature of the furnace control system. This paper details the development of a portable microcomputer-based data acquisition system for use in a pulse combustion research program. This system was used for dedicated and extended monitoring of pilot pulse combustion furnace installations across the North American Continent during the winter of 1979-80. Operating unattended for days and even weeks, the system recorded key operating parameters on industry-standard media for later analysis on larger laboratory-based computer systems. (6 refs.)

The inhabitants of the Earth are always burning things .... See Entry 98713

Hydrogen as the source of energy in internal combustion engines .... See Entry 103731

Large-scale explosion in the inhomogeneous atmosphere of the Earth with allowance for spectral radiation .... See Entry 104817

82.40D Atomic and molecular beam reactions

(see also 34.50L Chemical reactions as studied by atomic and molecular beams)

Chemiluminescent reaction between alkali dimers and oxygen molecules .... See Entry 103532

82.40T Chemiluminescence and chemical laser kinetics

(see also 42.55K Chemical lasers, 78.60P Chemiluminescence)

103531 An experimental apparatus for chemiluminescence and its characteristics. H.Inouye, T.Ishikawa, H.Sasaki (Res. Inst. for Sci. Measurements, Tohoku Univ., Sendai, Japan).
Bull. Res. Inst. Sci. Meas. Tohoku Univ. (Japan), vol.31, no.2-3, p.121-47 (1982). In Japanese.
An experimental apparatus on the basis of a beam-cell method was set up for studying chemiluminescence in ion-molecule collisions. Preliminary experiments on chemiluminescent reactions for C^{2+}-H_2, N^+-CO, and O^+-C_2H_2 systems revealed as an excellent performance ability of the apparatus. Characteristics of some ion beams produced in this apparatus are described in full detail. (10 refs.)

103532 Chemiluminescent reaction between alkali dimers and oxygen molecules. H.Figger, W.Schrepp, Xu-hui Zhu (Max-Planck-Inst. fur Quantenoptik, Garching, Germany).
J. Chem. Phys. (USA), vol.79, no.3, p.1320-5 (1 Aug. 1983).
The reaction of alkali dimers with oxygen molecules was studied in a crossed-beam experiment. Weak luminescence from the crossing zone was observed. It was found that it was predominantly emitted by the electronically excited products of the reactions $M_2+O_2\rightarrow MO_2+M^*$ and $M_2+O_2\rightarrow MO_2^*+M$ (*=electronic excitation). Lower limits for the dissociation energies between M and O_2 in the product molecules were derived from the cut-off wavelengths of the continuous chemiluminescence spectra observed. They are found to be consistent with the values calculated using an ionic model for the product molecule MO_2. (29 refs.)

103533 Visible chemiluminescence from the high-pressure reactions of F atoms with CH_3I and CH_2I_2. H.S.Braynis, J.C.Whitehead (Dept. of Chem., Univ. of Manchester, Manchester, England).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.7, p.1113-21 (July 1983).
Visible chemiluminescence in the region 400-890 nm was measured from the high-pressure (*ca.* 0.4 mbar) reactions of F atoms with CH_3I and CH_2I_2. Emission was observed from electronically excited $IF^*(B)$, $HCF^*(\tilde{A})$ and $CH^*(A)$ and from vibrationally excited $HF^{\ddagger}(X)$. There are essentially no differences in the observed chemiluminescence spectra from the two reactions and no major dependence on the source of F atoms (discharge of F_2+He or CF_4). A possible mechanism for the formation of IF* involves the intermediate species CH_3IF or CH_2I_2F. It is suggested that HCF*, CH* and $HF^{\ddagger}$ may be formed by the reactions of F or F_2 with CH or CH_2 and such a mechanism may be applicable to all high-pressure fluorine reactions with substituted methanes. Some studies of chemiluminescence in other high-pressure systems ($F+CH_3Br$, CH_3OH, ICl and HI) are also reported. (29 refs.)

Scattering of light and acoustic disturbances in the atomic iodine laser .... See Entry 100818

Effect of atomic spin-orbit state on reactivity: reaction of state-selected $Ca(^3P_j^0)$ with Cl_2 .... See Entry 103512

Formation of free fluorine atoms by laser-collisional initiation of the CH_3F+F_2 reaction .... See Entry 103519

Determination of picosecond relaxation times of bleachable dyes by the method of cross polarizers .... See Entry 103557

Chemiluminescence in autocatalytic thermal oxidation of polymers .... See Entry 103586

82.45 ELECTROCHEMISTRY AND ELECTROPHORESIS

(see also 66.10 Ionic conduction in liquids; for electro-osmosis, see 82.65)

103534 The potential of zero charge of oriented single-crystal RuO_2 in aqueous electrolytes. M.Tomkiewicz, Y.S.Huang, F.H.Pollak (Dept. of Phys., Brooklyn Coll., City Univ. of New York, New York, NY, USA).
J. Electrochem. Soc. (USA), vol.130, no.7, p.1514-18 (July 1983).
The impedance of 5 virgin faces of single crystal RuO_2 was measured over the frequency range of 1-10^6 Hz, in three electrolytes-10^{-3}M and 1M

Na_2SO_4 and 10^{-3}M KF. The fastest relaxing capacitive element was identified, and its values measured as a function of the electrode potential. A major contribution to this capacitance is due to the double layer capacitance. The potential of zero charge in 10^{-3}M Na_2SO_4 was measured for the five crystalline faces. The variations of the potential of zero charge with the crystalline faces are small. 'Average' value is ($\sim 0.09 \pm 0.1$) V vs. SCE. The potential of zero charge correlates well with the reported work functions of RuO_2 and Ru metal. (27 refs.)

103535 Silver sulfide based glasses. II. Electrochemical properties of GeS_2-Ag_2S-AgI glasses: transference number measurement and redox stabiity range. E.Robinel, A.Kone, M.J.Duclot, J.L.Souquet (Lab. d'Energetique Electrochimique, Saint Martin d'Heres, France).
J. Non-Cryst. Solids (Netherlands), vol.57, no.1, p.59-70 (Aug. 1983).
For pt.I see ibid., vol.57, p.49 (1983). The transference numbers of the species responsible for current transport in GeS_2-Ag_2S-AgI glasses, have been determined. Tubandt's method shows that the transference number of the Ag cation is equal to 1 (to within 2%). By electrochemical semipermeability flux measurement, the electronic transference number was estimated to be less than 10^{-8}, and by triangular voltammetry, the transference number of the iodide anion at approximately 10^{-5}. Triangular voltammetry can also be used to measure the redox stability range, which is about 3 V for current densities of 0.1 mA/cm^2. This high value is due to the low mobility of the anions below the glass transition temperature. (21 refs.)

103536 Synthesis of reduced complex oxides of molybdenum by fused salt electrolysis. W.H.McCarroll, C.Darling, G.Jakubicki (Chem. Dept., Rider Coll., Lawrenceville, NJ, USA).
J. Solid State Chem. (USA), vol.48, no.2, p.189-95 (1 July 1983).
Fused salt electrolysis has been used to prepare a number of reduced oxides of molybdenum with lanthanum, neodymium, and yttrium in single crystal or oriented polycrystalline form. The average valence of molybdenum in the various compounds ranged from 5.67 to 3.50. Previously unreported compounds include $La_5Mo_4O_{16}$ (triclinic a=5.64 Å, b=20.70 Å, c=5.64 Å, α=86.55°, β=90.0°, γ=93.45°); $La_2Mo_2O_7$ (orthorhombic, a=12.19 Å, b=6.05 Å, c=3.87 Å); $LaMo_2O_5$ (hexagonal, a=8.378 Å, c=19.26 Å). In addition, single crystal specimens have been prepared of Y_2MoO_5, $Ln_5Mo_3O_{16}$ (Ln=La, Nd) and metal atom cluster compounds of the $A_2Mo_3O_8$ type (A=Mg, Co, Ni, Zn). (28 refs.)

103537 A mathematical model of isotachophoresis. M.Yu.Zhukov, V.I.Yudovich (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.918-20 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.334-8 (Nov. 1982).
A mathematical model of isotachophoresis, used to separate a mixture of electrolytes by an electric field is constructed. In the diffusionless approximation the model is reduced to a system of quasilinear equations of the hyperbolic type. A generalized solution of the Cauchy problem for an arbitrary piecewise-constant distribution of electrolyte concentrations is investigated by the methods of Rozhdestvenskii and Yanenko (1978). It is shown that the well known Kohlrausch relations for the concentrations of neighboring zones, which lie at the foundation of the stationary theory of isotachophoresis, are a consequence of the Hugoniot conditions at discontinuities. The results obtained agree well with experiment. (8 refs.)

103538 Investigation of the relationship between the nature of an organic compound and its adsorbability on platinum. Influence of the potential of the platinum electrode on the mechanism of the adsorption and reduction of aromatic nitro compounds. N.V.Andreev, G.Horanyi, V.E.Kazarinov (Central Res. Inst. of Chem., Acad. of Sci., Budapest, Hungary).
Sov. Electrochem. (USA), vol.18, no.10, p.1160-6 (Oct. 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.10, p.1305-11 (Oct. 1982).
With the aid of the combined use of radioisotopic and electrochemical methods it has been shown that in the case of the reduction of aromatic nitro compounds, either the nitro group or the nitro group and the aromatic ring in the organic compound undergoes reduction, depending on the electrode potential. (9 refs.)

103539 Electric conductivity of ammonium-selective membranes containing neutral complex formers. N.V.Rozhdestvenskaya, O.K.Stefanova (A.A. Zhdanov Leningrad State Univ., Leningrad, USSR).
Sov. Electrochem. (USA), vol.18, no.10, p.1226-32 (Oct. 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.10, p.1379-85 (Oct. 1982).
Data are cited on the electric conductivity of ammonium-selective membranes containing neutral complex formers, as well as on the dynamics of the change in this quantity during contact of the membranes with aqueous solutions of NH_4Cl. The principles detected are explained on the basis of concepts of the formation of a dispersed aqueous phase in the membrane. (8 refs.)

103540 Temperature dependence of adsorption on mercury in the carboxylic acid series. F.I.Danilov, S.A.Panasenko, I.G.Shatukhin (F.E. Dzerzhinskii Chem. Engng. Inst., Dnepropetrovsk, USSR).
Sov. Electrochem. (USA), vol.18, no.10, p.1266-9 (Oct. 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.10, p.1420-3 (Oct. 1982).
The authors studied the effect of temperature (293 to 313±0.1K) on the adsorption of valeric, caproic, caprylic, and isovaleric (t-butanecarboxylic) acid on the DME from 0.8 N Na_2SO_4+0.2 N H_2SO_4 as an electrolyte, so as to extend knowledge of values of thermodynamic adsorption parameters and to elucidate the possible nature of attractive interaction. (7 refs.)

Kinetic description of Debye effect .... See Entry 101521

Composition of the general formula $Na_xLn_{1/3}Nb_{1-x}Ti_xO_3(0 \leq x \leq 2/3)$. Correlation between structural evolution and photoelectric properties .... See Entry 101672

The influence of growth conditions on sulfur incorporation in GaAs grown by molecular beam epitaxy .... See Entry 101727

An investigation into individual activity coefficient in electrolyte solution. II. The evaluation of individual ionic activity coefficient in mixed electrolyte solution .... See Entry 102003

Charge transport at mid-gap in trans-$(CH)_x$: An electrochemical study .... See Entry 102392

Effect of hydrogen pressure on the nature of the conductivity of solid lithium hydride .... See Entry 102471

Comparison of photoelectrochemical properties of n-TiO_2 films obtained by different production methods .... See Entry 102506

Photo- and electroluminescence spectra from an n-TiO_2 semiconductor electrode as related to the intermediates of the photooxidation reaction of water .... See Entry 102961

The electro- and photoluminescence spectra of oxide films formed during anodic oxidation of zinc .... See Entry 102963

Importance of hydrogen evolution in the development of structural imperfections during nickel electrocrystallisation .... See Entry 103082

Investigation of the mechanism of the inhibiting action of cinnamaldehyde in the electrodeposition of a tin-bismuth alloy .... See Entry 103083

Electrochemically prepared polythienylene films .... See Entry 103084

Distribution of elements according to the thickness of anodic oxide films on gallium arsenide .... See Entry 103362

Influence of an oxide film on the anodic anionic activation of metals .... See Entry 103396

Chromium passivity. Effect of potential and pH on passive film thickness .... See Entry 103397

Chromium passivity. Presence of Cr(VI) in the passive film ... See Entry 103398

The preparation and selected properties of Mg-doped p-type iron oxide as a photocathode for the photoelectrolysis of water using visible light .... See Entry 103567

Thermodynamics of unsymmetrical electrolyte mixtures. Enthalpy and heat capacity .... See Entry 103572

Thermodynamics of the unsymmetrical mixed electrolyte HCl-$LaCl_3$ .... See Entry 103573

Surface enhanced Raman spectra of benzotriazole adsorbed on a copper electrode .... See Entry 103583

Adsorption and oxidation of simple organic compounds on platinum electrodes .... See Entry 103589

Determination of adsorption parameters of two-dimensional condensed layers of organic compounds from experimental C vs. E curves .... See Entry 103607

Solid electrolyte interphase (SEI) electrodes VI: calcium-Ca$(AlCl_4)_2$-sulfuryl chloride system .... See Entry 103666

On the suppression of self discharge of the zinc electrodes of zinc-air cells and other related battery systems .... See Entry 103668

Study of a lithium-lithium propionate electrode in propylene carbonate .... See Entry 103676

Accelerated cycle life testing of lead-acid golf car batteries and the influence of separator type on battery life, energy consumption and operating cost .... See Entry 103677

Computer-controlled multiple-channel system for electrochemical experiments .... See Entry 103678

Structural effect of the zinc electrode on its discharge performance .... See Entry 103679

Low cost process for ohmic contacts on GaAs/$Ga_{1-x}Al_xAs$ concentrator solar cells based on palladium and gold deposition .... See Entry 103697

Photoelectrochemical solar cells: temperature control by cell design and its effects on the performance of cadmium chalcogenide-polysulphide systems .... See Entry 103702

Design studies of the sulfur trioxide decomposition reactor for the Sulfur Cycle hydrogen production process .... See Entry 103734

82.50 PHOTOCHEMISTRY AND RADIATION CHEMISTRY

(see also 33.50 Fluorescence, phosphorescence; radiationless transitions)

103541 Solvent structure effects on electron thermalization ranges in water-alcohol mixed solvents; preferred E_{Amax} values for $e^-{}_s$ in alchols. A.-D.Leu, K.N.Jha, G.R.Freeman (Chem. Dept., Univ. of Alberta, Edmonton, Alberta, Canada).
Can. J. Chem. (Canada), vol.61, no.6, p.1115-19 (June 1983).
Addition of 2 mol.% of an alcohol to water or of 1 mol.% of water to an alcohol increases the value of $G_{fi}\varepsilon_{max}(e^-{}_s)$ above that in the pure solvent. The effect is attributed mainly to an increasing free ion yield G_{fi}. The increase of G_{fi} correlates with a 'stiffening' of the solvent molecular rotational motions and a corresponding lower rate of energy loss by the epithermal electrons to dipole rotations. Thus the increase of G_{fi} is mainly attributed to a larger electron thermalization range b_{GP}. The value of $G_{fi}\varepsilon_{max}$ passes through a maximum at 2 mol.% of an alcohol in water; the maximum increases in the order methanol<ethanol<1-propanol as additive. The solvent 'stiffening' effect of these solutes increases in the same order. Some of the published values of E_{Amax} and $W_{1/2}$ for solvated electrons in alcohols appear to be too low. A set of preferred values is reported. (41 refs.)

103542 Quantum-chemical model for the photoisomerization of protonated Schiff bases of formaldehyde and acrolein. F.Dietz, A.Tadjer, N.Tyutyulkov (Section of Chem., Karl-Marx Univ., Leipzig, Germany).
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.120-1 (29 July 1983).
By means of potential energy curves in the excited states the authors discuss the mechanism of trans-cis isomerization of protonated imine and enimine. For the higher homologues isomerization about the C=N bond is highly improbable. (11 refs.)

103543 Quantum interference in the IR-multiphoton excitation of small asymmetric-top molecules: ozone. M.Quack, E.Sutcliffe (Lab. fur Phys. Chem., ETH Zurich, Zurich, Switzerland).
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.167-72 (29 July 1983).
Quantum dynamical calculations for the IR-multiphoton excitation and dissociation of ozone are presented using realistic rovibrational spectral structures from recent high-resolution spectroscopic studies. The time-dependent level populations, the frequency-dependent excitation and the intensity dependence of the rate coefficient, for IR-photochemical reaction are discussed in terms of quantum interference effects. (30 refs.)

103544 A pulse radiolysis study of the formation of the XeBr exciplex in electron beam irradiated xenon-bromine mixtures. R.Cooper, W.A.Mulac (Chem. Div., Argonne Nat. Lab., Argonne, IL, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.3, p.217-20 (5 Aug. 1983).
Nanosecond pulse radiolysis studies of xenon-bromine mixtures reveals that (XeBr)* emission is produced by two distinct processes. At very low electron beam intensities one process (ion recombination) is slowed down sufficiently to permit unambiguous kinetic analysis of the second process (energy transfer from xenon excited states to Br_2). (3 refs.)

103545 Tritium separation by laser multiple-photon dissociation of $CDTCl_2/CD_2Cl_2$ mixture. A.Yokoyama, K.Suzuki, G.Fujisawa, N.Ishikawa, M.Iwasaki (Div. of Chem., JAERI, Ibaraki, Japan).
Chem. Phys. Lett. (Netherlands), vol.99, no.3, p.221-4 (5 Aug. 1983).
Selective multiple-photon dissociation of $CDTCl_2$ in CD_2Cl_2 was studied using a TEA CO_2 laser. The dissociation rate of $CDTCl_2$ had a maximum value at 927 cm^{-1} (P(38) line) irradiation. The frequency agreed with the calculated ν_7 vibrational frequency (929 cm^{-1}) of $CDTCl_2$ within the accuracy of the

calculation. The tritium enrichment factor β_{prod} was obtained to be 29_{-15}^{+156} at 3 Torr total pressure and at 907.8 cm^{-1} irradiation. (15 refs.)

103546 Classical trajectory study of the effects of parent-molecule bending and overall rotation in polyatomic direct photofragmentation. Model $ICN+h\nu \rightarrow CN+I$. M.D.Pattengill (Dept. of Chem., Univ. of Kentucky, Lexington, KY, USA).
Chem. Phys. (Netherlands), vol.78, no.2, p.229-33 (15 July 1983).
The classical trajectory method has been used to investigate the effects of parent-molecule bending and overall rotation on product state attributes in the direct photofragmentation of model ICN. Comparisons with previous collinear, rotationless studies indicate that product CN vibrational distribution can be profoundly affected by permitting ICN to bend. Inclusions of ICN overall rotation (in addition to bending) produces CN vibrational distributions essentially identical to those obtained with the inclusion of bending alone. Rotational distributions (for individual CN product vibrational states) indicate substantial CN rotational excitation. As in the case of the vibrational distributions, addition of overall rotation to ICN bending produces little, if any, effect. Additionally, for the energy range investigated, the CN product rotational distributions show no marked qualitative energy dependence. (7 refs.)

103547 Kinetic models for stilbene photoisomerisation: comparison of theory and experiments. B.M.Ladanyi (Dept. of Chem., Colorado State Univ., Fort Collins, CO, USA), G.T.Evans.
J. Chem. Phys. (USA), vol.79, no.2, p.944-52 (15 July 1983).
Torsional correlation times for trans to cis isomerisation of stilbene in solution are calculated using Fokker-Planck and diffusional models for the barrier crossing process. Hydrodynamic interactions and the solvent-dependent potential of mean force are incorporated into the calculations. Both convective effects and hydrodynamic interactions are found to have a significant impact on the isomerisation rate of stilbene in alkane solvents near room temperature. It is found that the potential barrier between the trans and 90° states definitely has to be below 1200 cm^{-1}, the latest experimental value of this quantity, in order to explain the observed photoisomerisation rate. The dependence of the rate on friction is calculated and various improvements to the authors' model and their relative importance are discussed. (43 refs.)

103548 High vibrational overtone photochemistry of cyclobutene. J.M.Jasinski, J.K.Frisoli, C.B.Moore (Dept. of Chem., Univ. of California, Berkeley, CA, USA).
J. Chem. Phys. (USA), vol.79, no.3, p.1312-19 (1 Aug. 1983).
Direct single-photon excitation of high CH stretching overtone transitions has been used to induce the isomerization of cyclobutene to 1,3-butadiene. Values of the unimolecular isomerization rate constant $k(E)$ have been measured as a function of energy and overtone transition by studying the pressure dependence of the photoisomerization rate constant. The values of $k(E)$ depend on the total energy and do not show any observable dependence on the type of CH overtone transition excited. The values of $k(E)$ are in reasonable quantitative agreement with RRKM calculations. (31 refs.)

103549 Nonequilibrated energy distribution in polyatomic molecules: the infrared MPD of cyclobutanone. P.John, M.R.Humphries (Dept. of Chem., Heriot-Watt Univ., Edinburgh, Scotland), R.G.Harrison, P.G.Harper.
J. Chem. Phys. (USA), vol.79, no.3, p.1353-9 (1 Aug. 1983).
The TEA CO_2 infrared MPD of cyclobutanone, on irradiation of the ν_{24} fundamental mode, has been investigated as a function of incident fluence F_i, wavelength and pressure. Dissociation proceeds via two molecular routes; the first yields ethylene plus ketene CH_2CO, and the second cyclopropane and CO plus minor amounts of propylene. The branching ratio $R \equiv [C_2H_4]/[C_3H_6]$ increases dramatically at pressures less than ~3 Torr from the high pressure thermal limit. This nonthermal feature is most pronounced at low F_i. The average number of quanta absorbed per molecule $\langle n \rangle$, measured by pyroelectric and optoacoustic detection, is independent of cyclobutanone pressure between 0.1 and 10.0 Torr. $\langle n \rangle$ varies linearly with F_i in the range investigated 0.2-2.0 J cm^{-2}. An explicit formulation of the infrared MPD process is presented based on a truncated s-fold degenerate harmonic oscillator approach. Vibrational energy transfer is incorporated via v-v bimolecular collisions. The predicted dependence of R on pressure is in good agreement with the experimental data presented herein. Moreover, the observed linear dependence of $\langle n \rangle$ with F_i, and its independence with respect of pressure, is also borne out by this theory. (26 refs.)

103550 Photofragment spectroscopy and dynamics of the visible photodissociation of ozone. D.S.Moore, D.S.Bomse, J.J.Valentini (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.1745-57 (15 Aug. 1983).
The authors report collision-free coherent anti-Stokes Raman scattering (CARS) spectra of the O_2 fragment formed in the photodissociation of ozone at 532 and 578 nm. From these spectra they have extracted the nascent electronic, vibrational, rotational, and translational energy distributions of the photofragments. The O_2 fragment is produced only in the ground ${}^1\Sigma_g{}^-$ electronic state, even though the ${}^1\Delta_g$ excited state is energetically allowed. High ($J \approx 23$ to 51) rotational states in the first five vibrational levels of $O_2({}^3\Sigma_g{}^-)$ are populated in the photodissociation. For both photolysis wavelengths most of the available energy, 65%-67%, appears in translation, while 15%-18% is in rotation, and 17%-18% is in vibration. These energy distributions are discussed in terms of simple models of the dissociation dynamics. (44 refs.)

103551 Infrared laser multiple-photon dissociation of $CDCl_3$ in a molecular beam. I.P.Herman, F.Magnotta (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA), R.J.Buss, Y.T.Lee.
J. Chem. Phys. (USA), vol.79, no.4, p.1789-94 (15 Aug. 1983).
Pulsed CO_2 laser multiple-photon dissociation of $CDCl_3$ was examined in a molecular beam using 11 μ radiation. The only observed dissociation channel was hydrogen chloride elimination (>99.1%), with no evidence of simple chlorine atom cleavage (<0.9%). Implications for isotope separation are discussed. (23 refs.)

103552 Magnetic field effects on photosensitized electron transfer reactions in the presence of TiO_2 and CdS loaded particles. J.Kiwi (Inst. de Chimie Phys., Ecole Polytech. Federale, Lausanne, Switzerland).
J. Phys. Chem. (USA), vol.87, no.13, p.2274-6 (23 June 1983).
Magnetic fields have a pronounced effect on a wide variety of reactions under UV and visible light leading to H_2 production from water. Application of moderate magnetic fields leads to a variation of the fraction of radicals that interact with a heterogeneous catalyst. The rate of chemical reaction depends on the strength of a steady magnetic field and is observable only under specific conditions. (22 refs.)

103553 Steady-state kinetic studies on the exciplex formation between indoles and n-butyl alcohol. T.Tamaki (Res. Inst. for Polymers & Textiles, Ibaraki, Japan).
J. Phys. Chem. (USA), vol.87, no.13, p.2383-6 (23 June 1983).
The changes in the steady-state-fluorescence intensities of indole (IND) and 3-methylindole (3-MeI) as a function of n-butyl alcohol (BuOH) concentration ($<5 \times 10^{-2}$ M) are subjected to kinetic analysis by computer simulation with the kinetic scheme describing stepwise photoassociation of exciplex partners upi to a 1:2 stoichiometry. The simulation is gratifying for indole as well as for 3-methylindole. Except for the stability of a 1:1 complex, the kinetic behavior of specific interaction of indole with n-butyl alcohol is similar to that for 3-methylindole. The increased stability of the 1:1 complex of 3-methylindole is explained in terms of an increase in the excited state basicity at C-3 of this compound. (19 refs.)

103554 A comparison of the carbon-13 hyperfine constants of carboxylated cyclohexadienyl and hydroxycyclohexadienyl radicals. R.N.Sangster, K.P.Madden, R.H.Schuler (Dept. of Chem., Univ. of Notre Dame, Notre Dame, IN, USA).
J. Phys. Chem. (USA), vol.87, no.13, p.2395-8 (23 June 1983).
${}^{13}C$ ESR spectra of the H atom adducts to pyromellitic and benzenepentacarboxylic acids have been observed. Comparison of the ${}^{13}C$ hyperfine constants with those previously obtained for the OH adducts shows essentially identical values at the carboxyl positions and significant differences for the ring atoms only at the C_3 and C_6 positions. The spin density distribution in the π system is clearly not affected to any significant extent by OH substitution. In spite of this the ${}^{13}C$ hyperfine coupling constants for C_6, the site of addition, are 13 and 23% lower, respectively, in the OH adducts. This finding is at variance with correlation of ${}^{13}C$ couplings strictly in terms of the local and adjacent π spin densities. It is suggested that the differences noted, and the related drop of ~35% in the proton hyperfine constants at C_6, result mainly from the loss of symmetry in the OH substituted radicals. (12 refs.)

103555 The concentration process in the formation of development centres in silver halide microcrystals. J.W.Mitchell (Dept. of Phys., Univ. of Virginia, Charlottesville, VA, USA).
J. Photogr. Sci. (GB), vol.31, no.4, p.148-57 (July-Aug. 1983).
Discusses the processes whereby silver atoms are concentrated at a few sites during exposure to form development centres in silver halide emulsion grains. Two models are used. With the first model, the chemically sensitized grain has small surface monolayer islands of Ag_2S molecules with AG_2 molecules adsorbed at vacant sites around their edges, and exposure results in the photo-oxidation of these Ag_2 molecules with liberation of conduction electrons and charge-compensating interstitial silver ions. With the second model, the islands of Ag_2S molecules have co-adsorbed (Ag,Au)S and Au_2S molecules in a random distribution and no adsorbed Ag_2 molecules. Ag_2S molecules are now photo-oxidized during exposure, and $AuAg_3{}^+$ and $Au_2Ag_2{}^+$ concentration specks are formed by one effective photochemical event. A quantitative theory is presented which predicts the maximum dimension of a silver halide grain in which an efficient concentration process can operate. (79 refs.)

103556 Photosensitization and photostabilization of isotactic poly(1-butene) film with triazine complexes. R.Chandra (Dept. of Chem., Delhi Coll. of Engng., Delhi, India).
Polym. Bull. (Germany), vol.9, no.8-9, p.445-9 (March 1983).
The authors describe the results of the 3-(o-carboxyphenyl)-1-phenyltriazine-N-oxide-sensitized and copper (II) bis-3-(o-carboxyphenyl)-1-phenyltriazine-N-oxide-stabilized photodegradation of isotactic poly(1-butene) film in air at a temperature range of 267-313K with a light intensity flux 2.38×10^{-9} einsteins sec^{-1} cm^{-2}. The degradation was followed by viscometry, potassium ferri-oxalate actinometry and by measuring carbonyl index. The intrinsic viscosity, quantum yield and carbonyl index depend on several factors, i.e. temperature and triazene concentration. (8 refs.)

103557 Determination of picosecond relaxation times of bleachable dyes by the method of cross polarizers. M.A.Vasil'eva, V.B.Gul'binas, V.I.Kabelka, A.V.Masalov, V.P.Syrus (Inst. of Phys., Acad. of Sci., Vilnius, Lithuanian SSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.233-5 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.415-19 (Feb. 1983).
A background-free method is proposed for the determination of the time constants of fast relaxation of bleachable dyes. The method utilizes exciting and probe ultrashort light pulses. The absence of background is ensured by the use of crossed polarizers. The results are given of a determination (by the new method) of picosecond relaxation times of bleachable dyes of the kind used for mode locking of neodymium laser radiation. These results are in good agreement with the data obtained by the familiar absorption method. (11 refs.)

103558 Regressive of the latent image in carboxyl-containing cellulose materials under the influence of an electric field. I.N.Ermolenko, T.G.Lazareva.
Zh. Nauchnoi & Prikl. Fotogr. & Kinematogr. (USSR), vol.28, no.3, p.173-5 (May-June 1983). In Russian.
The authors study the effect of an electric field on the photosensitivity and regression of latent image centres formed by the action of UV radiation in cellulose materials containing carboxyl groups. The observed effect is shown to be correlated with the process of dielectric polarisation in the electric field. (5 refs.)

103559 Visible light sensitisation by means of cyanine dyes of polymer compositions based on diphenyl benzylamine and carbon tetrabromide. A.D.Grishina, A.V.Vannikov, T.N.Galiullina, M.A.Alperovich, B.I.Shapiro.
Zh. Nauchnoi & Prikl. Fotogr. & Kinematogr. (USSR), vol.28, no.3, p.175-81 (May-June 1983). In Russian.
The authors investigate the spectral sensitisation, using cyanine dyes with different redox potential, of compositions containing polyvinyl chloride, diphenyl benzylamine and carbon tetrabromide. It is shown that cyanine dyes having $E^1/_3Ox$ value for diphenyl benzylamine are effective sensitisers. (4 refs.)

103560 Concerning the role of Ag^+ ions in a photographic process with physical development on thin TiO_2 layers. Yu.V.Nechepurenko, G.A.Ragoisha, V.G.Sokolov, G.A.Branitskii.
Zh. Nauchnoi & Prikl. Fotogr. & Kinematogr. (USSR), vol.28, no.3, p.181-4 (May-June 1983). In Russian.
The authors examine the results of an investigation of the photographic and photoelectrochemical characteristics of thin TiO_2 layers containing at the film surface 10^{-9} to 10^{-6} g/cm^2 of Ag^+ ions. Two maxima are found in the curves of photosensitivity dependence on the concentration of adsorbed Ag^+ ions. The sensitisation of TiO_2 of Ag^+ photoreduction and the effect of photoactivation of TiO_2-Ag structures in relation to image formation in Ag-containing TiO_2 layers are discussed. (8 refs.)

103561 Concerning a decrease in penetration by oxygen of polymer layers with azides during irradiation with light. V.M.Treushnikov, A.M.Yanin.
Zh. Nauchnoi & Prikl. Fotogr. & Kinematogr. (USSR), vol.28, no.3, p.185-90 (May-June 1983). In Russian.
The authors determine the diffusion coefficients (D) of oxygen on the basis of a kinetic analysis of photochemical azide oxidation reactions in cyclized natural rubber and polystyrene. D in polymer layers without azides is found to be close to that determined by direct methods. In layers with azides present D is

shown to be 2 orders less. It is concluded that during irradiation processes occur which lead to a sharp decrease in permeability to molecular oxygen. (9 refs.)

103562 Mechanism of the initial stage of the surface photochemical process of the microcrystals of low-sensitivity photographic layers. A.N.Latyshev, K.V.Chibisov.
Zh. Nauchnoi & Prikl. Fotogr. & Kinematogr. (USSR), vol.28, no.3, p.209-12 (May-June 1983). In Russian.
The authors discuss the results of various previously published investigations into the detailed mechanism of the photochemical process at the surface of Ag halide microcrystals in low-sensitivity photographic layers. The role of ion and atom adsorption, and of dislocations at the surfaces of the microcrystals are examined. (23 refs.)

103563 Spectrophotometric investigation of the process of colour centre rearrangement during the fixation of a photochemically coloured emulsion. S.F.Chernov, V.V.Shcherbukhin, E.P.Senchenkov, E.A.Galashin.
Zh. Nauchnoi & Prikl. Fotogr. & Kinematogr. (USSR), vol.28, no.3, p.214-17 (May-June 1983). In Russian.
The authors discuss the absorption spectra of photochemically coloured ultra-fine grained emulsions of AgBr subject to fixation in a 0.15 M ammonia solution. The position of the maxima in the absorption spectra are determined by mathematical programming. (7 refs.)

Laser Diagnostics and Photochemical Processing for Semiconductor Devices. Proceedings of a Symposium .... See Entry 98648

Grain growth during rehalogenating bleaching .... See Entry 99209

Sensitizer centres: formation, properties, function and efficiency .... See Entry 99210

Spectral sensitisation in conjunction with supplementary chemical sensitisation .... See Entry 99215

Investigation of the interaction of diglycidol ether of methylphosphonic acid with gelatin .... See Entry 99216

Determination of the probability of quantum absorption for particles of photographic blackening .... See Entry 99217

The influence of a strong electric field on a photographic layer during blocked ionic conduction .... See Entry 99220

Change of state of colour centres in alloyed sodium chloride crystals .... See Entry 99222

Contraction of, and hole burning in a phosphorescence line corresponding to the forbidden $T_1 \leftarrow S_0$ transition in the spectrum of pyrene in a glassy matrix .... See Entry 100452

Ultrafast physical effects in cyanine dyes subjected to tunable picosecond excitation .... See Entry 100464

Shape resonances and the photodissociation cross section of MgH near threshold .... See Entry 100471

Resonances in molecular collisions: importance of mode decoupling in the exit channel of attractive potentials .... See Entry 100475

Yield of excited iodine atoms during many-photon dissociation of CF_3I and $(CF_3)_3CI$ .... See Entry 100478

Photofragment spectroscopy of N_2^{2+} .... See Entry 100480

Use of the photochromic properties of mercury dithizonate in hydrodynamics .... See Entry 101365

Irradiation effects in perovskite-type fluorides .... See Entry 101792

Negative photoplastic effect due to the relaxed excited state of the F-center in alkali halides .... See Entry 101846

Comparison of photoelectrochemical properties of n-TiO_2 films obtained by different production methods .... See Entry 102506

Photochemical conversion and optical absorption spectra of V centers in coloured KI crystals .... See Entry 102917

Infrared laser photoisomerization of 2-fluoroethanol in argon .... See Entry 103499

Long-lived polymer radicals. V. Synthesis of block copolymer by the reaction of living poly(*N*-phenylmethacrylamide) radical with vinyl monomers .... See Entry 103522

Surface ozonation and photooxidation of polyethylene film ... See Entry 103585

Transient decay following pulse excitation of diffuse scattering samples .... See Entry 103622

Influence of the physical structure of irradiated starches on their electron spin resonance spectra kinetics .... See Entry 103984

82.50E Photodissociation, photoionization as studied by luminescence and radiationless transitions

103564 Magnetic effects in glyoxal photodecomposition. N.I.Sorokin, N.M.Bazhin (Inst. of Chem. Kinetics & Combustion, Novosibirsk, USSR), G.G.Eremenchuk.
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.181-5 (29 July 1983).
The effect of a magnetic field (0-8 kG) on the fluorescence and product yield of glyoxal photolysis induced by 436 nm light has been investigated. Both the fluorescence and photolysis are quenched by a magnetic field. The maximum value of the effect on the fluorescence is 40%, that on the reaction is 15% at a glyoxal pressure of 0.05 Torr ($H=3$ kG). The pressure dependence of the magnetic effect has a maximum. The phenomena observed have been interpreted within a kinetic model. The rate constant of ${}^1A_u \rightarrow {}^3A_u$ collisional transition has been assumed to depend on yield strength and glyoxal pressure. (27 refs.)

103565 Delayed fragmentation of acetonitrile upon short-pulse UV irradiation: possible role of long-lived superexcited intermediates. B.B.Craig, W.L.Faust (Naval Res. Lab., Washington, DC, USA), R.G.Weiss.
J. Chem. Phys. (USA), vol.79, no.3, p.1286-96 (1 Aug. 1983).
The authors have studied fragment emission in the spectral range 200-900 nm, following short-pulse UV excitation (25 ps, 266 nm, 0.2-10 mJ) of acetonitrile. The dominant components of emission are the CN $B^2\Sigma^+ \rightarrow X^2\Sigma^+$ violet system and the C_2 $d\ {}^3\Pi_g \rightarrow a^3\Pi_u$ Swan system. Emissive CH and NH are also observed. Each of these diatomics is produced with a pressure-dependent rate. An instrumental risetime of 0.6 ns enabled study of the rise and fall of violet and of Swan emission over the pressure range 0.27-10 Torr. The formation kinetics suggest that there are long-lived intermediates to the violet and Swan emissive populations. These precursors are not observed in emission. They have zero-pressure lifetimes of 20 to 30 ns; in collision with the parent they are removed with large bimolecular rate constants ($<10^{-9}$ cm^3 s^{-1}). With the use of isotopically labeled acetonitrile, the authors have established that major fractions of CN $B^2\Sigma^+$ and of C_2 $d^3\Pi_g$ are formed intramolecularly. Further, two channels of intramolecular CN $B^2\Sigma^+$ production are recognized. They share a common risetime, which may indicate a common precursor. The preferred channel retains the CN association of the parent. In the other channel, the carbon atom originates in the methyl group of the parent, suggesting rearrangement within an intermediate. The authors believe that the precursors are superexcited or highly excited species $C_2H_nN^{**}$ ($0 \leq n \leq 3$). (59 refs.)

103566 Simultaneous one- and two-photon processes in the photodissociation of NCNO using a tunable dye laser. I.Nadler, J.Pfab, G.Radhakrishnan, H.Reisler, C.Wittig (Chem. Dept., Univ. of Southern California, Los Angeles, CA, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.2088-90 (15 Aug. 1983).
State-to-state studies of the photodissociation of polyatomic molecules can provide valuable information regarding fragment yields and quantum state distributions. Such information is often prerequisite to understanding the dynamics of dissociation and the nature of the excited potential surface(s). The authors report data indicating the NCNO will be a very important test molecule for the theoretical models of photodissociation dynamics. It has the desirable characteristics of nitroso compounds, a low C-NO dissociation energy (29 kcal mol.$^{-1}$), an $\pi^* \leftarrow n(S_1 \leftarrow S_0)$ transition in the region 500-880 nm (which in some nitroso compounds has been shown to be predissociative), and an NO fragment which can be monitored by laser induced fluorescence (LIF). In addition, the CN fragment can be easily detected by LIF, and thus E, V, R, T energy distributions in both fragments can be determined. (12 refs.)

103567 The preparation and selected properties of Mg-doped p-type iron oxide as a photocathode for the photoelectrolysis of water using visible light. C.Leygraf, M.Hendewerk, G.Somorjai (Materials & Molecular Res. Div., Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
J. Solid State Chem. (USA), vol.48, no.3, p.357-67 (15 July 1983).
Stable Mg-doped iron oxides that exhibit *p*-type character have been synthesized. These have been utilized in the form of sintered polycrystalline disks for the photodissociation of water. The authors report the influence of sintering temperature, surface oxygen deficiency, Mg-doping level, and solution chemistry on the photoactivity of the Mg-doped iron oxide photocathodes. (21 refs.)

103568 Spatial-anisotropy and polarized-atomic-fluorescence measurements following molecular photodissociation. H.Hemmati, W.M.Fairbank,Jr., P.K.Boyer, G.J.Collins (Colorado State Univ., Fort Collins, CO, USA).
Phys. Rev. A (USA), vol.28, no.2, p.567-76 (Aug. 1983).
A study has been made of the photodissociation of the molecules NaI, TlI, $HgBr_2$, and $PbBr_2$ by polarized 193-nm ArF laser light. A significant degree of polarized fluorescence was measured from excited photoproducts Tl and HgBr. No polarization was observed in the Na and Pb fluorescence, while the Hg polarization was small. For Tl the spatial anisotropy of the dissociated atoms was also measured by atomic absorption, yielding an asymmetry parameter value of $\beta=1.2$. The best current explanation for the polarized Hg and Tl emission is that fine-structure and hyperfine-structure magnetic substates, respectively, are preferentially populated by the dissociation process. (14 refs.)

103569 Dissociation of UF_6 molecules involving excitation of combination modes by NH_3-N_2 laser radiation. V.G.Averin, M.Akhrarov, G.S.Baronov, B.I.Vasil'ev, A.Z.Grasyuk, M.G.Morozov, E.P.Skvortsova, A.B.Yastrebkov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.189-94 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.346-53 (Feb. 1983).
The results are presented of a study of the dissociation of UF_6 molecules as a result of simultaneous interaction of resonant (NH_3-N_2 laser) and quasiresonant (CO_2 laser) infrared fields with $\nu_3+\nu_5$ (821.827 cm^{-1}) and $\nu_1+\nu_4$ (852.8 cm^{-1}) combination vibrations. The method used to record the dissociation process (observation of the HF* luminescence) made it possible to determine its rate in a single illumination pulse. It was found that two-frequency infrared-infrared excitation of the combination vibrations of the UF_6 molecule resulted in efficient multiphoton dissociation. A study was made of the influence on the dissociation rate of the intensity and frequency of the infrared field. Mass-spectrometric measurements failed to detect isotopic selectivity of the dissociation process. (12 refs.)

Production of $O({}^1D)$ and $O({}^3P)$ by vacuum ultraviolet photodissociation of molecular oxygen .... See Entry 100473

Dissociation of SF_6 molecules in an infrared laser field under gasdynamic cooling conditions .... See Entry 100481

Scattering of light and acoustic disturbances in the atomic iodine laser .... See Entry 100818

Photo- and electroluminescence spectra from an n-TiO_2 semiconductor electrode as related to the intermediates of the photooxidation reaction of water .... See Entry 102961

82.60 CHEMICAL THERMODYNAMICS

(see also 05.70 Thermodynamics)

103570 Note on the prediction of the enthalpy of formation of solid compounds of the transition and noble metals with chalcogens and halogens. A.K.Niessen (Philips Res. Labs., Eindhoven, Netherlands).
High Temp.-High Pressures (GB), vol.14, no.6, p.649-51 (1982). [received: June 1983] (International Conference on Chemistry of Materials at High Temperatures, Harwell, Oxon., England, 7-10 Sept. 1981).
It is shown that the model proposed by Miedema and coworkers (1980) to predict the enthalpy of formation of metal alloys can also be applied in principle to transition-metal chalcogenides and halides when the charge transfer to the atomic cells of these elements is limited. (6 refs.)

103571 Chemical equilibrium calculations of tungsten-halogen systems. J.A.Sell (Phys. Dept., General Motors Res. Labs., Warren, MI, USA).
J. Appl. Phys. (USA), vol.54, no.8, p.4605-13 (Aug. 1983).
The performance of the compound bromotrifluoromethane ($CBrF_3$) as a tungsten-halogen bulb fill gas was evaluated theoretically by chemical equilibrium calculations. It was found to be an ideal fill gas in terms of maintaining clear bulb walls and redepositing evaporated tungsten on hot spots in the filament. The calculations were done at different $CBrF_3$ and water concentrations. The compounds most responsible for tungsten transport were identified; fluorine compounds of tungsten dominate over bromine compounds. Finally, $CBrF_3$ is compared to other possible fill gases such as CBr_2F_2, CBr_3F, CBr_4,. and also HBr, since HBr is presently used commercially. (30 refs.)

103572 Thermodynamics of unsymmetrical electrolyte mixtures. Enthalpy and heat capacity. K.S.Pitzer (Dept. of Chem., Univ. of California, Berkeley, CA, USA).
J. Phys. Chem. (USA), vol.87, no.13, p.2360-4 (23 June 1983).
There is a purely electrostatic contribution to the thermodynamic properties of electrolytes for the mixing of ions of different charge but the same sign. The previous treatment, which was limited to activity or osmotic coefficients, is extended to enthalpies and heat capacities and applied to the measurements of R.B. Cassel and R.H. Wood (1974) on the heat of mixing in the systems $NaCl-BaCl_2$ and $NaCl-Na_2SO_4$. (20 refs.)

103573 Thermodynamics of the unsymmetrical mixed electrolyte $HCl-LaCl_3$. R.N.Roy, J.J.Gibbons (Dept. of Chem., Drury Coll., Springfield, MO, USA), J.C.Peiper, K.S.Pitzer.
J. Phys. Chem. (USA), vol.87, no.13, p.2365-9 (23 June 1983).
The contribution of higher order electrostatic terms (beyond the Debye-Huckel approximation) has been investigated for the system $H^+-La^{3+}-Cl^--H_2O$. EMF measurements were carried out on solutions at temperatures from 288.15 to 318.15K, and at ionic strengths from 0.1 to 5.0 mol kg^{-1}, by using hydrogen and silver-silver chloride electrodes. From these measurements it is possible to determine the Pitzer mixing coefficients $^S\theta_{H,La}$ and $\psi_{H,La,Cl}$ as a function of temperature. They are well represented by linear equations yielding temperature-invariant estimates of $\partial^S\theta_{H,La}/\partial T$ and $\partial\psi_{H,La,Cl}/\partial T$. These estimates may be used to predict the relative apparent molar enthalpy for aqueous solutions containing H^+, La^{3+}, and Cl^- with reasonable confidence. (22 refs.)

103574 Thermodynamic and kinetic descriptions of equilibrium. P.L.Corio (Dept. of Chem., Univ. of Kentucky, Lexington, KY, USA).
J. Phys. Chem. (USA), vol.87, no.13, p.2416-19 (23 June 1983).
A method is given for determining a necessary and sufficient condition for consistency of the kinetic and thermodynamic descriptions of the equilibrium state. It is assumed that the kinetics satisfies J. Wei's axioms (1962), but no special assumptions are introduced regarding the form of the reaction rate near equilibrium. The computational procedure is illustrated in several examples. (13 refs.)

103575 Lattice model for nonrandom pairing and the determination of 'sociation' constants of organic complexes. D.E.Martire (Dept. of Chem., Georgetown Univ., Washington, DC, USA).
J. Phys. Chem. (USA), vol.87, no.13, p.2425-30 (23 June 1983).
A quasi-chemical calculation for a lattice of solute (a), inert-solvent (b), and additive-solvent (c) molecules of different size is used to obtain more general expressions for the infinite-dilution NMR chemical shift and GLC partition coefficient of the solute, as a function of mixed-solvent composition. The inert solvent is explicitly included in modeling the competitive equilibrium process. It is confirmed that the 'sociation' constant, which reflects the difference between the actual and random number of pair interactions involving potentially active segments on molecules a and c, is the experimentally determinable equilibrium constant of complex formation. The derived expressions, which provide a more complete description for weak complexes, are shown to reduce to familiar equations in the respective limits of random pairing and strong complexes. (33 refs.)

103576 Gas-liquid chromatographic and nuclear magnetic resonance study of haloform+di-*n*-alkyl ether+*n*-alkane mixtures at 30°C. T.J.Bruno, D.E.Martire, M.W.P.Harbison, A.Nikolic, C.F.Hammer (Dept. of Chem., Georgetown Univ., Washington, DC, USA).
J. Phys. Chem. (USA), vol.87, no.13, p.2430-6 (23 June 1983).
Gas-liquid chromatographic (GLC) relative partition coefficients and proton nuclear magnetic resonance (NMR) chemical shifts of haloform solutes ($CHCl_3$, $CHCl_2Br$, $CHBr_2Cl$, and $CHBr_3$) are measured as a function of di-*n*-alkyl ether+*n*-alkane mixed-solvent composition at 30°C. Equilibrium constants of 1:1 hydrogen-bond complex formation ($K_{ac}{}^c$) are extracted from these data using equations derived from a nonrandom pairing model. The average difference between the $K_{ac}{}^c$ values determined from the GLC and NMR measurements, respectively, is 0.008 L mol^{-1}. These values are not highly dependent on the nature of the haloform, or on the chain length of the ether and paraffin solvent molecules. The contribution to the GLC data from interactions involving the halogen end of the haloform molecule and solvent molecules, are analyzed and discussed. (33 refs.)

103577 Molecular structure of liquid alcohols. P.Huyskens (Dept. of Chem., Univ. of Leuven, Heverlee, Belgium).
J. Mol. Struct. (Netherlands), vol.100, p.403-14 (July 1983).
A new thermodynamic treatment of continuous association is presented, where the various equilibria between *i*-mers are replaced by a single equilibrium between an O-H group in the bonded and the non-bonded states, linked in both cases to an indefinite ensemble of molecules. The treatment leads to an association constant K which differs from those considered in the theories of Kretschmer and Wiebe (1954) and of Wieh and Bagley (1967). For pure alcohols the association constant can be estimated from the vapor pressure of the alcohol and that of the homomorphous hydrocarbon. The fraction γ of free O-H groups determined in this way is markedly smaller than those calculated from the other theories. For the normal alcohols the product KV_A is approximately constant at a given temperature, V_A being the molar volume. This can be expected from the increasing of the standard entropy of the non-bonded molecules when the molecular volume increases. For secondary and tertiary alcohols the product KV_A is significantly lower due to steric hindrances. For all the alcohols considered the enthalpy of the hydrogen bond remains nearly constant $-\Delta H$ being equal to 24.8 ± 2 kJ mol^{-1}. (38 refs.)

103578 The standard enthalpy of formation of $LaNi_5$. The enthalpies of hydriding of $LaNi_{5-x}Al_x$. W.N.Hubbard, P.L.Rawlins, P.A.Connick, R.E.Stedwell,Jr., P.A.G.O'Hare (Chem. Technol. Div., Argonne Nat. Lab., Argonne, IL, USA).
J. Chem. Thermodyn. (GB), vol.15, no.8, p.785-98 (Aug. 1983).
The enthalpies of reaction in HCl(aq) of $LaNi_5$(cr), La(cr), and Ni(cr) were measured. From these measurements and appropriate auxiliary quantities, the standard enthalpy of formation, $\Delta_f H_m{}^\circ$, of $LaNi_5$(cr), was determined. The enthalpies of reaction between H_2 and $LaNi_5$, as well as $LaNi_{4.5}Al_{0.5}$, and $LaNi_4Al$, have been measured by hydrogen titration calorimetry. The enthalpy of solution of H_2 in the α-phase of $(LaNi_5+H_2)$ is -28 kJ.mol^{-1}, and in the two-phase plateau region the enthalpy of hydriding by H_2 is $-(31.6 \pm 0.2)$ kJ.mol^{-1}. In the two-phase plateau region of $(LaNi_{5-x}Al_x+H_2)$ the enthalpy of hydriding by H_2 is -38 kJ.mol^{-1} for $LaNi_{4.5}Al_{0.5}$ and -46 kJ.mol^{-1} for $LaNi_4Al$. The relation between the enthalpy of hydriding of the alloy by H_2 and its aluminum content was found to be $\Delta_{hyd}H_m{}^\circ$ ($LaNi_{5-x}Al_x$, cr, 298.15K)$=-(31.6+14.4x)$ kJ.mol^{-1}. The thermodynamic quantities at $T=298.15$K are reported $\Delta_f G_m{}^0$(kJ×mol^{-1}) $LaNi_5$ -159.1 ± 8.3 3.5 ± 0.8 -160 ± 8.3 $LaNi_5H_{6.2}$ -258 ± 8.3 -339.5 ± 0.9 -157.4 ± 8.3. (22 refs.)

103579 Hulett's enhanced solvent tension. An alternative to Lewis' diminished solvent activity. H.T.Hammel (Max-Planck-Inst. fur Physiologische und Klinische Forschung, Bad Nauheim, Germany).
Phys. & Chem. Liq. (GB), vol.13, no.1, p.25-36 (1983).
Hulett proposed in 1903 that solute enhances the tension in the cohesive forces between solvent molecules by an amount equal to the osmotic pressure of the solvent. He attributed all the colligative properties of the solution solvent to this enhanced solvent tension. In 1908 Lewis proposed that the altered state of the solvent in solution was due to a reduced activity caused by the solute. Hulett's proposal is based on physical principles and thermodynamic argument and is a valid alternative to Lewis' proposal. Under all circumstances, the solution solvent is altered by the solute precisely as if the average tension between the molecules of solvent was enhanced by the osmotic pressure of the solution solvent, Π_1, no matter how the solute does it, no matter what the compressibility of the solvent is at any T and p and no matter what the relationship is between Π_1 and x_1, the mole fraction of solvent in the solution. (17 refs.)

Thermochemical properties [of titanium, its compounds and alloys] ....See Entry 98664

Reduced partition function ratios of titanium, zirconium, and hafnium compounds ....See Entry 100230

Infrared spectroscopic studies of hydrogen bonding in triethylammonium salts. II. Association of triethylammonium salts with bases ....See Entry 100398

Heats of interaction of polyvinyl chloride with plasticizers, kinetics of swelling and phase equilibrium ....See Entry 101911

A thermodynamic study of (magnesium oxide+silicon dioxide) by mass spectrometry ....See Entry 102005

Thermodynamics of liquid (potassium+potassium bromide) at high temperatures ....See Entry 102007

Thermodynamic investigation of (a transition metal+germanium or silicon). II. (Palladium+silicon) alloys ....See Entry 102008

Thermodynamics of Na_2CO_3-$CaCO_3$-CaO slags for use in hot metal refining ....See Entry 103124

Boron particle ignition in a restricted thermodynamical equilibrium ....See Entry 103524

Influence of turbulence on the formation of high nonequilibrium concentrations of atoms and free radicals in diffusion flames ....See Entry 103526

Thermal efficiency of the magnesium-iodine cycle for thermochemical hydrogen production ....See Entry 103732

Design studies of the sulfur trioxide decomposition reactor for the Sulfur Cycle hydrogen production process ....See Entry 103734

82.65 SURFACE PROCESSES

103580 Statistical rates for reactions of heterogeneous surfaces: the influence of non-ideal collisions. S.D.Prasad, L.K.Doraiswamy (Nat. Chem. Lab., Poona, India).
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.129-34 (29 July 1983).
Using the random patch model, kinetic expressions are derived for the pressure dependence of first- and second-order surface reactions. Collisions between gas-phase and adsorbed molecules which affect the desorption probability are taken into account. For first- and second-order reactions a representation for the rates is given in terms of incomplete gamma functions for three distributions. These collisional effects cause the surface rates to rise steeply in a narrow range of pressure, due to the exponential dependence of the local isotherm on pressure. (14 refs.)

103581 Resonance Raman spectra of benzene adsorbed on Cu^{2+}-montmorillonite. Formation of poly(*p*-phenylene) cations in the interlayer of the clay mineral. Y.Soma, M.Soma (Nat. Inst. of Environmental Studies, Ibaraki, Japan), I.Harada.
Chem. Phys. Lett. (Netherlands), vol.99, no.2, p.153-6 (29 July 1983).
Resonance Raman spectra of benzene adsorbed on Cu^{2+}- and Ru^{3+}-montmorillonites have demonstrated the formation of poly(*p*-phenylene) cations in the interlayer of the clay mineral. The interlayer cation is reduced in a humid atmosphere to yield poly(*p*-phenylene). Biphenyl or *p*-terphenyl gives consistently the same product. (10 refs.)

103582 Diffusion controlled reactions of gases with surfaces and state dependent reactivity. II. Diffusion slip and Knudsen corrections. L.Monchick (Appl. Phys. Lab., Johns Hopkins Univ., Laurel, MD, USA), S.Hess.
J. Chem. Phys. (USA), vol.79, no.4, p.2098-9 (15 Aug. 1983).
For pt.I see ibid., vol.77, p.307 (1982). Recently, the authors considered the reaction rate of a surface with molecules diffusing up from an ambient solvent, and demonstrated measurable dependence on internal state of the solute molecules. The distribution and state of the reactant were described by a Bloch-Torrey equation and the reaction by an extension of the radiation boundary condition customarily used in diffusion controlled reaction theory. More refined considerations of simple reactions, based on kinetic theory, show that the reaction rate should be corrected for finite diffusive step length and for nonequilibrium perturbations of the velocity distribution function. An approximate correction for both effects is introduced into the state dependent diffusion mediated reaction rate theory. (13 refs.)

103583 Surface enhanced Raman spectra of benzotriazole adsorbed on a copper electrode. J.Rubim, I.G.R.Gutz, O.Sala, W.J.Orville-Thomas (Inst. de Quimica, Univ. de Sao Paulo, Sao Paulo, Brazil).
J. Mol. Struct. (Netherlands), vol.100, p.571-83 (July 1983).
The surface enhanced Raman spectrum of benzotriazole (BTAH) adsorbed on a copper electrode has been studied as a function of the potential applied to the electrode. The effect of pH and of the type of halide in the electrolyte solution has also been investigated. The presence of some complexes involving Cu(I), benzotriazole or benzotriazolate (BTA^-) and the halide has been characterized. The protective film formed on copper surface, in the presence of benzotriazole, has been identified as cuprous benzotriazolate [Cu(I)BTA]. (23 refs.)

103584 Isopiestic studies of aqueous solutions at elevated temperatures. VII. $MgSO_4$ and $NiSO_4$. H.F.Holmes, R.E.Mesmer (Chem. Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
J. Chem. Thermodyn. (GB), vol.15, no.8, p.709-19 (Aug. 1983).
Isopiestic measurements have been made on $MgSO_4$(aq) and $NiSO_4$(aq) at 383.14K with NaCl(aq) serving at the reference electrolyte. Irreversible solubility effects prevented successful measurements at higher temperatures. Osmotic coefficients at 383.14K are smaller and less dependent on molality than at 298.15K. The ion interaction model, as modified for 2-2 electrolytes, was fitted to the osmotic coefficients. Only three of the four parameters of the model could be evaluated, thereby precluding the direct calculation of activity coefficients from the isopiestic results. Combination of the present

results with published freezing temperatures and enthalpies does permit the computation of activity coefficients in the case of $MgSO_4$(aq). At 383.15K the activity coefficient of $MgSO_4$(aq) becomes quite small (<0.05) at very moderate molalities (0.5 mol.kg^{-1}). Because of uncertainties in the calculations only general observations concerning trends in the activity coefficient at elevated temperatures and high molalities are warranted. (34 refs.)

103585 Surface ozonation and photooxidation of polyethylene film. J.Peeling (Dept. of Chem., Univ. of Petroleum & Minerals, Dhahran, Saudi Arabia), D.T.Clark.
J. Polym. Sci. Polym. Chem. Ed. (USA), vol.21, no.7, p.2047-55 (July 1983).
High-density polyethylene (HDPE) and low-density polyethylene (LDPE) films were oxidized by treatment with ozone and by photooxidation with a low-pressure mercury lamp. The changes that resulted in the surfaces of the films were followed by ESCA. On ozonation, the surface of LDPE initially is oxidized more rapidly than that of HDPE; however, extended ozonation produces a surface composition that corresponds to C_8O for HDPE and to $C_{18}O$ for LDPE. The surface oxidation products are mainly carboxyl groups, with lower levels of carbonyl and C-O groups. For both polymers photooxidation provides more extensively oxidized surfaces than ozonation, although the surface of HDPE oxidizes slightly faster than that of LDPE treated under identical conditions. In both cases the surface stoichiometry after extensive photooxidation is C_6O. The functional groups formed are mainly carboxyl and C-O. The effects of ozonation and photooxidation on the polyethylene surfaces are compared with those produced by several other means of surface oxidation. (46 refs.)

103586 Chemiluminescence in autocatalytic thermal oxidation of polymers. L.Zlatkevich (Allied Fibers & Plastics, Morristown, NJ, USA).
J. Polym. Sci. Polym. Lett. Ed. (USA), vol.21, no.7, p.571-4 (July 1983).
A distinguishing feature of the oxidation kinetics of many organic substances is the autocatalytic reaction that is accompanied by the accumulation of hydroperoxides. Hydroperoxides appear as one of the first products of the reaction. Subsequent oxidation of the parent substrate is autocatalyzed by the decomposition of hydroperoxides which produce free radical chain carriers for the chain reaction. Numerous techniques have been developed over the years to study the oxidative stability of polymers. Among various methods, chemiluminescence accompanying the thermal oxidation has been referred to by several authors. The intensity of emitted light could be a convenient criterion for the estimation of thermal oxidative stability of polymers. A typical light intensity-versus-time curve for the chemiluminescence produced by autoxidation of a polymer (normally made at constant sample temperature) consists of four regions. There is an induction period during which the light intensity is low and practically constant, oxidation is slight, and buildup of peroxides or hydroperoxides is slow. Following the induction period, there is an autocatalytic stage in which the peroxides catalyze further oxidation and the intensity of emitted light increases quite rapidly. The induction and acceleration periods are not separate phenomena, but parts of a typical autocatalytic reaction. The light intensity next reaches the highest level (peak peroxide concentration). Finally, there is a period of light decay (a deceleration of the rate of oxidation). (5 refs.)

103587 Ab initio study of the symmetric reaction path of H_2 with a surface *V* center in magnesium oxide. S.A.Pope (Chem. Dept., Univ. of Manchester, Manchester, England), M.F.Guest, I.H.Hillier, E.A.Colbourn, W.C.Mackrodt, J.Kendrick.
Phys. Rev. B (USA), vol.28, no.4, p.2191-8 (15 Aug. 1983).
An all-electron ab initio calculation, including correlation effects, of the symmetric reaction path of H_2 with a surface *V* center in magnesium oxide has been carried out. The importance of lattice relaxation effects has been demonstrated, and the position of the saddle point has been located. The calculated barrier to the reaction, 40 kcal mol^{-1}, is considerably greater than the value necessary for H_2-D_2 exchange at 78K, suggesting that the lowest-energy pathway involves the asymmetric interaction of H_2 with the surface *V* center. (46 refs.)

103588 The role of adsorbed sulfur in the H_2-D_2 equilibrium reaction on Pt single crystals. C.M.Pradier, Y.Berthier, J.Oudar (Lab. de Phys.-Chimie des Surfaces, Univ. Pierre et Marie Curie, Paris, France).
Surf. Sci. (Netherlands), vol.130, no.1, p.229-43 (July 1983).
The H_2-D_2 equilibrium on Pt single crystals was investigated under intermediate pressure (100-400 Torr) and temperature (50-250°C), as a function of sulfur coverage. On Pt(100) and Pt(111), adsorbed sulfur modifies the kinetic parameters, activation energy and pre-exponential factor, the latter depends on the temperature on Pt(110) only. The clean Pt(110) face was found to be 5 times more active than the clean Pt(111). On both faces, adsorption of sulfur induces electronic effects on the neighbouring reactional sites. The difference in the behaviour of the two faces and a clear influence of the arrangement of the adsorbed sulfur atoms, deduced from LEED diagrams, tend to prove the structure dependency of the H_2-D_2 reaction. A consistent reaction mechanism could be proposed, involving the dissociative adsorption and surface recombination of hydrogen and deuterium, and the reaction between adsorbed molecules for high sulfur coverages. The value of the sulfur coverage which makes the platinum inactive towards H_2-D_2 is lower for the (111) than for the (110) orientation; this is in correlation with the roughness of the surface; the denser at atomic scale a surface is, the further is the extent of the lateral interactions due to adsorbed sulfur. (14 refs.)

103589 Adsorption and oxidation of simple organic compounds on platinum electrodes. H.Lal (Chem. Faculty, Inst. of Technol., Bombay, India).
Sov. Electrochem. (USA), vol.18, no.10, p.1208-15 (Oct. 1982). Translation of: *Elektrokhimiya (USSR),* vol.18, no.10, p.1359-66 (Oct. 1982).
The author generalizes the experimental data on the influence of the degree of aging of Pt/Pt electrodes and the presence of tightly chemisorbed O-type particles on the surface on the adsorption and oxidation of simple organic substances. The promoting role of adsorbed atoms in processes of oxidation of organic substances is discussed. (37 refs.)

103590 The role of surface phenomena in the interactions of reactive metals with gases. G.Horz, E.Fromm (Max-Planck-Inst. fur Metallforschung, Inst. fur Werkstoffwissenschaften, Stuttgart, Germany).
Vacuum (GB), vol.33, no.5, p.265-70 (May 1983).
The reactions of metals with gases are often controlled by reaction steps on the surface and, thus, they can be strongly influenced by non-metallic species either adsorbed on the surface or forming compound-like surface layers. Considering in particular the effects of oxygen, first energetic conditions for the formation of compound-like sorption layers and for the surface segregation of nonmetals are briefly treated. Then experimental results are presented which refer to these surface phenomena and to their influence on metal-gas interactions. The discussion deals with (i) the formation of oxide-like sorption layers on transition metals (77-400K) and the influence of oxidic layers on the hydrogen absorption by tantalum (77-700K) and with (II) the surface segregation of oxygen on tantalum and α-hafnium (1400-2100K) and the influence of surface-segregated oxygen or nitrogen on the kinetics of the decomposition of hydrocarbons on tantalum and α-hafnium (1300-2300K). (38 refs.)

Sorption of active gases by non-evaporable getter .... See Entry 99122

Solid-state NMR studies of the reactions of silica surfaces with polyfunctional chloromethylsilanes and ethoxymethylsilanes .... See Entry 100417

Gas desorption during irradiation of metals with molybdenum ions ....See Entry 101821

The adsorption of hydrocarbons on silicalite and ZSM5 ....See Entry 102153

Heat of adsorption of water on E glass fibre surfaces ....See Entry 102164

Electronic structures of the $LaBO_3$ (B=Co, Fe, Al) perovskite oxides related to their catalysis ....See Entry 102256

Electric properties of antimony oxide films formed by heating antimony films in air ....See Entry 102544

An extended X-ray absorption fine structure spectroscopy study of a highly dispersed Rh/Al_2O_3 catalyst: The influence of CO chemisorption on the topology of rhodium ....See Entry 102997

A time dependent wave packet approach to three-dimensional gas-surface scattering .... See Entry 103019

Changes in the chemical reactivity of metals exposed to an inert gas glow discharge ....See Entry 103404

Laser-pulsed plasma chemistry: surface oxidation of niobium ....See Entry 103406

Production of hydrogen by direct thermal decomposition of water with the aid of a semipermeable membrane ....See Entry 103502

Investigation of the relationship between the nature of an organic compound and its adsorbability on platinum. Influence of the potential of the platinum electrode on the mechanism of the adsorption and reduction of aromatic nitro compounds ....See Entry 103538

Electric conductivity of ammonium-selective membranes containing neutral complex formers ....See Entry 103539

Temperature dependence of adsorption on mercury in the carboxylic acid series ....See Entry 103540

Magnetic field effects on photosensitized electron transfer reactions in the presence of TiO_2 and CdS loaded particles ....See Entry 103552

Light-scattering studies of hydroxyethylcellulose in water/nonionic surfactant binary mixtures. Evidence for preferential solvation of polymer chains by surfactant micelles .... See Entry 103603

Adsorption of polysaccharides on a calcite using spin labelled polymers ....See Entry 103604

Influence of the nature of the supporting electrolyte on the adsorption of substances forming two-dimensional condensed layers at the mercury/electrolyte interface .... See Entry 103606

Determination of adsorption parameters of two-dimensional condensed layers of organic compounds from experimental C vs. E curves ....See Entry 103607

82.70 DISPERSE SYSTEMS

(for flow behaviour, see 47.55K)

103591 Surface-enhanced Raman scattering of colloid-stabilizer systems. P.C.Lee, D.Meisel (Chem. Div., Argonne Nat. Lab., Argonne, IL, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.3, p.262-5 (5 Aug. 1983).
Surface-enhanced Raman scattering (SERS) from silver and gold colloids stabilized by poly(vinyl alcohol) (PVA), poly(ethylene glycol), carbowax, and poly(vinyl pyridine) (PVP), has been observed. From the bands observed in the SERS of the PVA stabilized sols it is concluded that the PVA adsorbs on the metal through unhydrolyzed acetate groups. Carbowax adsorbs on the metal through the C-O-C groups. PVP adsorbs through the pyridine π system which leads to a flat lying ring conformation on the metal. (16 refs.)

103592 Motion of a cloud of particles under gravity and its sedimentation on a flat horizontal surface. G.M.Makhviladze, O.I.Melikov.
Fluid Dyn. (USA), vol.17, no.6, p.867-75 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza,* vol.17, no.6, p.64-73 (Nov.-Dec. 1982).
On the basis of the nonstationary two-dimensional equations of the mechanics of heterogeneous media a numerical investigation is made of the motion of a cloud of particles under the influence of gravity in an unbounded medium and the interaction of the descending cloud of particles with a flat horizontal surface. Depending on the degree of hydrodynamic interaction between the particles, there are different regimes of motion of the cloud during sedimentation; the change in its spatial configuration determined by the large-scale vortex motion of the carrier medium is determined. The concentration distributions of the carrier medium is determined. The concentration distributions of the particles on the sedimentation surface are obtained. A coefficient of dispersal is introduced for the cloud of particles on the flat horizontal surface, and its dependence on the concentration of the particles, their diameters, and other parameters is investigated. (17 refs.)

103593 Microemulsions and colloids. C.Taupin (Lab. de Phys. de la Matiere Condensee, Coll. de France, Paris, France).
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.551-6 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Colloidal systems are presently the object of an intense scientific activity since they are unique systems for the study of interactions which are of the order of kT in the intermediate range of distances about several hundreds of Angstrom. Microemulsions have in common many macroscopic physical properties such as transparency, fluidity but, depending on the particular chemical composition, various structural facets appear. They go from true particulated colloids to systems in dynamical exchange and, for some cases, to critical mixtures which put them in continuity to true solutions. (10 refs.)

103594 A theory on the electroviscous effect: a method for the estimation of the viscosity of dispersions of charged spherical colloidal particles. J.A.Menjivar, C.Rha (Dept. of Nutrition & Food Sci., MIT, Cambridge, MA, USA).
J. Chem. Phys. (USA), vol.79, no.2, p.953-6 (15 July 1983).
A method to estimate the effect of electrostatic interactions on the shear viscosity of concentrated dispersions of charged spherical particles is presented. The secondary electroviscous effect can be related to an effective maximum packing fraction (ϕ_M), defined as the particle concentration at which the charged particles attain complete long-range order. The maximum packing fraction (ϕ_M) can be determined either theoretically or experimentally. This excluded volume approach quantitatively describes the roles of surface potential (ψ_0), particle radius (a), suspending medium ionic strength (I), and particle concentration (ϕ) on the low-shear viscosity of colloidal

monodispersions of charged spherical particles. The validity of the proposed theory is suggested by an agreement with existent literature data. (25 refs.)

103595 The phase diagram of charged colloidal suspensions. D.Hone (Inst. for Solid State Phys., Tokyo Univ., Tokyo, Japan), S.Alexander, P.M.Chaikin, P.Pincus.
J. Chem. Phys. (USA), vol.79, no.3, p.1474-9 (1 Aug. 1983).
The thermodynamics of a system of identical electrically charged spheres in colloidal suspension in a polar fluid (typically, H_2O), are calculated within a model of point particles interacting via a screened Coulomb (Yukawa) potential of suitably renormalized strength. The particles are taken to be sufficiently massive that a classical theory is appropriate. The free energies of the crystalline phases are calculated within a mean field theory which is an extension of the self-consistent harmonic approximation. The melting curve is estimated from the semiempirical Lindemann rule, with mean squared displacements again calculated self-consistently. As functions of the relevant parameters: electrical charge of each sphere, density of spheres and added salt concentration, stable predicted phases include FCC and bcc crystals and a disordered fluid. Under suitable circumstances a reentrant BCC→FCC→BCC transition is predicted as salt is added, and BCC is predicted always likely to be the stable phase just below the melting transition. (9 refs.)

103596 Surface tensions and micellization of ω-cyclohexylalkanoic acids and their sodium salts. A.Skauge, J.J.Spitzer (Dept. of Chem., Univ. of Lethbridge, Lethbridge, Alberta, Canada).
J. Phys. Chem. (USA), vol.87, no.13, p.2398-401 (23 June 1983).
The surface properties of a homologous series of ω-cyclohexylalkanoic acids and their sodium salts of general formula $C_6H_{11}(CH_2)_nCOOH$ with $n=0$, 1, 2, 3 were determined at 25°C. For sodium carboxylates with $n=1$, 2, 3 the critical micelle concentrations were found to be 1.0, 0.53, and 0.26 M. Surface tension measurements on aqueous solutions of these compounds were used to calculate the saturation areas per molecule, the free energies of adsorption, and the efficiency and effectiveness of adsorption. The cyclohexyl ring in these compounds makes the saturation areas larger than those of the corresponding straight-chain acids and salts. This effect diminishes with the increasing number of CH_2 groups in the alkyl chain. A 'rule of two'; ($-RT$ ln 2) is found to be valid for the standard free energy of adsorption per CH_2 group to a charged air/solution interface as compared to the 'rule of three' ($-RT$ ln 3) that is typical of uncharged interfaces. (30 refs.)

103597 Temperature-induced phase transition and structural changes in micellar solutions of sodium oleate observed by Raman scattering. P.T.T.Wong, H.H.Mantsch (Div. of Chem., Nat. Res. Council of Canada, Ottawa, Canada).
J. Phys. Chem. (USA), vol.87, no.13, p.2436-43 (23 June 1983).
Raman spectra of aqueous sodium oleate in the coagel and micellar phases have been measured as a function of temperature over the temperature range from −40 to 40°C. The temperature-induced phase transition between the micellar and coagel phases on both heating and cooling has been characterized. The transition exhibits very high hysteresis, the critical micellization temperature of 0.42 M sodium oleate being observed at 27°C, while the critical coagelization temperature of this system was found at 11°C. Changes in the spectra, including the polarized Raman spectra of the micellar phase, has been used to discuss short-range structural changes of various functional groups in sodium oleate. (49 refs.)

103598 Critical behaviour of the elastic constant and the friction coefficient in the gel phase of gelatin. J.-C.Bacri, D.Gorse (Lab. d'Ultrasons, Univ. Pierre et Marie Curie, Paris, France).
J. Phys. (France), vol.44, no.8, p.985-91 (Aug. 1983).
The critical behaviour of the elastic constant and the friction coefficient have been measured in the gel phase of gelatin. The critical exponents, 1.8 for the elastic constant, and 1 for the friction coefficient are in good agreement with 3d-percolation theory. (15 refs.)

103599 Existence and properties of post-gel solutions for the kinetic equations of coagulation. F.Leyvraz (DPMC, Univ. de Geneve, Geneve, Switzerland).
J. Phys. A (GB), vol.16, no.12, p.2861-73 (21 Aug. 1983).
The kinetic equations of coagulation with kernels R_{ij} are studied for both factorisable ($R_{ij}=r_ir_j$) and diagonal ($R_{ij}=A_i\delta_{ij}$) kernels. It is rigorously shown that they allow solutions of the type $c_j(t)=a_j/t$ for suitably chosen a_j. These solutions are further shown to have finite mass if $R_{jj}\sim j^d$ for $d>1$. The asymptotic behaviour of the a_j is also studied and found to agree with numerous previous findings. (8 refs.)

103600 The primary electroviscous effect in a suspension of spheres with thin double layers. E.J.Hinch, J.D.Sherwood (Dept. of Appl. Maths. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
J. Fluid Mech. (GB), vol.132, p.337-47 (July 1983).
The authors study the primary electroviscous effect in a suspension of spheres when the double layer thickness κ^{-1} is small compared with the particle radius a. The case of a 1-1 symmetric electrolyte is examined using the methods of Dukhin and coworkers (1974), whilst the asymmetric electrolyte is studied along lines similar to those of O'Brien (1983). Sherwood's (1980) asymptotic results for high surface potentials and high Hartmann numbers are extended and complemented. (8 refs.)

103601 Coagulation equations with gelation. E.M.Hendriks, M.H.Ernst, R.M.Ziff (Inst. voor Theoretische Fysica, Rijksuniv. Utrecht, Utrecht, Netherlands).
J. Stat. Phys. (USA), vol.31, no.3, p.519-63 (June 1983).
Smoluchowski's equation for rapid coagulation is used to describe the kinetics of gelation, in which the coagulation kernel K_{ij} models the bonding mechanism. For different classes of kernels the authors derive criteria for the occurrence of gelation, and obtain critical exponents in the pre- and postgelation stage in terms of the model parameters; they calculate bounds on the time of gelation t_c, and give an exact postgelation solution for the model $K_{ij}=(ij)^\omega$ ($\omega>1/2$) and $K_{ij}=a^{i+j}$ ($a>1$). For the model $K_{ij}=i^\omega+j^\omega$ ($\omega<1$, without gelation) initial solutions are given. It is argued that the kernel $K_{ij}\sim(ij)^\omega$ with $\omega\simeq1-1/d$ (d is dimensionality) effectively models the sol-gel transformation in polymerizing systems and approximately accounts for the effects of cross-linking and steric hindrance neglected in the classical theory of Flory (1953) and Stockmayer (1943) ($\omega=1$). For all ω the exponents, $\tau=\omega+3/2$ and $\sigma=\omega-1/2$, $\gamma=(3/2-\omega)/(\omega-1/2)$ and $\beta=1$, characterize the size distribution, at and slightly below the gel point, under the assumption that scaling is valid. (36 refs.)

103602 Particle size from optical anisotropy effects in scattered light. J.C.Ravey, P.Mazeron (Lab. de Biophys. Moleculaire, Univ. de Nancy I, Vandoeuvre les Nancy, France).
Polymer (GB), vol.24, no.8, p.991-4 (Aug. 1983).
An original light-scattering method often suitable for the case of anisotropic particles is explained. Two particular values of the scattering angle θ are needed: θ_m, the angular position of the minimum of the H_h component, and θ_0, the angular value for which $H_h=V_v$. This method has been successfully applied to the case of copolymer single crystals. (10 refs.)

103603 Light-scattering studies of hydroxyethylcellulose in water/nonionic surfactant binary mixtures. Evidence for preferential solvation of polymer chains by surfactant micelles. Y.Boscher, F.Lafuma, C.Ouivoron (Lab. de Phys.-Chimi. Macromoleculaire, ESPCI, Paris, France).
Polym. Bull. (Germany), vol.9, no.10-11, p.533-6 (April 1983).
The authors report the occurrence of interactions innonionic polymer (hydroxyethylcellulose:HEC)/nonionic surfactant (polyethylene oxide nonly phenyl ether) systems through light-scattering studies, in a given composition range of the binary mixture H_2O/surfactant, preferential solvation by surfactant micelles is observed. The variation of the preferential adsorption coefficient with surfactant concentration is governed by the size of the micelles. (9 refs.)

103604 Adsorption of polysaccharides on a calcite using spin labelled polymers. M.Rinaudo, C.Noik (Centre de Recherches sur les Macromolecules Vegetales, Univ. Sci. et Medicale de Grenoble, Grenoble, France).
Polym. Bull. (Germany), vol.9, no.10-11, p.543-7 (April 1983).
The experimental results given concern the preparation of spin labelled amylose and amylopectins. These polymers are then used to investigate the adsorption on a calcite dispersed in water. From analysis of the electron spin resonance spectrum, the fractions of monomers involved in trains (p) are deduced; the dependence of p on the molecular weight of the amylopectins and the molecular structure of the polymers are discussed. (7 refs.)

103605 An observation on the Han-Villamizer critical pressure concept in thermoplastic foams. J.L.Throne (Amoco Chemicals Corp., Naperville, IL, USA).
Polym. Eng. & Sci. (USA), vol.23, no.6, p.354-5 (April 1983).
Draws together the Han-Villamizar (1978) experimental observations in the critical pressure at which gas bubbles became visible in flowing thermoplastic melts and a simple method of predicting the equilibrium pressure based on gas solubility. It is shown that the observed pressure is 40 to 75 per cent of the calculated pressure. (7 refs.)

103606 Influence of the nature of the supporting electrolyte on the adsorption of substances forming two-dimensional condensed layers at the mercury/electrolyte interface. E.V.Stenina, N.P.Kolobaeva, B.B.Damaskin, N.V.Fedorovich (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Sov. Electrochem. (USA), vol.18, no.10, p.1155-60 (Oct. 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.10, p.1299-304 (Oct. 1982).
The influence of the nature and concentration of the supporting electrolyte on the adsorption of substances which form two-dimensional condensed layers has been investigated by recording C-E and C-t curves. The choice of spatial isomers of adamantanol and borneol as objects of investigation makes it possible to attribute all the differences in the kinetics of the formation of the condensed layers of these isomers to the different conditions for the occurrence of the respective adsorption steps. The specifically adsorbed background ions and the concentration of the supporting electrolyte have a strong influence on the range of potentials for the adsorption of the surfactants and the kinetics of the filling of the surface. (8 refs.)

103607 Determination of adsorption parameters of two-dimensional condensed layers of organic compounds from experimental C vs. E curves. E.V.Stenina (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Electrochem. (USA), vol.18, no.10, p.1199-203 (Oct. 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.10, p.1349-52 (Oct. 1982).
For cases where the attraction constnant (α) and the capacity at limiting coverage (C') are linear functions of potential, a method of calculating the adsorption parameters of organic compounds is suggested which is based on an analysis of desorption potential as a function of concentration of the organic material. The accuracy is estimated with which adsorption parameters can be calculated by this method, both in the above situation and in the similar case where α and C' do not change with potential. This estimate is obtained with the aid of simulated $j\phi_d$ vs. ln c curves. (3 refs.)

Sol-gel transition .... See Entry 99058

Measurements of the size and position of aerosol droplets using holography .... See Entry 99080

Investigation of the interaction of diglycidol ether of methylphosphonic acid with gelatin .... See Entry 99216

Relaxation processes in emulsion microcrystals of silver halides with adsorbed dyes .... See Entry 99221

Influence of the rate of deformation of a photographic emulsion jet during extrusion on the magnitude of maximum elongation emulsification .... See Entry 99223

Theory of double-jet emulsification (review) .... See Entry 99225

Thermal conductivity of plastic foams .... See Entry 101017

On a relaxing model for the flow of a mixture of gas with porous particles .... See Entry 101310

Small-angle Newton scattering from H_2O/D_2O solutions of a sodium alkylbenzenesulfonate having a branched alkyl group (neutron scattering) .... See Entry 101540

Effect of water on the crystallization of Li_2O-SiO_2 glasses and gels .... See Entry 101586

Recent studies of radiation induced F-center and colloid particle formation in synthetic NaCl and natural rock salt .... See Entry 101799

Thin films and froth flotation .... See Entry 102125

Role of surface interactions in stratification of magnetic fluids .... See Entry 102728

The concentration process in the formation of development centres in silver halide microcrystals .... See Entry 103555

Spectrophotometric investigation of the process of colour centre rearrangement during the fixation of a photochemically coloured emulsion ... See Entry 103563

82.80 CHEMICAL ANALYSIS AND RELATED PHYSICAL METHODS OF ANALYSIS

103608 Photodiode array detectors for LC. S.A.Borman.
Anal. Chem. (USA), vol.55, no.8, p.836a-42a (July 1983).
The growing importance and advantages of photodiode array detectors for liquid chromatography are discussed. (5 refs.)

103609 Structure determination of carbonates and diglycol carbonates by gas chromatography-mass spectrometry. S.P.Griff (Dart & Kraft Inc., Paramus, NJ, USA).
Appl. Spectrosc. (USA), vol.37, no.4, p.354-7 (July-Aug. 1983).
The use of spectroscopy and chromatography permitted the elucidation of the structures of various carbonates and diglycol carbonates as well as the prediction of fragmentation pathways for these classes of compounds. (1 ref.)

103610 Geothermal analysis at the wellhead. C.Lawrence.
EPRI J. (USA), vol.8, no.6, p.28-32 (July-Aug. 1983).
EPRI's mobile laboratory allows precise on-site chemical analyses of geothermal fluids to mitigate problems of corrosion and scale. The development and facilities offered by this mobile laboratory are briefly described. (no refs.)

103611 Robust estimation in pulse fluorometry. A study of the method of moments and least squares. I.Isenberg (Dept. of Biochem. & Biophys., Oregon State Univ., Corvallis, OR, USA).
Biophys. J. (USA), vol.43, no.2, p.141-8 (Aug. 1983).
Most laboratories use least-squares iterative reconvolution (LSIR) as a routine method for estimating decay parameters in pulse fluorometric data. It is shown here, however, that LSIR is very sensitive to small amounts of error in the data whenever two decays become too close to one another, or whenever analyses of three decays are attempted. In such cases, inferior methods of estimating integrals, small zero point shifts, or small errors in the measured exciting light will result in failures of least squares, where the method of moments, with moment index displacement and λ invariance testing, will succeed. The method of moments is therefore robust with respect to such errors while least squares is not. (27 refs.)

103612 The combined use of chromatography and the mass spectrometer in industrial application. M.O.Mizier.
Regul. & Mando Autom. (Spain), vol.17, no.129, p.87-92 (June 1983). In Spanish.
The article describes the combined use of chromatography (in the gas and liquid phases) and the mass spectrograph as a powerful means of identifying and quantifying the composition of mixtures which occur in toxicology, pharmacology, and in the oil, perfumery and food industries. The process consists in using chromatography to separate the constituents of the mixture and the mass spectrometer to identify them. It discusses gas- and liquid-phase chromatography, the mass spectrometer, and the two resulting interfaces, with examples of the available apparatus and a description of various methods of ionisation in mass spectrography. (no refs.) *C.J.O.G.*

103613 Absolute α-induced thick-target gamma-ray yields for the elemental analysis of light elements. R.Lappalainen, A.Anttila, J.Raisanen (Dept. of Phys., Univ. of Helsinki, Helsinki, Finland).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.441-4 (1 July 1983).
A systematic study of the absolute thick-target yields of prompt γ-rays following $^4He^+$ bombardment has been carried out at $E_\alpha=2.4$ MeV for the elements $Z=3$-9, 11-14. The spectra of interest are depicted and a table of the most suitable γ-rays for elemental analysis is given. The detection limits are given under practical measuring arrangements. The advantage of the method is its good sensitivity for the detection of Li, Be, B and F on the ppm level even in samples containing high concentrations of other light elements such as Na, Mg and Al. (10 refs.)

103614 Application of coincidence techniques to X-ray fluorescence analysis. P.Puumalainen, P.Sikanen (Dept. of Phys., Univ. of Kuopio, Kuopio, Finland).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.463-7 (1 July 1983).
Two methods are presented for the reduction of background in X-ray fluorescent spectra. This is achieved by requiring coincidence between either the photoelectron and the characteristic X-ray or the K- and L-characteristic X-rays of the element of interest. This results in about one order of magnitude loss in the count rate of characteristic X-rays, which can be compensated for by increasing the intensity of the X-ray source. An advantage of the method is that there are virtually no background counts in the spectra. (9 refs.)

103615 Polarisation properties of bremsstrahlung produced by electron opaque targets of low-Z elements with application to X-ray fluorescence analysis. P.Sikanen, P.Puumalainen (Dept. of Medical Phys., Univ. of Kuopio, Kuopio, Finland).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.469-73 (1 July 1983).
An X-ray tube with changeable transmission-type anode was constructed for the production of linearly polarised bremsstrahlung. For anode materials two low-Z elements, Al ($Z=13$) and Cu ($Z=29$), were chosen. Polarisation of X-rays emitted at an angle of 55° with respect to the direction of electrons was measured as a function of electron and photon energy. The X-ray source was also used in X-ray fluorescence analysis to directly excite fluorescence in the sample. A background reduction by a factor of 3.3 with respect to unpolarised excitation was observed. (12 refs.)

103616 Improved flow-through GC/IR lightpipe. S.E.Garlock (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.25, no.12, p.6709-10 (May 1983).
The effluent from gas chromatograph column is passed into a hollow lightpipe and to such additional detectors or waste, as desired, and drawn by Bernoulli effect. (no refs.)

103617 In situ investigations of the metal-compound semiconductor interaction by mass spectrometry and electrical resistance measurements. D.Szigethy, I.Mojzes, T.Sebestyen (Res. Inst. for Tech. Phys., Hungarian Acad. of Sci., Budapest, Hungary).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.1, p.117-29 (1 Aug. 1983).
The authors describe the experimental technique of an in situ mass spectrometric method proved to be suitable for studying the processes taking place during heat treatments of contacts between metals and compound semiconductors. This method was combined with an in situ electrical measurement of the voltage drop across the sample during the heat treatment. In the case of gallium arsenide, the contacts were exposed to an arsenic molecular beam for replacing the arsenic evaporated out of the contact system due to high-temperature annealing. (30 refs.)

103618 Mass spectrometric studies of impurities in silane and their effects on the electronic properties of hydrogenated amorphous silicon. R.R.Corderman, P.E.Vanier (Div. of Metall. & Materials Sci., Brookhaven Nat. Lab., Upton, NY, USA).
J. Appl. Phys. (USA), vol.54, no.7, p.2987-92 (July 1983).
The concentration of volatile impurities in silane (SiH_4) and disilane (Si_2H_6) used to prepare hydrogenated amorphous silicon (a-Si:H) thin films by glow-discharge deposition has been measured by modulated molecular beam mass spectrometry with a sensitivity of 1 ppm. From dark conductivity measurements on these films the location of the Fermi energy E_F was determined. The Fermi levels of a-Si:H films were progressively lower with increasing concentrations of chlorine-containing molecules (mostly HCl and SiH_3Cl) in the silane, indicating that these species can act as weak p-type dopants in a-Si:H. Oxygen-containing species (mostly SiH_3OSiH_3) were also detected in silane. It is clear from these results that large variations in electronic properties of glow discharge a-Si:H can be attributed to differences in purity of silane used in the deposition. (35 refs.)

103619 Radiation damage to lyophilized mineral solutions during electron probe analysis: quantitative study of chlorine loss as a function of beam current-density and sample mass-thickness. A.F.Le Roy (Biomedical Engng. & Instrumentation Branch, Nat. Inst. of Health, Bethesda, MD, USA), N.Roinel.
J. Microsc. (GB), vol.131, pt.1, p.97-106 (July 1983).
Results are reported for chlorine loss from lyophilized deposits with mass-thickness varying between 5 and 50 mg mm^{-2} for NaCl salts and 5 and 80 mg mm^{-2} for KCl salts. Electron accelerating voltage was kept constant at 15 kV. The range of beam current-density (I/S, current/sample surface area) was from 0.1 to 1.5 A mm^{-2}. Samples were irradiated for 1200 s. The results show that under some conditions there is a period of stable chlorine signal before chlorine loss occurs. This is observed between 0.1 and 1 A mm^{-2}, for a period which can last several hundred seconds depending on beam current-density and sample mass-thickness. For each value of I/S, however, no stable chlorine signal can be observed for samples whose mass-thickness exceeds a value negatively correlated with I/S. The curves of decrease of characteristic chlorine X-ray signal (expressed as per cent of count rate in the initial counting interval) versus irradiation time can be fitted by the sum of two exponentials with half lives T_1 and T_2. In NaCl, T_1 and T_2 values are highly correlated with I/S but not with mass-thickness. In KCl, T_1 is correlated only with mass-thickness and T_2 only with I/S. Mixing plasma with mineral solutions prevents chlorine loss. (29 refs.)

103620 A statistical method for the analysis of quantitative thin-film X-ray microanalytical data. D.F.Blake (Dept. of Geological Sci., Univ. of Michigan, Ann Arbor, MI, USA), A.M.Isaacs, R.H.Kushler.
J. Microsc. (GB), vol.131, pt.2, p.249-55 (Aug. 1983).
A series of equations is presented through which thin-film X-ray microanalytical data may be characterized statistically. Test statistics based on the Gaussian distribution are then presented, together with examples of the use and evaluation of an empirically derived Mg/Ca working curve. (8 refs.)

103621 High-performance ion-exchange chromatography of alkali metals with conductivity detection. M.Ahmad, Attiq ur Rehman Khan (Pakistan Inst. of Nuclear Sci. & Technol., Nilore, Pakistan).
Nucleus (Pakistan), vol.18, no.4, p.29-35 (Oct.-Dec. 1981).
High-performance ion-exchange chromatography of alkali metal and ammonium ions was studied using a conductivity meter as detector. Dilution with 0.003 N nitric acid gave excellent resolution. Sensitivity levels, for a 200 μl injection, vary from 5 ppm for potassium to 0.1 ppm for lithium. A method to decrease retention times by reducing the exchange capacity of the cation exchange column used, by loading it with calcium ions, without affecting the resolution, has been described. Application of the method to water, soil and uranium dioxide samples has been demonstrated. (8 refs.)

103622 Transient decay following pulse excitation of diffuse scattering samples. R.W.Kessler, G.Krabichler, S.Uhl, D.Oelkrug (Inst. fur Phys. und Theoretische Chem., Univ. Tubingen, Tubingen, Germany), W.P.Hagan, J.Hyslop, F.Wilkinson.
Opt. Acta (GB), vol.30, no.8, p.1099-1100 (Aug. 1983).
Analytical solutions are examined in order to predict how the measured decrease in diffuse reflectance observed in the flash photolysis of powdered samples is related to the concentration of a transient absorbing species. It is shown on the basis of these calculations that when the transient reflectance changes by less than 10 per cent, the change in reflectance is a linear function of transient concentration. Experimental evidence supporting this conclusion is presented from studies of the triplet state of coronene chemisorbed on γ alumina where the concentration of the excited state can also be monitored by measuring luminescence intensity, which is shown to have a virtually identical dependence on the excited state concentration as the transient change in reflectance due to triplet-triplet absorption. Since the luminescence intensity is a linear function of the transient concentration, it follows that this is also true for the transient reduction in diffuse reflectance. Non-exponential decay of the transient reflectance of electronically excited molecules as a function of time may be observed because of heterogeneous adsorption. (9 refs.)

103623 Measurement of metastable atom microconcentrations in a molecular beam by resonant laser fluorescence. V.E.Dobryshin, V.I.Rakhovskii, V.M.Shustyakov.
Opt. & Spectrosc. (USA), vol.54, no.1, p.37-40 (Jan. 1983). Translation of: *Opt. & Spektrosk. (USSR)*, vol.54, no.1, p.68-72 (Jan. 1983).
A method is described for making absolute measurements of metastable atom microconcentrations in a molecular beam using the resonant fluorescence excited by a single-frequency dye laser. Absolute measurements of the concentrations of calcium atoms in metastable states $4^3P_{0,1,2}$ are presented. The relative error of these absolute measurements does not exceed 21% at a concentration of the order of 10^4 cm^{-3}. (7 refs.)

103624 End group determination in hydroxyl-telechelic polyisobutylenes by infrared spectroscopy. V.S.C.Chang, J.P.Kennedy (Inst. of Polymer Sci., Univ. of Akron, Akron, OH, USA).
Polym. Bull. (Germany), vol.9, no.10-11, p.518-24 (April 1983).
A convenient method for the quantitative determination of terminal hydroxy functionality of linear α,ω-di (hydroxy)-polyisobutylene and tri-arm star α,ω,δ-tri(hydroxy)polyisobutylene has been developed and evaluated. The method involves infrared quantitation of the free OH absorption at 3640 cm^{-1} by the use of long path liquid cells in very dilute CCl_4 solution (i.e. in a range where H bridges are absent) in conjunction with M_n determination (vapor phase osmometry or gel permeation chromatography). The results obtained by this method confirm earlier end-group analysis data obtained by more cumbersome methods and indicate that the number of OH end-groups in α,ω-di(hydroxy)polyisobutylene and α,ω,δ-tri(hydroxy)polyisobutylene produced by the infrared technique is 2.0 ± 0.1 and 3.0 ± 0.15, respectively. (31 refs.)

103625 A quantitative atom-probe field-ion microscope study of the compositions of dilute Co(Nb) and Co(Fe) alloys. R.Herschitz, D.N.Seidman (Dept. of Materials Sci., Cornell Univ., Ithaca, NY, USA).
Surf. Sci. (Netherlands), vol.130, no.1, p.63-88 (July 1983).
The compositions of Co-1.0 at.%Nb and Co-1.0 at.%Fe alloys have been measured using the atom-probe field-ion microscope. The main purpose of this experimental work was to find a set of optimum conditions which gives the correct solute concentrations in these alloys. This information was necessary for measuring the absolute compositions, in extensive investigations of solute atom segregation effects to individual stacking faults in these alloys. The dependence of each alloy's composition on the following parameters was inves-

tigated: (1) the specimen temperature; (2) the pulse fraction; (3) the field-evaporation rate; (4) the crystallographic plane; (5) the effect of the presence of hydrogen in the atom-probe on the measured Nb composition in a Co-1.0 at.%.Nb alloy. It is shown that the composition determined by the atom-probe FIM is very sensitive to some of the parameters listed above. The effects of these experimental parameters on the measured Nb and Fe concentrations are discussed in terms of possible field-evaporation models. Under certain experimental conditions drastically different behavior has been observed in these alloys; preferential field-evaporation of solute atoms in a Co-1.0 at.%Fe alloy and preferential retention of solute atoms in a Co-1.0 at.%Nb alloy was observed. Correct solute concentrations were obtained by using the following experimental parameters: (1) a specimen temperature of less than or equal to 60K; (2) a pulse fraction of greater than or equal to 0.10. (50 refs.)

103626 Surface analysis by XPS, AES and SIMS method in the Leybold Heraeus LHS 10 system. R.Wechsung (Leybold Heraeus GmbH, Cologne, Germany).
Vide les Couches Minces (France), vol.38, no.217, p.309-31 (May-July 1983). In French.
Attempts to introduce the principles of the various surface analysing methods. Typical examples are given which demonstrate the wide range of applications of these methods. In spite of the rapid development of surface analysing techniques within the last few years, their adoption in industry is just beginning. It is hoped that in the near future the analysing apparatus will be used not only for solving basic problems but also for routine analysis and process control. (10 refs.)

103627 The surface geometrical structure effect in X-ray fluorescence analysis of metallic samples. W.Stankiewicz, A.Fudal, M.Wojtowicz (Inst. of Non-Ferrous Metals, Gliwice, Poland).
X-ray Spectrom. (GB), vol.12, no.3, p.92-6 (July 1983).
The results of investigation into the effect of geometrical surface structure in X-ray fluorescence analysis of Cu-Ni alloy are presented. The experimental materials were samples of spectrometric standard quality, in which surfaces were especially prepared by grinding and polishing. The surface state was estimated qualitatively, using a scanning electron microscope, and quantitatively, using a profilograph, by the determination of the roughness parameters R_a and R_z. The relationships between the roughness parameters and Cu, Ni and Si fluorescent radiation intensities, as well as the scattered radiation from the X-ray tube anode element were established. The optimum range of the surface state for a given alloy has been defined. (6 refs.)

FTIR in the service of art conservation ....See Entry 98715

Profile deconvolution method for small computers ....See Entry 99085

A rapid-response recording system for electrothermal atomic absorption spectrophotometry ....See Entry 99086

Formation of an absorbing layer of atoms in semiclosed atomizers for atomic absorption spectrometry. Small atomizers ....See Entry 99198

Boolean logic system for infrared spectral retrieval ....See Entry 99206

Development of a totally computer-controlledl triple quadrupole mass spectrometer system ....See Entry 99230

Design and operating characteristics of a retarding field energy analyzer-quadrupole mass filter for measurement of energy distribution of thermal ion ..
....See Entry 99231

Uncertainties in thick-target PIXE analysis ....See Entry 99234

Abbreviations for microscopical and analytical methods ....See Entry 99241

Selective detection of ultra-low concentration of atomic cesium by laser radiation ....See Entry 100330

Effect of matrix on the magnetic enhancement of spectral lines in the DC arc
....See Entry 101490

Observations on the structure, stability and transformations of the graphite: $SbCl_5$ intercalate ....See Entry 101643

Surface variations in chemical composition of titanium disulphide single crystals ....See Entry 102128

Optical absorption of transition metal ions in silica coating films prepared by the sol-gel technique ....See Entry 102974

Correlation between energy distribution of Sr^+ thermal ion and mass spectrometric thermal analysis for SrO-W system ....See Entry 103025

Influence of crystalline perfection and surface species on the X-ray photoelectron spectra of natural and synthetic graphites ....See Entry 103027

The effect of Mo^{5+} ions (in the presence of Mo^{6+} ions) on the elastic moduli of molybdenum phosphate glasses ....See Entry 103195

Distribution of elements according to the thickness of anodic oxide films on gallium arsenide ....See Entry 103362

Resonance neutron radiography ....See Entry 103484

Pyrolysis effects on the reactions of alkoxide anions ....See Entry 103505

Gas-liquid chromatographic and nuclear magnetic resonance study of haloform+di-*n*-alkyl ether+*n*-alkane mixtures at 30°C ....See Entry 103576

Study of a lithium-lithium propionate electrode in propylene carbonate ....
....See Entry 103676

Determination of arsenic and phosphorus compounds in groundwater with reduced molybdenum blue ....See Entry 103766

Preconcentration of trace elements in natural water with cellulose piperazinedithiocarboxylate and determination by neutron activation analysis ....
....See Entry 103767

Determination of hexachloroacetone in air ....See Entry 103768

Time-resolved laser-induced breakdown spectrometry of aerosols ....
....See Entry 103769

Determination of ethylene and other reactive hydrocarbons in the atmospheric air at Trombay, Bombay by gas chromatography using a chemiluminescent detector ....See Entry 103771

The measurement of fluorine concentration in environmental samples by using $^{19}F(p,\alpha\gamma)^{16}O$ prompt nuclear reaction analysis ....See Entry 103773

Mossbauer spectroscopic analysis of iron in soils and rocks in the eastern Himalayan foothill region ....See Entry 104354

On uranium concentration in water ....See Entry 104415

Determination of iron contents in boreholes by neutron capture method ....
....See Entry 104581

86.00 ENERGY RESEARCH AND ENVIRONMENTAL SCIENCE

Greater Los Angeles Area Energy Symposium ....See Entry 98649

86.10 ENERGY RESOURCES AND THEIR UTILISATION

(inc. economic aspects; for nuclear engineering and nuclear power studies, see 28.00)

103628 Economic aspects of the utilization of regenerative sources of energy. H.-J.Ziesing (Deutsches Inst. fur Wirtschaftsforschung, Berlin, Germany).
Energiewirtsch. Tagesfragen (Germany), vol.33, no.7, p.435-42 (July 1983). In German.
Discusses legal, financial and industrial aspects of utilization of sources of energy in West Germany, with statistics. Nearly 5% of the GNP is spent on importing energy carriers. (29 refs.) *J.S.*

103629 The investment demand in energy and its dependence upon a consistent energy policy. R.von Bennigsen-Foerder.
Elektrotech. Z. ETZ (Germany), vol.104, no.13, p.641-3 (July 1983). In German.
The author states that with the end of the usual expansion in energy demand, competition between energy sources increases the importance of an economic energy policy including a revision of the attitude to coal as a favoured fuel. The falsehood of relating an increase in GNP to an equivalent increase in energy consumption is exposed. The author lays great emphasis upon the need for research in energy techniques without indicating which direction this should take. It is stressed however that the guidelines 'security of supply' and 'favourable price'—relative to today's energy situation—should not influence the path taken by research. (no refs.) *H.G.*

103630 The mathematical analysis on an efficient use of energy. H.Ohkubo, A.Suzuki, R.Kiyose (Dept. of Nuclear Engng., Univ. of Tokyo, Tokyo, Japan).
J. Fac. Eng. Univ. Tokyo Ser. B (Japan), vol.36, no.4, p.787-826 (Sept. 1982).
A basic question addressed here is how efficiently are limited energy resources such as oil consumed and can advanced energy such as nuclear be introduced. The definition of efficiency, therefore, is not in terms of thermodynamics but the most economical long-term allocation of energy. A number of investigators have applied the theory of dynamic linear programming for this question. Here, major attention is paid to a theoretical analysis on the shadow price of each constraint, which is a principal indicator of the efficiency, and to make a mathematical formulation on the technological progress factor, which is more or less inherent for advanced energy. For example, the types of constraints is classified mathematically and the general formula is derived to show the relation between shadow price for each constraint and marginal production cost of energy. The efficiency of a long-term nuclear fuel cycle system is examined as a representative to conclude that the marginal production cost of plutonium is quite sensitive to the assumption of the technological progress factor. (21 refs.)

103631 Australian energy supply/demand pattern changes since 1977. E.D.J.Stewart, B.B.Bennett, G.M.Folie, N.A.Galwey, J.C.Miller, J.L.Symonds, J.Tysoe.
Energy 83. Towards an Energy Policy for Australia, Canberra, Australia, 11-13 May 1983 (Barton, Australia: Instn. Eng., Australia 1983), p.18-43
The paper reviews the changes in the Australian energy supply/demand patterns since the time of the Energy 1977 Conference organised by The Institution of Engineers, Australia. The paper consists of a section presenting an overview of the total Australian energy scene with special attention to the policies and actions of Government and their impacts plus a second section consisting of individual reviews of specific primary energy sources—black coal, brown coal, petroleum, minor energy sources, natural gas, uranium and electricity. (no refs.)

103632 Economic aspects of energy policy. G.W.Edwards.
Energy 83. Towards an Energy Policy for Australia, Canberra, Australia, 11-13 May 1983 (Barton, Australia: Instn. Eng., Australia 1983), p.44-52
Economic studies of energy resources can be divided into two broad categories. One category can be termed 'macroeconomic'. Examples of such studies are provided by Vincent, Dixon, Parmenter and Sams (1979, 1980). The first of these studies was concerned with the effects of an Australian policy change (the adoption of import parity pricing for Australian crude oil in 1978) on such variables as employment, GDP and rural incomes. In the second study the effects of increases in world energy prices on variables of interest were examined. The second category of studies can be labelled 'resource allocation'. The emphasis in these is on the effects of various arrangements in the energy economy, and elsewhere in the economy, on the economic efficiency of energy production, consumption and trade. The orientation of the paper places it in the second category. (28 refs.)

Energy 83. Towards an Energy Policy for Australia ....See Entry 98613

86.10B Fossil and other fuels

103633 The contribution of coal for future energy requirements. D.S.Smith.
Electr. Energ.-Electron. (Portugal), no.188, p.261-7 (June 1983). In Portuguese.
The opening section gives a brief history, from about 1950, of the energy market. The increases in oil prices from 1973 are emphasised, as are some important political factors. A table gives the world energy balances for 1950, 1960, 1970 and 1973, split into coal, oil, gas and other forms. The case for coal is then presented as a secure and competitive commodity, fairly well distributed. A table shows the estimated recoverable quantities of oil, gas and coal over the Communist and non-Communist blocs. Further tables give energy reserves and consumption for these blocs in 1981, inter-regional coal commercial activities and world annual coal consumption in 1980. Details are given of coal utilisation in the electricity, cement and general industries. Some views of the European market are given. (no refs.) *G.V.D.*

103634 Coal classically. Comparison and evaluation of selected possibilities of coal utilisation. H.Klaiss, H.Steeb.
Energie (Germany), vol.35, no.6, p.152-8 (June 1983). In German.
Gives statistical data on world energy resources, coal resources in various countries and primary energy consumption in West Germany by sectors. Some techniques of coal utilisation are compared and their relative methods

assessed from energy, pollution and economic considerations. It is concluded that whatever, constraints might apply to future energy supplies, coal will play a dominant role, that, at present, classical methods of coal utilisation such as direct combustion and heat/power generation with their good efficiency and low pollution appear best from resource conservation aspects and that coal enrichment does not offer advantages over conventional combustion techniques. (22 refs.) *P.G.R.*

103635 The future role of oil and natural gas in the Soviet Union. A.F.G.Scanlan (BP, London, England).
Energiewirtsch. Tagesfragen (Germany), vol.33, no.7, p.465-9 (July 1983). In German.
Discusses the internal and international consequences of the stagnation of oil production in and export of natural gas from the Soviet Union, with statistics. (no refs.) *J.S.*

103636 Prospects for coal: technical developments. W.G.Kaye (National Coal Board, Cheltenham, England), T.J.Peirce.
Phys. Technol. (GB), vol.14, no.4, p.183-9 (July 1983).
The price advantage of UK coal over oil and gas suggests that it will regain a major share of the industrial energy market as the economy recovers. The development of efficient and reliable methods of coal burning is discussed. (4 refs.)

103637 Coal. T.G.Callcott, H.R.Goode, N.A.Brown, J.Cramsie, R.G.Davies, M.A.Johnson, G.R.Rigby, F.F.Roxborough, I.McC. Stewart, K.Sullivan.
Energy 83. Towards an Energy Policy for Australia, Canberra, Australia, 11-13 May 1983 (Barton, Australia: Instn. Eng., Australia 1983), p.141-66
This paper sets out information, from the Australian perspective, under the following main headings; resources, production, transport and handling, demand and technology. (8 refs.)

103638 Synthetic liquid fuels in Australia. R.A.Durie, G.R.Drewe, P.Huggins, I.McC. Stewart.
Energy 83. Towards an Energy Policy for Australia, Canberra, Australia, 11-13 May 1983 (Barton, Australia: Instn. Eng., Australia 1983), p.167-98
The paper briefly examines the future needs for synthetic liquid fuels in Australia and the potentials offered by coal, oil shale and natural gas as feedstocks. The current status of the technologies, under development, for producing liquid fuels from these nonrenewable fossil feedstocks, are reviewed, and problems/challenges to be faced in establishing a synthetic fuels industry in Australia, are identified and discussed. (18 refs.)

103639 Liquid fuels-petroleum. A.L.Salusinszky, H.W.Baddams, J.Harry, D.Nicklin, T.Ramsey, I.Shedden, G.Shiels.
Energy 83. Towards an Energy Policy for Australia, Canberra, Australia, 11-13 May 1983 (Barton, Australia: Instn. Eng., Australia 1983), p.197-205
In the past five years Australia's transport fuel outlook has changed substantially. On the supply side of the balance the assessment of the known indigenous crude oil fields has improved to such an extent that peak production instead of declining from 1980, as was expected, can now be maintained at least to the middle of this decade. Furthermore, with the intensified exploration activity, which doubled in the last five years, there is at least a fifty percent chance that further discoveries will permit to maintain present production level until about 1990. In spite of the more optimistic outlook with respect to petroleum product supply in the 80s, Australia may be hit by emergency-caused interruptions in crude oil imports. Probably such interruptions will be short lived but a policy for increased storage of critical products could do much to blunt the impact of such occurrences. The situation of the 90s is difficult to predict but most probably indigenous crude oil supply in relation to liquid fuel demand will decrease. As a result beside imported crude oils liquid fuels derived from other sources, such as shale, tar, coal and natural gas may be required to supplement production. The burden of the high cost of the new fuels could be distributed more evenly by controlling the level of indigenous crude oil production in the 80s: an almost impossible political task. (4 refs.)

103640 Gas supply until 2000: some policy options. R.D.Palmer, D.Boddam-Whetham, J.Burnside, P.R.Eiszel, J.E.Hayes, R.Hutchinson, D.Polglaze.
Energy 83. Towards an Energy Policy for Australia, Canberra, Australia, 11-13 May 1983 (Barton, Australia: Instn. Eng., Australia 1983), p.206-35
Australia has large gas reserves, but the location of the majority of these reserves is a long way from the main centres of demand. When the forecast demand for gas is matched against the existing supplies, it is apparent that the supply/demand matching problem is very different for the various gas companies. This paper looks at reserves and demand State by State. It then looks at the various ways the gas supply can be supplemented when the existing contracts expire or the presently declared reserves are finally depleted. The various options looked at include pipelining gas from other reserves, the use of liquified natural gas from Australian resources, and the manufacture of substitute natural gas. Some cost estimates are given for these. Most of the demand for gas is for heating purposes. However, gas is a valuable chemical feedstock, and some of these uses are discussed, and their potential demand for gas compared with the gas reserves. The use of gas as a transport fuel is also discussed. It can be concluded that Australia's known gas reserves are sufficient to last well into the next century if agreement can be made about how these reserves should be shared. The uncertainty about the level of future gas prices and the size of gas reserves can only extend the currently estimated life of the reserves. The technology to manufacture gas from a wide range of coals and oils is available elsewhere in the world, and little development will be required to adapt it to Australian feedstocks. The price of the gas so produced will be competitive with oil and should ensure a market for gas into the foreseeable future. (56 refs.)

103641 Energy from biomass. R.G.H.Prince, J.P.Barford, D.Barrett, R.B.Brooks, I.Gorrie, P.F.Greenfield, J.S.Keniry, K.D.Kirby, A.G.Lane, I.G.Prince, B.J.Ralph, P.A.D.Rickard, G.A.Stewart, B.Wonder.
Energy 83. Towards an Energy Policy for Australia, Canberra, Australia, 11-13 May 1983 (Barton, Australia: Instn. Eng., Australia 1983), p.254-64
Biomass is a convenient term to broadly describe a wide range of materials of biological origin. By far the greatest quantity of biomass is in the form of plant cellular material, derived via the process of photosynthesis from incident solar radiation. Biomass has long been used as food, fibre, fuel and chemicals. As an energy resource it may be used in a multiplicity of ways. Unlike conventional fossil fuels, carefully managed biomass can be considered a renewable energy resource. (15 refs.)

103642 Energy use—transport. N.F.Gentle.
Energy 83. Towards an Energy Policy for Australia, Canberra, Australia, 11-13 May 1983 (Barton, Australia: Instn. Eng., Australia 1983), p.298-315
The 1977 Task Force made ten recommendations with respect to transport. These recommendations were: 1. Fuel economy goals for motor vehicles to be prescribed. 2. Review of motor vehicle emission standards. 3. Emphasis should be placed on energy conservation in traffic management. 4. Emphasis should be placed on energy conservation in transport planning. 5. More effective use of motor cars should be emphasised. 6. Emphasis should be placed on energy efficient transport. 7. The use of LPG for certain vehicle fleets should be encouraged and implemented as a matter of urgency. 8. The feasibility of introducing synthetic liquid fuels compatible with motor gasoline should be investigated. 9. Electric powered transport should be encouraged. 10. The long term development of energy efficient land uses should be investigated. The main emphasis of this paper relates to Recommendation 5 (more effective use of motor cars) and Recommendation 6 (energy efficient transport). The paper also includes a discussion on Recommendation 9 (electric powered transport). (36 refs.)

103643 Energy use and conservation in buildings. R.J.Roennfeldt, E.R.Ballantyne, A.M.Brown, A.J.Cummine, A.van Ocken.
Energy 83. Towards an Energy Policy for Australia, Canberra, Australia, 11-13 May 1983 (Barton, Australia: Instn. Eng., Australia 1983), p.316-29
This report identifies changes in energy use in Australian residential, commercial, institutional and industrial buildings for the period 1977 to 1982 and discusses the actions and initiatives which were significant determinants of these changes. It assesses the potential for future reductions in energy use in buildings and proposes strategies to assist this process. (15 refs.)

The case for solar/hydrogen energy ....See Entry 103652

Coal gas as a feed fuel for phosphoric acid fuel cell power plants ....See Entry 103680

Biomass as an energy source ....See Entry 103708

Hydrogen as the source of energy in internal combustion engines ....See Entry 103731

86.10D Wind energy

103644 Wind energy—a utility perspective. K.T.Fung, R.L.Scheffler, J.Stolpe (Southern California Edison Co., Rosemead, CA, USA).
Greater Los Angeles Area Energy Symposium, Los Angeles, CA, USA, 28 Oct. 1980 (North Hollywood, CA, USA: Western Periodicals Company 1980), p.210
Of all the renewable energy systems, wind turbine generators are likely to make the earliest significant cost-effective contribution to the utility grid. This paper presents issues facing the utility industry relating to implementation of and effective wind energy program. The Company's wind energy program is presented, which is designed to provide pertinent answers to the technical, economic and environmental issues concerning WTG installations and their commercial visibility. (no refs.)

86.10H Geothermal energy

103645 Geothermal power generation—an aggressive utility program. G.K.Crane (Southern California Edison Co., Rosemead, CA, USA).
Greater Los Angeles Area Energy Symposium, Los Angeles, CA, USA, 28 Oct. 1980 (North Hollywood, CA, USA: Western Periodicals Company 1980), p.203-4
While water-dominated geothermal resources with potential for large scale power generation have been known to exit in Southern California for many years, they have not yet been commercially developed. The Company as well as other utilities and resource production companies have made major commitments to the development of geothermal resources located in the Imperial Valley. Edison's program includes the construction of three flash steam power plants with varying objectives and designs which will assist in assessment of the feasibility of hot water geothermal as a base load generation option. (no refs.)

103646 Efficiency of geothermal energy use in a non-electrical application. A.Naimpally (California State Univ., Long Beach, CA, USA).
Greater Los Angeles Area Energy Symposium, Los Angeles, CA, USA, 28 Oct. 1980 (North Hollywood, CA, USA: Western Periodicals Company 1980), p.205-9
Using the thermodynamic concept of 'energy availability', a study of the efficiency of geothermal energy usge in evaporators is performed. On the assumption that the percentage of material being evaporated is constant, material and energy balances are performed for the evaporator. The standard thermodynamic definition of the 'energy availability function' is utilized to obtain an expression for the 'amount of feed processed in the evaporator per unit loss of energy availability', as a function of the temperature drop in the evaporator. The results are shown in graphical form. (3 refs.)

Changes in compressional and shear wave velocities and dynamic moduli during operation of a hot dry rock geothermal system ....See Entry 104254

Geothermic lineaments in Morocco ....See Entry 104276

Calculations on the thermal conditions around a salt diapir ..See Entry 104283

The relationship of surface γ-ray intensity with groundwater in South Spring area, Chongqing ....See Entry 104582

86.10K Solar energy

103647 Power from the Sun. Solar voltaic power in the field of rural development.
Zimbabwe Eng., vol.21, no.2, p.XXVII-XXXVII (March 1983).
Solar installations are now the most economic sources of power for certain operations in the rural areas. Analysis of the relative costs of solar energy and its competitors has shown that although the initial capital cost of the solar module is more than four times that of a diesel alternative, the difference can be recovered in four years (assuming no increase in diesel costs) as a result of the high operating expenses of alternative forms of energy. The design life of a solar panel is more than 20 years, in contrast to ten years for a diesel engine. (no refs.)

103648 Solar energy—its contribution to the future energy supply of the Federal Republic of Germany. C.-J.Winter, J.Nitsch, H.Klaiss.
Brennst.-Waerme-Kraft (BWK) (Germany), vol.35, no.5, p.243-54 (May 1983). In German.
The utilization of solar energy and the rational energy use are for the Federal Republic of Germany economic energy and environmental—politically advantageous energy supply strategies. Its potential and its range of use for the low-temperature heat and electricity supply are introduced. Speed of construction and market share are dependent on structural threshold conditions, technical progress and price development of conventional energy carriers. These dependences are mentioned. The investigations come to the conclusion that up to the year 2000 rational energy use, especially, heat insulation measures, will be the most effective means for reducing the demand for fossil energy carriers. Beyond the year 2000 regenerative energy sources can constitute up to 20 per cent of the primary energy consumption of the Federal Republic of

Germany. Furthermore, solar energy in the form of imported hydrogen from countries with high solar radiation can contribute to meet the demand. (42 refs.)

103649 Australian coal resources and its market perspective. R.R.Vine. *Electr. Energ.-Electron. (Portugal),* no.188, p.258-60 (June 1983). In Portuguese.
The paper discusses the Australian coal industry and the possibility of exports filling Portuguese requirements. A few brief details are given of known Australian resources in Queensland and New South Wales. The control of these between Federal and State governments is explained. Present annual production is given as 90 million tonnes, including 51 millions for export. The export fields are briefly discussed, including the very important European market. This is made attractive by the wide variety of Australian coal types available to suit most customers. At present 80% of Australian electricity production is based on coal. The storage and shipping infrastructures are described briefly. The Australian coal export industry is private but the government keeps a watching eye on market prices. Some recent coal industry activities in Australia are described. (no refs.) *G.V.D.*

103650 Economics of solar water heating in private households. G.Bergmann (Philips GmbH Forschungslab. Aachen, Germany).
Energiewirtsch. Tagesfragen (Germany), vol.33, no.7, p.443-7 (July 1983). In German.
Discusses cost of solar heating for domestic hot water systems, with formulae and tables of results and comparisons with heat pumps and conventional systems. Yields of 425 kWh/m^2 (annual average) can be achieved. The collector surface required is 1 m^2/person and the installation costs work out as DM 9000 for the average family using 3000 kWh per year. (13 refs.) *J.S.*

103651 Optimum power from a solar thermal power plant using solar concentrators. T.C.Kandpal, A.K.Singhal, S.S.Mathur (Centre for Energy Studies, Indian Inst. of Technol., New Delhi, India).
Energy Convers. & Manage. (GB), vol.23, no.2, p.103-6 (1983).
In this paper, the optimum temperature of operation of a solar concentrator and thus the maximum power obtained from a solar thermal power plant has been calculated. Results are plotted graphically and discussed. (no refs.)

103652 The case for solar/hydrogen energy. W.J.D.Escher (E.F. Technol., St. Johns Inc., MI, USA).
Int. J. Hydrogen Energy (GB), vol.8, no.7, p.479-98 (1983).
The Hydrogen Energy System concept is overviewed as background. A 'Solar/Hydrogen Systems Assessment' (vol.7, p.3, 1982) delineated early-availability systems based on photovoltaic, thermal/heat-engine, wind and hydropower solar conversion, and associated water electrolysis to yield product hydrogen and oxygen as 'hydrogen energy'. Most significant, both small-scale (local, dispersed) and large-scale (central, remote) solar/hydrogen generation facilities can be established in balance with prevailing societal-selection dictates. Involving a readily storable, transportable 'energy currency', existing hydrogen-energy systems can be inter-tied as desired, provided load-management-related economic advantages to both the energy-user and the 'energy utility' of that era. Future solar/hydrogen-electric residences might, buy and sell hydrogen and electricity in a 'grid-cooperative' arrangement. The salient operative question concerns the efficacy of 'conventional wisdom' in the energy free-market decision-making process. In an aura of business-as-usual, solar/hydrogen's timely contribution to 'picking up the load' from exhaustible fossil fuels in the face of still-escalating world energy demand is judged most problematic. An unprecedented cooperative world effort for the research, development, demonstration and deployment of solar hydrogen energy delivery capabilities is suggested. (13 refs.)

103653 On the use of solar energy. J.Gosse.
Rev. Energ. (France), vol.34, no.354, p.264-9 (May 1983). In French.
Solar energy was in current use by the experimental workers of the 18th century, and during the 19th century, notably through the efforts of Mouchot, aroused great interest through its industrial applications. However, the ease of use of hydrocarbons blocked further development. The difficulty of choosing any particular type of installation is described; it depends on assessment of a range of criteria whose characteristics are fundamentally different, and the relative importance to be attached to each depends on the decision-maker. The final choice is in the end a compromise based on circumstances. A simple method is defined for assessing the energy value of an installation. It is shown that a generating station using primary energy from planetary resources has an energy value dependent on the yield of the transformation from primary energy into usable energy. In the case of solar energy, the value, or profitability, is dependent on the energy investment required, principally for the manufacture of the equipment. (11 refs.)

103654 Theoretical concentration of solar radiation by central receiver systems. T.Sakurai, Y.Shibata (Tohoku Univ., Sendai, Japan).
Sol. Energy (USA), vol.31, no.3, p.261-70 (1983).
Solar concentrations by central receiver systems have been calculated theoretically for various values of obliquity of the incident radiation, assuming that plane heliostat-mirrors, sufficiently small in dimension, cover a circular field without clearance. Through this calculation, the performance characteristics of this system such as the availability of the radiant energy incident on the heliostat-field, the distribution of interruption by an adjacent mirror, the optimum rim-angle for the mean area- and the mean volume-concentration and the attainable temperature were revealed. The study was extended towards the practical problem of decreasing the number of heliostats by increasing the dimensions of heliostat-mirrors, and the effect of increasing mirror-dimensions was argued for both plane and curved mirrors. (6 refs.)

103655 Development of a point focusing collector farm system. G.Schmidt, P.Schmid, H.Zewen, S.Moustafa (Messerschmitt-Bolkow-Blohm GmbH Space Div., Munchen, Germany).
Sol. Energy (USA), vol.31, no.3, p.299-311 (1983).
A parabolic collector and thermal test loop has been operated and a small solar farm is under construction in Kuwait. Some experiences gained in the analysis and design of solar farm systems are summarized. Derived from this experience, possible future development trends of such farm systems using point focusing paraboloid collectors are outlined. (4 refs.)

103656 Statistical comparison of models for estimating solar radiation on inclined surfaces. C.C.Y.Ma, M.Iqbal (Dept. of Mech. Engng., Univ. of British Columbia, Vancouver, Canada).
Sol. Energy (USA), vol.31, no.3, p.313-17 (1983).
The objectives of this study are to compare statistically three models for estimating solar radiation on inclined surfaces and to recommend one that is general and accurate. The isotropic model, and Klucher's and Hay's anisotropic models are chosen for discussion. The hourly and daily formulations of these models are briefly described. Results show that they all produce large errors at steep slopes. The errors are minimum during the summer months. The isotropic model under-estimated consistently throughout the year resulting in the worst performance. Hay's model also under-estimated constantly but by a smaller amount. Klucher's model over-estimated in the summer and under-estimated in the winter, but can be considered just as general and accurate as Hay's model for estimating insolation on inclined surfaces. (3 refs.)

103657 Proportioning composites for efficient thermal storage walls. T.R.Knowles.
Sol. Energy (USA), vol.31, no.3, p.319-26 (1983).
Thermal storage walls for use in passive solar collectors are analyzed with the purpose of establishing guidelines for the design of low-mass, high-efficiency walls. Numerical results for the efficiency of thermal transfer are shown to be well approximated by a simple, stationary-state formula, with which general design objectives are identified, in particular the desirability of materials having prescribed thermal heat capacity and conductivity. The required proportioning of metals, masonry and phase change materials to yield materials with such properties is determined for the case of parallel layering. Illustrations of binary and ternary composites are presented. Compared with concrete, paraffin-metal mixtures are found to offer thermal storage walls having a 90 per cent reduction in storage mass and a 20 per cent relative increase in efficiency. (8 refs.)

103658 A simple analysis of an open regeneration system. P.Gandhidasan (Dept. of Mech. Engng., Univ. of the West Indies, St. Augustine, Trinidad).
Sol. Energy (USA), vol.31, no.3, p.343-5 (1983).
Liquid desiccants have great potential for use in solar energy applications such as heating and cooling of buildings, crop drying, power generation, etc. In all such applications the spent absorbent solution must be concentrated for reuse. Different methods of regenerating the weak solutions using solar enegy have been discussed. One the simplest methods is the open surface regeneration system. Recently for an open regeneration system, Collier (1979) derived an expression to calculate the amount of water evaporated from the weak solution. In this derivation the variation of the rate of evaporation of water along the flow length of the open regenerator has been taken into consideration. The analysis is somewhat complex. It is shown in this note that a simple expression can be derived for the rate of evaporation of the water if it is assumed that the temperature, concentration and vapour pressure are constant at the arithmetic average of these values at the beginning and end of the regenerator. (6 refs.)

103659 Solar heating of municipal pools. G.T.Gordon, G.G.Henkel.
Trans. Inst. Eng. Aust. Civ. Eng. (Australia), vol.CE25, no.2, p.135-42 (May 1983).
In an era of rising energy costs the use of solar energy for the heating of municipal pools is becoming increasingly attractive. The season for open pool swimming is limited in southern Australia because water temperatures fall below comfort conditions. Solar energy is readily available over the summer period, when high efficiencies are achievable using simple solar systems. The feasibility of solar pool heating is influenced by climate, cost and likely trends in cost increases of conventional fuels, the capital cost of a solar system, interest rates and inflation. It is important that any feasibility study considers life cycle costing and a range of conventional fuel cost increases. If fixed annual costs of a capital intensive solar installation can be contained below the likely conventional energy costs then solar energy is economic and this can be greatly assisted by an inflationary economic climate. In Canberra two solar pool heating installations have been set up as solar demonstration municipal pool heating projects. One uses unglazed collectors for an outdoor pool; the other uses glazed collectors for an indoor pool. Feasibility studies have been undertaken on heating the municipal pools in Canberra and a range of alternative energy approaches has been considered. The paper outlines the design approach used and the results of the work undertaken in Canberra for the NCDC. It demonstrates the economics of a range of options available for the heating of municipal pools and provides technical information for design application. (8 refs.)

103660 Feedback control of the primary circuit of a solar power plant. L.Carotenuto, M.La Cava, G.Raiconi (System Dept., Univ. of Calabria, Cosenza, Italy).
Control of Distributed Parameter Systems 1982. Proceedings of the Third IFAC Symposium, Toulouse, France, 29 June-2 July 1982 (Oxford, England: Pergamon 1983), p.461-7
Considers the problem of closed loop stability of the primary circuit of a solar power plant equipped with a feedback control scheme with the purpose of eliminating the effect on the output temperature of residual disturbances not cancelled by already existing control actions. Because the model of the plant with flow control is typically bilinear the stability analysis of the whole feedback control system is worked out through the extension of Lyapunov techniques to distributed parameter systems. To simplify the computation of the stabilizing feedback control a finite-dimensional approximation of the continuous model, involving a fixed discretization of the spatial domain is introduced. Two different time discretization schemes are considered: the first based on the finite difference method and the second on the method of characteristics. For each of the considered discrete models a class of stabilizing controls is obtained; among them particular attention is given to some specifical laws which are able to optimize a suitable performance index for the system. Several examples are finally worked out, which show the efficiency of the proposed control schemes both in response to typical disturbances and in presence of plant parameter variations. (8 refs.)

103661 Solar energy. D.J.Close, R.E.Collins, M.Kingsmill, W.R.Read, L.G.Turner, E.A.Woodley.
Energy 83. Towards an Energy Policy for Australia, Canberra, Australia, 11-13 May 1983 (Barton, Australia: Instn. Eng., Australia 1983), p.265-73
In this paper the emphasis has been placed on policy implications rather than a detailed survey of technical advances or requirements. Considerable attention has been paid to the recommendations for an energy policy for Australia and the information on which these were based, and some qualifications are noted. Funding arrangements for research, development and demonstration through NERDDC and various state committees are described in detail, and financial incentives and disincentives to the use of solar equipment are discussed. (17 refs.)

103662 Heliostat control systems. W.G.Hart (Martin Marietta Corp., Baltimore, MD, USA).
24th Midwest Symposium on Circuits and Systems, Albuquerque, NM, USA, 29-30 June 1981 (North Hollywood, CA, USA: Western Periodicals 1981), p.715-19
Describes the control system for the heliostats that will be installed at the 10-MW solar thermal central receiver pilot plant at Barstow, its evolution from the heliostat control system in use at the central receiver test facility in Albuquerque, and development work on future systems. The following topics are covered: distributed computer system for overall control of the field of heliostats; stability and control of individual heliostats; pointing accuracy requirements and error allocations; load torque requirements; power and energy requirements; and cost considerations. (no refs.)

103663 Solar central receiver technology—what has been learned in the 70's. R.W.Hughey (US Dept. of Energy, Washington, DC, USA).
Greater Los Angeles Area Energy Symposium, Los Angeles, CA, USA, 28 Oct. 1980 (North Hollywood, CA, USA: Western Periodicals Company 1980), p.37-8
During the decade of the 70s, the Solar Central Receiver concept progressed from an engineering curiosity to a very promising potential alternative to fossil fuel as a major energy source for the USA. Plans for the next three stages (demonstration, market development and eventual commercialisation) are outlined briefly. (no refs.)

103664 Power from parabolic dishes: progress and prospects. V.C.Truscello, A.N.Williams (Solar Thermal Power Systems Project, Jet Propulsion Lab., Pasadena, CA, USA).
Greater Los Angeles Area Energy Symposium, Los Angeles, CA, USA, 28 Oct. 1980 (North Hollywood, CA, USA: Western Periodicals Company 1980), p.39-43
Summarizes the status of parabolic dish technology in the fiscal year 1980 and comments on its future prospects. Performance projections for dish modules and the progress of the engineering experiments to be deployed in user environments are given primary emphasis. The developments in dish technology and in the engineering experiments serve as indicators of progress toward eventual commercial readiness. (no refs.)

A thermoelectric detector for high radiant flux densities ....See Entry 99188

Holographic concentrator insuring a chromatic dispersion on a photovoltaic cell array ....See Entry 100687

Solar energy in industry ....See Entry 103714

Comparative study on performance of two models of solar device for melting wax during the winter season ....See Entry 103716

Transient analysis of forced circulation solar water heating system with collectors in series ....See Entry 103717

Transient analysis of double basin solar still ....See Entry 103718

Year-round performance of an improved collector-cum-storage type solar water heater ....See Entry 103719

Theoretical study of tilted solar still as a regenerator for liquid desiccants ....See Entry 103720

Transient performance of normal/reverse flat plate collector with selective absorber surface ....See Entry 103721

Experimental and analytical performance study of a thermosyphon water heater ....See Entry 103722

Numerical optimization of a solar air heating system based on encapsulated PCM storage ....See Entry 103726

Design studies of the sulfur trioxide decomposition reactor for the Sulfur Cycle hydrogen production process ....See Entry 103734

Production of hydrogen by direct thermal decomposition of water ....See Entry 103735

Prediction of global solar radiation from bright sunshine hours and other meteorological data ....See Entry 104465

Solar climates of the United States based on long-term monthly averaged daily insolation values ....See Entry 104531

Harmonic analysis of monthly insolation levels in the United States ....See Entry 104532

Simple models for hourly to daily radiation ratio correlations ....See Entry 104533

86.10N Nuclear energy

103665 Nuclear energy. J.L.Symonds, A.King, J.O.Reynolds, H.Saddler, R.K.Warner, R.E.Wilmshurst.
Energy 83. Towards an Energy Policy for Australia, Canberra, Australia, 11-13 May 1983 (Barton, Australia: Instn. Eng., Australia 1983), p.236-48
This paper reviews the world nuclear energy scene as it affects Australia and its mining and uranium treatment industries. The prospects for new industries are discussed in the light of changes in legislation and regulations required, their demand for human resources and skills, and any impact which such industries may have on communities either socially or environmentally. (36 refs.)

86.30 ENERGY CONVERSION

86.30E Primary cells

103666 Solid electrolyte interphase (SEI) electrodes VI: calcium-$Ca(AlCl_4)_2$-sulfuryl chloride system. E.Peled, R.Tulman, A.Meitav (Dept. of Chem., Tel-Aviv Univ., Tel-Aviv, Israel).
J. Power Sources (Switzerland), vol.10, no.2, p.125-35 (July 1983).
The electrochemistry of the $Ca/Ca(AlCl_4)_2$-sulfuryl chloride (SC) system and its capability of functioning as a primary cell were studied. The OCV of this cell is about 3.4 V and it exhibits a rather flat discharge curve of 3.1-2.9 V at current densities of 0.4-2.0 mA cm^{-2}. Cell capacity is 35-45 mA h cm^{-2} (for 1.1 mm thick porous carbon cathodes). Cell failure results from anodic polarization. Cells were found to resist charging and reversal abuses and no indication of calcium deposition during reversal was found. It was found that the calcium anode is covered by a thin film (most likely $CaCl_2$) which serves as a SEI. Its thickness on fresh electrodes is about 15-30 Å and it increases with time. The rate determining step for the calcium dissolution process is the ionic migration through the SEI. The ionic resistivity of the SEI is about 4×10^9 Ω cm. (18 refs.)

103667 A possible mechanism for the reduction of voltage delay in the $Li/SOCl_2$ system via cyanoacrylate coatings. N.A.Fleischer, R.J.Ekern (RAYOVAC Corp., Madison, WI, USA).
J. Power Sources (Switzerland), vol.10, no.2, p.179-89 (July 1983).
Scanning electron microscopy and X-ray photoelectron spectroscopy were used to investigate the passivation of lithium treated with alkyl 2-cyanoacrylates in $LiAlCl_4/SOCl_2$ electrolyte. Cyanoacrylate coatings reduce anode polarization by affecting the morphology and growth kinetics of the LiCl passivating film. The mechanism for these effects depends on the gradual dissolution of the coating in electrolyte and its subsequent replacement by LiCl. Dissolving either the monomer or polymer form of cyanoacrylate directly into the electrolyte without coating the lithium also effects LiCl film growth and reduces polarization. (17 refs.)

103668 On the suppression of self discharge of the zinc electrodes of zinc-air cells and other related battery systems. C.Chakkaravarthy, H.V.K.Udupa (Central Electrochem. Res. Inst., Karaikudi, India).
J. Power Sources (Switzerland), vol.10, no.2, p.197-200 (July 1983).
Describes a simple procedure to determine the mercury content, without resorting to any analytical procedure, in the chemically amalgamated zinc electrode. The effect of mercuric ion concentration and immersion time on the amalgamation of the zinc electrode is also shown. A simple alloying method is described as an alternative to the one reported by Bernard (Brit. Pat. 182, 466, 1970) who enclosed mercury in a thick-walled zinc capsule and submerged it in molten zinc. The ampere hour outputs of a few experimental 1.4 V, 50 A h zinc-air alkaline cells are given to show that the alloying procedure is more effective than the chemical method, especially when the amalgamated zinc is stored prior to use. (3 refs.)

103669 Lithium batteries for memory preservation. D.Linden.
Wescon/81 Conference Record, San Francisco, CA, USA, 15-17 Sept. 1981 (El Segundo, CA, USA: Electron. Conventions 1981), p.29/1/1-2
Lithium is very attractive as a battery anode material because of its lightweight, high voltage and high electrochemical equivalence. Lithium batteries are rapidly becoming an important power source for a variety of applications because of their many performance advantages over conventional batteries. They have particular advantages with regard to their application as a back-up power source for volatile RAM devices to obtain a nonvolatile memory system. The characteristics of high performance lithium batteries are discussed, and a listing of typical primary cells and their nominal voltages given. (no refs.)

103670 New lithium batteries for memory preservation. R.E.Ralston (Lithium Systems Div., Duracell Internat. Inc., Elmsford, NY, USA).
Wescon/81 Conference Record, San Francisco, CA, USA, 15-17 Sept. 1981 (El Segundo, CA, USA: Electron. Conventions 1981), p.29/2/1-8
A number of new lithium primary batteries are now available for use as a back-up battery for memory preservation. These high performance batteries are small in size, compatible for PC board installation, have superior shelf life characteristics and meet the specific needs of memory applications. The author discusses these points and the design of three different types of lithium batteries. (no refs.)

103671 Characteristics of lithium solid state batteries in memory circuits. S.J.Garlock (Instrument Div., Lear Siegler Inc., Grand Rapids, MI, USA).
Wescon/81 Conference Record, San Francisco, CA, USA, 15-17 Sept. 1981 (El Segundo, CA, USA: Electron. Conventions 1981), p.29/3/1-8
The need for non-volatile random access memory has lead to the use of CMOS memories with a battery supplying the power needed to continue memory retention when main power is no longer available. The use of a battery in the harsh aviation environment necessitates a careful evaluation of a battery's ability to consistently supply power at various loads over extreme temperature ranges under severe environmental stress and still afford personnel and equipment safety. The author details the criteria and procedure for evaluating lithium solid state batteries. (no refs.)

103672 The use of lithium batteries in memory circuits. L.H.Fentnor, L.A.Schaum (Battery Engng., Hughes Aircraft Co., Tucson, AZ, USA).
Wescon/81 Conference Record, San Francisco, CA, USA, 15-17 Sept. 1981 (El Segundo, CA, USA: Electron. Conventions 1981), p.29/4/1-3
Hughes Aircraft Company (HAC) has been and is currently supplying the electronics utilized in the F-15 landing computer. This design requires the incorporation of a standby power source (battery) to preserve the semiconductor memory system of this electronic design. The authors describe the power requirements for the HAC design and presents typical performance capabilities of the lithium-anode/lead-iodide+lead-sulphide cathode chemical system; and, the performance capabilities of lithium-anode/thionyl-chloride cathode chemical systems manufactured by three leading battery producers. (no refs.)

103673 Lithium thyonyl chloride batteries for memory preservation. G.Giveony, B.Ravid (Tadiran Israel Electronics Industries Ltd., Rehovot, Israel).
Wescon/81 Conference Record, San Francisco, CA, USA, 15-17 Sept. 1981 (El Segundo, CA, USA: Electron. Conventions 1981), p.29/5/1-9
Lithium inorganic (thionyl chloride) batteries provide an ideal solution to designer's requirements for a battery to backup static CMOMS RAM's in order to achieve a nonvolatile memory. The lithium inorganic battery offers such advantages as high voltage, high energy density, ten-year life expectancy, extreme temperature range endurance and safety. Examples from telecommunication, communication, telephony, instrumentation and industrial controls demonstrate the implementation of the lithium inorganic battery in the design of nonvolatile CMOS memories. The upgraded performance of the equipment in which the battery and the nonvolatile memory are being used is described. (4 refs.)

86.30F Secondary cells

103674 Beta-alumina for sodium-sulphur batteries. A.Wicker (CGE, Lab. de Marcoussis, Marcoussis, France).
Ind. Ceram. (France), no.772, p.352-5 (1983). In French.
Aims to review the state-of-the-art concerning the use of beta-alumina ceramics as a solid electrolyte in the sodium-sulphur battery. Design and operating conditions of a sodium-sulphur cell are first outlined leading to specifications for beta-alumina tubes. The various fabrication procedures which have been studied are presented with regard to powder preparation, shaping and sintering. The major problem encountered by the beta-alumina developers is the in-cell durability of the electrolyte tube. Studies on the electrical breakdown which is the main cause of failure have been recently emphasized: failure is usually associated with the penetration or the formation of sodium in the electrolyte or as a general blackening extending from the sodium side. To solve this problem further research and development on improving the durability and the reliability of beta-alumina tubes are needed. (42 refs.)

103675 Mathematical analysis of a Zn/NiOOH cell. H.Gu (Electrochem. Dept., General Motors Res. Lab., Warren, MI, USA).
J. Electrochem. Soc. (USA), vol.130, no.7, p.1459-64 (July 1983).
A mathematical model has been developed to predict the time dependent behavior of a Zn/NiOOH cell. The model uses experimentally determined polarization expressions to describe the losses between the positive and the negative electrodes. The electronic losses in the plane of the electrode are simulated by a network of resistors. The potential distribution, and current distribution, the cell voltage, the power capability, and the energy of a cell can be predicted. The mathematical model provides an analytical tool to evaluate, for example, the trade-offs between power capability and current collector mass, needed to design an electric vehicle battery. (5 refs.)

103676 Study of a lithium-lithium propionate electrode in propylene carbonate. J.M.S.Saltao, C.A.C.Sequeira (Lab. de Electroquimica, Inst. Superior Tecnico, Lisbon, Portugal).
J. Power Sources (Switzerland), vol.10, no.2, p.111-23 (July 1983).
Preliminary data are presented on the electrochemical behavior of a secondary lithium electrode in propylene carbonate at 25°C. The anion of the insoluble lithium propionate salt, whose precipitation is favored by the anodic dissolution of lithium, was introduced into the solvent as a tetrabutylammonium salt. Steady-state potentiostatic polarization curves, anodic galvanostatic, and cyclic voltammetry measurements provided information on the kinetics of the lithium system. It was shown to be reversible, provided that the overpotential does not exceed 60 mV, and may be able to deliver current densities of the order of 0.25 mA/cm^2 without appreciable polarisation. Consideration of the reduction of the electrolyte on platinum and lithium electrodes is also discussed. (16 refs.)

103677 Accelerated cycle life testing of lead-acid golf car batteries and the influence of separator type on battery life, energy consumption and operating cost. B.S.Goldberg, A.G.Hausser, B.T.Le (Tech. Center, Amerace Corp., Butler, NJ, USA).
J. Power Sources (Switzerland), vol.10, no.2, p.137-48 (July 1983).
Commercial lead-acid golf car batteries containing five different separator materials were cycle life tested. An accelerated cycle life test was employed in which the battery temperature was allowed to rise as the batteries became less efficient in power utilization towards the end of life, and there was no rest period between charge and discharge during cycling. The effects of continuous cycling and separator type on battery performance were monitored throughout the test together with battery temperature, end of charge current, energy balances, and capacity. Cycle life test data through correlation with actual expected life in the field allowed calculations to be made to determine the relative effective operating cost of various battery types. The battery made with FLEX-SIL rubber separators exhibited the best life and economics when compared with batteries containing ACE-SIL rubber, polyethylene, cellulose (paper), and sintered PVC separators. (5 refs.)

103678 Computer-controlled multiple-channel system for electrochemical experiments. M.H.Katz, J.T.Nichols, F.R.McLarnon, E.J.Cairns, J.E.Katz (Lawrence Berkeley Lab., Berkeley, CA, USA).
J. Power Sources (Switzerland), vol.10, no.2, p.149-65 (July 1983).
A test system has been designed and constructed to allow the simultaneous and continuous cycling of 16 electrochemical cells, and the system can be readily expanded to accommodate 48 cells. It is configured with eight independent current-control units, each dedicated to two series-connected cells, and the cells can be driven by single charge and single discharge power supplies. The current controllers have a resolution and stability within 0.025% of full scale, and a response time constant of 1 ms. The charge and discharge profiles, including pulse charging and EPA power profile discharging, are implemented through the use of various computer algorithms. (11 refs.)

103679 Structural effect of the zinc electrode on its discharge performance. T.S.Chang, Y.Y.Wang, C.C.Wan (Dept. of Chem. Engng., Nat. Tsing Hua Univ., Hsinchu, Taiwan).
J. Power Sources (Switzerland), vol.10, no.2, p.167-77 (July 1983).
The formation conditions in the preparation of zinc electrodes for the nickel-zinc battery were varied to obtain different electrode structures. The porosity and pore size distribution of the zinc electrode were found to be dominant factors in determining the electrode capacity. The optimal porosity was estimated to be about 0.64. (18 refs.)

A neutron powder diffraction study of α- and β-PbO_2 in the positive electrode material of lead-acid batteries .... See Entry 101646

Description of a deposition cell employing evaporation under vacuum .... See Entry 103058

86.30G Fuel cells

103680 Coal gas as a feed fuel for phosphoric acid fuel cell power plants. B.R.Krasicki, B.L.Pierce (Advanced Energy Systems Div., Westinghouse Electric Corp., Pittsburgh, PA, USA).
Int. J. Hydrogen Energy (GB), vol.8, no.7, p.499-508 (1983).
The effects of a number of coal gasification systems and their gas compositions on a 7.5 MW$_{(e)}$ DC Phosphoric Acid Fuel Cell (PAFC) power plant are assessed. Both low and medium BTU synthesis gases were considered from various promising gasification processes. Degree of development or commercialization, technical complexity, availability and coal restrictions were taken into account. System studies performed on the plant for nonintegrated and integrated fuel conditioning systems are discussed for the various gasification processes. Representative characteristics for the derived coal gases and PAFC system performance data are presented. The direct capital costs of the PAFC power plant are evaluated for each system. (2 refs.)

103681 Status of solid polymer electrolyte fuel cell technology and potential for transportation applications. L.J.Nuttall, J.F.McElroy (General Electric Co., Electrochem. Energy Conversion Programs, Wilmington, MA, USA).
Int. J. Hydrogen Energy (GB), vol.8, no.8, p.609-15 (1983).
The solid polymer electrolyte fuel cell technology was used to provide electrical power for two operational spacecraft programs, and development programs span a wide range of applications which include ground power and undersea, as well as advanced space systems. The technology is also finding applications in the areas of water electrolysis and chlor-alkali production. During 1981 a study was conducted for the Los Alamos National Laboratory to determine the feasibility of using this technology for vehicular propulsion. The results of the study show that, with adequate development, such a power plant is possible which will meet the performance, size and weight objectives. It is also estimated that the costs for such a system could be competitive with other potential advanced power systems. (1 ref.)

86.30J Photoelectric conversion: solar cells and arrays

103682 New promise for photovoltaics. R.Whitaker.
EPRI J. (USA), vol.8, no.6, p.6-15 (July-Aug. 1983).
Looks at the R&D in the photovoltaics industry in the fields of amorphous silicon, single-crystal silicon in ribbon form, concentrating systems and polycrystalline silicon and other materials. The present status of solar cells manufactured with materials in these forms in terms of efficiency and economics is pointed out and the potential for the generation of large scale power using these technologies in the future is discussed. (4 refs.)

103683 Economic aspects of the utilization of solar energy by means of solar cells. R.Dahlberg (AEG Telefunken AG, Heilbronn, Germany).
Energiewirtsch. Tagesfragen (Germany), vol.33, no.7, p.453-8 (July 1983). In German.
Discusses the economics of solar generators and solar hydrogen power stations, with detailed calculation of costs of installation and operation, and comparison with conventional power supply systems. Only the solar hydrogen power system has a chance of becoming a genuine alternative source of energy. (4 refs.) *J.S.*

103684 Parameters of solar cell arrays. M.Shechter (Tel-Aviv Univ., Tel-Aviv, Israel), J.Appelbaum, G.Yekutieli.
IEEE Trans. Electron Devices (USA), vol.ED-30, no.6, p.616-18 (June 1983).
Presents an analytically derived method of combining nonidentical solar cell parameters to obtain a single-exponential approximation for an array. It is assumed that the array *I-V* equation is of the same form as that of the single cell. The array possesses two photocurrents: one at the open circuit voltage and the other depends on load current. (5 refs.)

103685 Two-dimensional modeling of the MIS grating solar cell. P.de Visschere (Lab. voor Elektronika, Rijksuniv. Gent, Gent, Belgium).
IEEE Trans. Electron Devices (USA), vol.ED-30, no.7, p.840-9 (July 1983).
A two-dimensional model has been developed for simulating the behavior of a metal-insulator-semiconductor (MIS) grating solar cell. In contrast with traditional methods, which solve the nonlinear semiconductor equations directly, this model solves a derived nonlinear boundary value problem, using an integral equation technique. The general characteristics of MIS grating solar cells have been calculated and are explained in terms of the underlying physical processes. In order to gain a better understanding of the collection mechanism taking place in a grating solar cell, a new concept, the 'diffusion thickness of the space-charge layer' is introduced. The best-known grating solar cell is the MIS inversion layer solar cell. However, it is shown that for common values of the surface charge, an inversion layer cell with a low base doping level may not have as high an efficiency as a cell with a more heavily doped base, in which the minority-carrier flow is two-dimensional. (34 refs.)

103686 Solar cell efficiency calculations using an average absorption coefficient. B.Kallback (Inst. of Microwave Technol., Stockholm, Sweden).
Int. J. Electron. (GB), vol.55, no.2, p.299-302 (Aug. 1983).
Efficiency calculations have been performed for an n$^+$p-solar cell with reflecting back surface, using an average absorption coefficient. The relevance of using an average absorption coefficient is examined by comparing the result with calculations for a wavelength dependent absorption coefficient. (4 refs.)

103687 Sizing an autonomous photovoltaic installation. II.. J.-A.G.de Andoain.
Mundo Electron. (Spain), no.130, p.159-66 (July 1983). In Spanish.
For pt.I see ibid., no.128, p.113-19 (1983). Despite many articles on sizing autonomous photovoltaic installations, no clear advances in the development of a sizing theory have emerged yet; specially in an oversizing theory. The paper initiates a series of articles which are intended to break classical methods of iterative sizing, opening a discussion in new fields whose interest is focused on its operativeness and to propose a theory which covers subjects such as: the dependence of accumulation with oversizing, the cost function for oversizing, the system autonomy and oversizing, among other topics of interest. (no refs.)

103688 Electron irradiation effects on amorphous silicon solar cells. M.Katayama, H.Morimoto, K.Sugawara (Solar systems Group, Sharp Corp., Nara, Japan).
Phys. Status Solidi a (Germany), vol.78, no.1, p.K5-8 (16 July 1983).
The authors study the electron irradiation effects on a-Si solar cells. The irradiation tests were performed for a-Si:H:F solar cells by exposing them in 1 MeV electron beams, with fluences up to 10^{16} e/cm^2. The solar cells were fabricated onto stainless steel substrate of thickness 0.2 mm. (7 refs.)

103689 Characterization of grain boundaries in polycrystalline solar cells using a computerized electron beam induced current system. C.Donolato (CNR-Istituto Lamel, Bologna, Italy), R.O.Bell.
Rev. Sci. Instrum. (USA), vol.54, no.8, p.1005-8 (Aug. 1983).
The automatic evaluation of grain boundary activity in a polycrystalline solar cell can be carried out by interfacing a microcomputer to a scanning electron microscope operating in the electron beam induced current mode (EBIC). The grain boundary surface recombination velocity and diffusion length in the neighboring grains are obtained by digital acquisition and processing of the related EBIC profile. The technique is applied to the evaluation of hydrogen passivation of a ribbon solar cell. (11 refs.)

103690 Stability of p-i-n hydrogenated amorphous silicon solar cells to light exposure. Y.Uchida, M.Nishiura, H.Sakai, H.Haruki (Fuji electric Corporate Res. & Dev. Ltd., Yokosuka, Japan).
Sol. Cells (Switzerland), vol.9, no.1-2, p.3-12 (June-July 1983).
Light-induced and forward bias current effects were studied on p-i-n hydrogenated amorphous silicon (a-Si:H) solar cells with various i layer thicknesses. The indium tin oxide ($In_{2-x}Sn_xO_{3-y}$)/(p-i-n)/stainless steel (SS) solar cell is stable to light exposure in comparison with the $In_{2-x}Sn_xO_{3-y}$/(n-i-p)/SS solar cell. The degradation of the cell is less when its i layer is thinner. Doping the i layer with a small amount of boron makes the cell quite stable to light exposure. These results suggest that the light-induced effects can be controlled by choosing an appropriate junction structure and junction formation technique. The change in performance of the $In_{2-x}Sn_xO_{3-y}$/(n-i-p)/SS cell after forward current biasing in the dark depends on the i layer thickness, similarly to the light-induced performance change. In contrast, a slight enhancement in the performance is observed for the $In_{2-x}Sn_xO_{3-y}$/(p-i-n)/SS cell after forward current biasing. Environmental tests show that the encapulsated a-Si:H solar cells withstand temperatures of up to 100°C and high humidities (60°C, 95% relative humidity). (11 refs.)

103691 Light-induced effects in indium tin oxide/n-i-p hydrogenated amorphous silicon solar cells. M.-K.Han, W.A.Anderson (Dept. of Electrical & Computer Engng., State Univ. of New York, Amherst, NY, USA), H.Wiesmann.
Sol. Cells (Switzerland), vol.9, no.1-2, p.13-17 (June-July 1983).
Light-induced effects have been studied on hydrogenated amorphous silicon solar cells having an air mass 1 efficiency of 5%-7% and an area of 0.1-0.2 cm^2. Within 72 h of illumination the open-circuit voltage did not decrease while the fill factor decreased from 0.6 to 0.4 and the short-circuit current density decreased from 11.5 to 10.5 mA cm^{-2}. The increased shunt current is found to be critical to the device performance of degraded cells. The increased shunt current may be due to an increased surface recombination velocity. The series resistance was almost unchanged. Annealing in air at 150°C restored much of the efficiency loss previously caused by light-induced effects. (5 refs.)

103692 Light-induced instability of amorphous silicon photovoltaic cells. S.Tsuda, N.Nakamura, K.Watanabe, T.Takahama, H.Nishiwaki, M.Ohnishi, Y.Kuwano (Res. Centre, Sanyo Electric Co. Ltd., Osaka, Japan).
Sol. Cells (Switzerland), vol.9, no.1-2, p.25-36 (June-July 1983).
Changes in the characteristics of amorphous silicon (a-Si) solar cells caused by light exposure were studied. The degradation ratio of the conversion efficiency of p-i-n a-Si solar cells caused by light exposure depends on the thickness of the i-layer. A decrease in the fill factor was commonly observed, and in such cases the diode quality factor and shunt current density increased, which suggested a change in junction properties. It was shown that additional doping of the i-layer with a small amount of boron prevents the decrease in conversion efficiency with light exposure. In a 1 year experiment on a 2 kW a-Si power generating system, a 10% decrease in conversion efficiency was observed (without additional boron doping). (7 refs.)

103693 Effects of optical stress on the properties of sputtered amorphous silicon solar cells and thin films. H.P.Maruska, T.D.Moustakas, M.C.Hicks (Exxon Res. & Engng. Co., Corporate Res. Labs., Linden, NJ, USA).
Sol. Cells (Switzerland), vol.9, no.1-2, p.37-51 (June-July 1983).
Sputtered amorphous silicon solar cells and thin films (four-point probe specimens) were deposited under a variety of conditions differing in hydrogen concentration, target voltage and substrate temperature. The samples were subjected to as long as 400 h of simulated air mass 1 illumination. Some of the cells retained essentially stable values of short-circuit current density J_{sc}, while others did not. Losses in J_{sc} were not simply due to increases in series resistance, and the spectral repsonses were altered. A low temperature anneal restored the initial state. No significant changes were noted in the open-circuit voltage V_{oc}. Analysis of space charge current densities in the cells gave an indication of the increased densities of midgap states following the stress. It was not possible to correlate the changes in cell performance with the controlled deposition conditions, and impurities may play a part. The conductivity changes measured in gap cell structures do not correlate with the observed changes in solar cell structures, possibly because of contributions from the surface conductivity. (16 refs.)

103694 Analysis of photoinduced changes in the performance of amorphous silicon solar cells. Y.Tawada, K.Nishimura, S.Nonomura, H.Okamoto, Y.Hamakawa (Faculty of Engng. Sci., Osaka Univ., Osaka, Japan).
Sol. Cells (Switzerland), vol.9, no.1-2, p.53-61 (June-July 1983).
Photoinduced changes in the performance of a-SiC:H/a-Si:H (where a-SiC:H and a-Si:H denote hydrogenated amorphous SiC and silicon) heterojunction solar cells were investigated under illuminations of 1 sun and 10 suns. The fill factor and the conversion efficiency decreased sharply with time under 10 suns illumination. In order to separate the origin of the photo-induced fill factor change from thermal effects on the fill factor, the temperature dependence and heat-treatment-induced recovery of the cell performance were also studied. With these systematic data, a series of experimental and theoretical analyses were carried out using the variable minority carrier transport model. The results show that the photo-induced changes are caused not only by the bulk Staebler-Wronski effect but also by changes in the surface recombination factor. (15 refs.)

103695 Properties of the defect causing solar cell degradation. R.S.Crandall, D.L.Staebler (RCA Labs., Princeton, NJ, USA).
Sol. Cells (Switzerland), vol.9, no.1-2, p.63-74 (June-July 1983).
Using a combination of transient solar cell degradation and deep level transient spectroscopy measurements of p-i-n (where i denotes an intrinsic layer) and Schottky barrier hydrogenated amorphous silicon solar cells it is shown that a deep electron trap having nearly the same energy for electron capture or release is responsible for many of the aspects of solar cell degradation. The chief effect of this trap, which has a small electron capture cross section at room temperature, is to capture electrons from the conduction band and to transfer them to metastable states outside the energy gap, thus changing the Fermi level. (27 refs.)

103696 The CdS-CuInSe$_2$ solar cell interface: thermodynamic considerations. J.F.Wager, O.Jamjoum, L.L.Kazmerski (Solar Energy Res. Inst., Golden, CO, USA).
Sol. Cells (Switzerland), vol.9, no.3, p.159-68 (Aug. 1983).
Simple thermodynamic arguments are used to investigate the oxidation of CuInSe$_2$ and the possible chemical reactions at the CdS-CuInSe$_2$ interface. Reaction products are predicted for the oxidation of CuInSe$_2$ and the oxidation of CdS and for reactions between CdS and CuInSe$_2$, as well as between CdS and the CuInSe$_2$ native oxide. It is suggested that the oxidation of CdS is possibly associated with the partial improvement in the response of CdS-CuInSe$_2$ solar cells with annealing treatments in an oxygen ambient. (14 refs.)

103697 Low cost process for ohmic contacts on GaAs/Ga$_{1-x}$Al$_x$As concentrator solar cells based on palladium and gold deposition. C.Flores (Centro Informazioni Studi Esperienze SpA, Milan, Italy).
Sol. Cells (Switzerland), vol.9, no.3, p.169-77 (Aug. 1983).
A new fabrication process for high concentration GaAs/Ga$_{1-x}$Al$_x$As solar cells is described that does not require any vapour deposition of the ohmic contacts. The process is based on the electroless deposition of palladium as a p-type contact, while electrolytic gold is used as an n-type contact. Palladium exhibits good ohmic behaviour without any thermal alloying. From test patterns the specific resistance r_c of the ohmic contacts turns out to be 10^{-4} Ω cm^2 for palladium on p-type GaAs and 7×10^{-6} Ω cm^2 for gold on n-type GaAs. Several solar cells were fabricated and tested at 800 suns. The devices have series resistances lower than 10 mΩ cm^2 and thus are comparable with solar cells based on evaporated ohmic contacts. (9 refs.)

103698 X-ray photoelectron spectroscopy studies of copper diffusion behaviour and related degradation phenomena in thin film CdS:Cu$_2$S solar cells. A.C.Rastogi, S.Salkalachen (Div. of Specialized Techniques, Nat. Phys. Lab., New Delhi, India).
Sol. Cells (Switzerland), vol.9, no.3, p.185-202 (Aug. 1983).
Quantitative growth of thin Cu$_2$S layers in chemiplated thin film CdS:Cu$_2$S solar cells was observed by studying the depth profile concentrations of copper and sulphur by the X-ray photoelectron spectroscopy technique. Scanning electron microscopy examination of the junction revealed a complex and corrugated structure at the interface. From a study of the spatial distributions of cadmium, copper and sulphur and measurements of the saturated [Cd]/[S] ratios it is inferred that in deep layers the copper originates from grain boundaries. Similarly, by isolating the copper profile in the Cu$_2$S layers, the CdS grain-grain boundary region and the CdS grain boundaries and by applying suitable diffusion equations with appropriate boundary conditions, the diffusion coefficients in the midgrain and grain boundary regions were evaluated. In the chemiplating process copper diffusion is 5×10^2 times faster in the grain boundary than in midgrain. A short heat treatment of the cells causes the redistribution of cadmium and copper in the junction, making the interface sharper. Analysis yields diffusion coefficients of 5.8×10^{-11} $\exp(-0.229/kT)$ in midgrain and $1.06\ \exp(-0.964/kT)$ in the grain boundary. In order to gain knowledge of the degradation effects arising from copper migration, the evaluated diffusion coefficients were used to compute the time in which loss of Cu$_2$S stoichiometry and widening of the copper-compensated layer will lead to significant reduction in cell performance. This study shows that copper diffusion is not a severe life-limiting factor for CdS solar cells. (29 refs.)

103699 Stability of Pd/Nb$_2$O$_5$/amorphous hydrogenated silicon solar cells. V.Premachandran, S.Guha (Tata Inst. of Fundamental Res., Bombay, India).
Sol. Cells (Switzerland), vol.9, no.3, p.203-8 (Aug. 1983).
The stability of Pd/Nb$_2$O$_5$/amorphous hydrogenated silicon solar cells was investigated. Heat treatment in vacuum at 70°C was found to increase the saturation current density J_s and to reduce the open-circuit voltage V_{oc} to values close to those for palladium Schottky structures. Further deterioration in the characteristics takes place on exposure to H$_2$. The original values can be restored by exposing the diodes to O$_2$ or air. (12 refs.)

103700 On the effective minority carrier diffusion length of polycrystalline silicon solar cells. S.Kumari, S.K.Jain, B.K.Das, G.C.Jain (Div. of Materials, Nat. Phys. Lab., New Delhi, India).
Sol. Cells (Switzerland), vol.9, no.3, p.209-14 (Aug. 1983).
Polycrystalline substrates can be characterized in terms of an 'effective' minority carrier diffusion length L_e. Based on a generalized expression, L_e was computed for polycrystalline silicon solar cells in terms of the intragranular diffusion length L_0, the grain size d and the distance βL_0 up to which the grain boundary has an influence in accordance with a model suggested by Koliwad and Daud, who have demonstrated that $\beta=1$. These theoretical computations were compared with the experimental results of diffusion length measurements on solar cells fabricated from solar grade polycrystalline silicon. The value of β was found to vary randomly between 1.3 and 1.7 assuming uniform L_0 in all the grains. This is thought to be due to impurity-induced effects. Non-uniform grain boundary enrichment with impurities such as iron, chromium, nickel and copper was observed using scanning Auger microscopy and secondary ion mass spectroscopy techniques. (6 refs.)

103701 Degradation of the performance of Cu$_2$S/CdS solar cells due to a two-way solid state diffusion process. K.Moitra, S.Deb (Dept. of Electronics & Telecommunication Engng., Jadavpur Univ., Calcutta, India).
Sol. Cells (Switzerland), vol.9, no.3, p.215-28 (Aug. 1983).
A model of a mechanism of degradation in Cu$_2$S/CdS solar cells, arising out of the growth of a recombination layer in the skin region near the junction due to the two-way diffusion of copper and cadmium atoms, was proposed by Deb and Saha to explain the time variation in the performance of such cells using ceramic tablets. The analytical relations given by Deb and Saha were mainly guessed through intuitive reasoning. In the present paper an attempt is made to develop the model further and to give it an analytical basis through a solution of the relevant diffusion equation, subject to the assumption that the concentrations of excess copper and cadmium atoms at the skin region boundary and junction side boundary respectively of the recombination layer are constant and that the distributions of the diffusing species in the medium are linear. Apart from confirming the linear law for the normalized short-circuit current density versus the square root of time, the relation thus obtained leads to more reliable estimates of the rate constants mentioned earlier. The expressions derived are used to analyse the degradation in performance of vacuum-deposited thin film Cu$_2$S/CdS solar cells, as opposed to the ceramic cells studied earlier. (14 refs.)

103702 Photoelectrochemical solar cells: temperature control by cell design and its effects on the performance of cadmium chalcogenide-polysulphide systems. N.Muller, D.Cahen (Weizmann Inst. of Sci., Rehovot, Israel).
Sol. Cells (Switzerland), vol.9, no.3, p.229-45 (Aug. 1983).
The results of experiments probing the influence of various design parameters of photoelectrochemical cells on light-induced heating of such cells are presented. Both simulated (indoor) and outdoor experiments were performed. The use of a proper cell design allows a large degree of control over the operating temperature range of the cell. The temperature dependence of the photovoltaic performance of cells using CdSe and Cd(Se, Te) thin film polycrystalline photoelectrodes in aqueous polysulphide solution was found to depend on the individual photoelectrode. A general trend showing an optimal temperature range above room temperature can be discerned. Systems with higher conversion efficiencies tend to have a higher optimal temperature range than those with poorer efficiencies. This is attributed mainly to solution chemistry limitations. In addition the authors present data for similar cells that worked for periods between 3 and 15 months under mid-European climate conditions. While some variability was observed, several of the cells suffered not at all, or only slightly. The stability of the photoelectrodes under these conditions is ascribed mainly to the well-insulated cells used, which ensure operating temperatures under solar illumination up to 40°C above the ambient temperature. (27 refs.)

103703 Optimization of substrate thickness for interdigitated back contact silicon solar cells. P.Verlinden, F.van de Wiele (Lab. de Microelectronique, Univ. Catholique de Louvain, Louvain-la-Neuve, Belgium).
Sol. Cells (Switzerland), vol.9, no.3, p.247-56 (Aug. 1983).
A simplified analytical model for interdigitated back contact solar cells is used in a computer program to calculate the optimum substrate thickness giving the maximum efficiency as a function of the measured diffusion length and surface recombination velocity. The program also calculates the maximum allowable thickness corresponding to a short-circuit current density reduction of 10%. Simple empirical formulae are presented allowing the rapid and highly accurate determination of the optimum value of the substrate thickness as a function of the above parameters. (9 refs.)

103704 Simple method for the determination of the minority carrier diffusion length in metal/insulator/semiconductor solar cells. S.Niedzwiedz, S.K.Krawczyk (Inst. of Electron Technol., Tech. Univ. of Warsaw, Warsaw, Poland).
Sol. Cells (Switzerland), vol.9, no.3, p.257-60 (Aug. 1983).
A simple method for the determination of the minority carrier diffusion length in metal/insulator/semiconductor (Schottky) solar cells is proposed. This parameter is calculated directly from the peak position of the solar cell spectral response, measured under constant-light-intensity conditions. Excellent sample-to-sample agreement within lots, as well as very good agreement with the results obtained by another technique, is apparent. Diagrams presented in this paper permit direct readout of the diffusion length in monocrystalline silicon. (8 refs.)

103705 Annealing and diffusion processes in thin film CdS/Cu$_2$S solar cells. F.J.Bryant, A.K.Hariri, S.Salkalachen, C.G.Scott (Dept. of Phys., Univ. of Hull, Hull, England).
Thin Solid Films (Switzerland), vol.105, no.4, p.343-51 (29 July 1983).
Diffusion of copper during post-fabrication annealing of CdS/Cu$_2$S thin film solar cells was studied by Auger electron spectroscopy. Depth profiles of the constituent element concentrations indicate that, for samples annealed in air, a deep penetration of copper into the cadmium sulphide layer occurs together with a significant out-diffusion of cadmium. In contrast, the copper penetra-

tion which results from vacuum or hydrogen annealing treatment is substantially less and no out-diffusion of cadmium is observed for annealing temperatures up to 400°C. (15 refs.)

103706 A consideration about the antireflective coating of silicon solar cells. N.Shibata (Faculty of Engng., Osaka Electro-Communication Univ., Neyagawa, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part C (Japan), vol.J66C, no.5, p.430-1 (May 1983). In Japanese.
An antireflective layer is formed on a *P/N* silicon solar cells by processing hydrofluoric acid for about 10 minutes. After HF processing, the conversion-efficiencies of the cells are improved by about 30%. (3 refs.)

Pulsed UV excimer laser doping of semiconductors .... See Entry 101732

Theory of electron-hole kinetics in amorphous semiconductors under illumination: application to solar cells .... See Entry 102412

Light-induced effects in amorphous silicon material and devices .... See Entry 102458

Staebler-Wronski effects in hydrogenated amorphous $Si_{1-x}Ge_x$ .... See Entry 102459

Photoelectrochemical study of $(Ti,V)O_2$ and $(Ti,Nb)O_2$ alloys .... See Entry 102504

Characterization of fluorine-doped In_2O_3 films synthesized by spray pyrolysis .... See Entry 102542

The case for solar/hydrogen energy .... See Entry 103652

86.30K Photoelectrochemical conversion

Photoelectrochemical study of $(Ti,V)O_2$ and $(Ti,Nb)O_2$ alloys .... See Entry 102504

Photo- and electroluminescence spectra from an n-TiO_2 semiconductor electrode as related to the intermediates of the photooxidation reaction of water .... See Entry 102961

Photoelectrochemical solar cells: temperature control by cell design and its effects on the performance of cadmium chalcogenide-polysulphide systems .... See Entry 103702

86.30L Electrogasdynamic and magnetohydrodynamic conversion

(see also 52.75 Plasma devices and applications)

103707 Status and perspectives of MHD generators. L.H.Th.Rietjens (Dept. of Electrical Engng., Eindhoven Univ. of Technol., Eindhoven, Netherlands).
Phys. Bl. (Germany), vol.39, no.7, p.207-10 (July 1983). In German.
High efficiencies can be achieved in the conversion of heat into electrical energy by the introduction of a combined magnetohydrodynamic (MHD) steam cycle. The potential offered by MHD has been demonstrated by studies showing coal-to-busbar conversion efficiencies approaching 50% with an electricity cost lower than that of competitive systems. Low NO_x and SO_2 emission levels are obtained. The development program areas identified and recommendations for new developments given. (13 refs.)

86.30M Thermoelectric conversion

Reactor tests of two thermoemission electric power generating elements in a single loop channel .... See Entry 99615

86.30N Thermionic conversion

The formation of double-valued sheaths in thermionic converters .... See Entry 101481

86.30P Photosynthesis

(see also 87.25 Cellular biophysics)

103708 Biomass as an energy source. L.F.Diaz, C.G.Golueke (Cal Recovery Systems Inc., Richmond, CA, USA).
Greater Los Angeles Area Energy Symposium, Los Angeles, CA, USA, 28 Oct. 1980 (North Hollywood, CA, USA: Western Periodicals Company 1980), p.111-36
Considers biomass resources and their impact on energy needs of the USA. Anaerobic digestion and other major conversion technologies receive attention. (15 refs.)

86.30Q Chemical energy conversion

(for electrochemical conversion, see 86.30D; for photoelectrochemical conversion, see 86.30K)

Production of hydrogen by direct thermal decomposition of water with the aid of a semipermeable membrane .... See Entry 103502

86.30R Thermal energy conversion (heat engines and heat pumps)

103709 Heat pump basics. I: heat pumps in large commercial buildings. V.S.Manian (Cummins & Barnard Inc., Ann Arbor, MI, USA).
Energy Eng. (USA), vol.80, no.3, p.25-50 (1983).
Basic requirements for successful applications and an illustrative energy estimating procedure for heat pump systems are discussed. (16 refs.)

103710 Domestic heating systems and their selection. J.E.Randell (Dept. of Civil Engng., Univ. of Salford, Salford, England).
Build. Serv. Eng. Res. & Technol. (GB), vol.4, no.2, p.52-61 (1983).
Current trends in domestic heating practice are reviewed and the effects of higher standards of building insulation on heating system selection and performance are considered. Characteristics of the basic types of heating system are examined in the light of increased energy consciousness. Alternative design philosophies are identified and the practical implications of low energy buildings in the selection and design of heating systems are discussed. The arguments are illustrated by reference to experimental low energy houses constructed in Salford and the results of investigative experiments on the houses are considered from a practical viewpoint. (2 refs.)

103711 Present position and trends in the development of energy absorption systems. B.Dietrich, U.Jacobs (Rheinisch-Westfalischen Elektrizitatswerkes AG, Essen, Germany).
ETA Elektrowaerme Tech. Ausbau Ed. A (Germany), vol.41, no.4, p.A114-28 (July 1983). In German.
The principle of operation of heat pumps is reviewed and their advantages over solar heat is pointed out. The numerous sources of heat for a heat pump, such as solar heat, air, rain, soil etc. are discussed. The mathematical basis of energy absorption through heat exchanger surfaces is dealt with and a numerical example is given. For reliable and even operation under varying temperature conditions (summer/winter) a heat pump should be associated with a conventional fuel boiler. Regarding absorption surface requirements, a 150 m^2 surface area house would need appr. 50 m^2 roof absorption surface. Sketches of heat pump/conventional boiler systems as well as some of roof platten installations are given. The latest versions of roof heat absorbers consist of copper, aluminium or polythene pipes and are integral with the roof. (no refs.) *G.R.S.*

103712 Theoretical and experimental research into a compact energy absorber. W.Krumm, F.N.Fett, G.Wozny.
ETA Elektrowaerme Tech. Ausbau Ed. A (Germany), vol.41, no.4, p.A129-33 (July 1983). In German.
A heat pump absorber is exposed to the influence of a number of environmental elements, such as wind velocity, solar radiation, rain, air moisture precipitation etc. A mathematical model of a heat absorber taking all these factors into account is presented and tests on a heat pump of nominal capacity of 13.6 kW are described. The experimental results agreed closely with the theoretical predictions. It was shown that wind velocity and air moisture have the greatest effect on absorption efficiency. (5 refs.) *G.R.S.*

103713 Planning and construction of a heat pump plant with a vertical ground heat exchanger. L.T.van Agthoven, K.Wiskie.
ETA Elektrowaerme Tech. Ausbau Ed. A (Germany), vol.41, no.4, p.A133-7 (July 1983). In German.
An experimental heat pump installation is described for heating a house of 370 m^2 surface area and 1340 m^2 room volume. The heat requirement was 18 kW and the heat pump has 30 vertical heat exchangers buried in the ground. The house was heated by hot water in under floor pipes. Sketches show the type of heat exchanger elements employed and the general arrangement of the exchanger. A curves gives the average pipe temperature with relation to the particular time in the heating season. The heating system is schematically represented. (10 refs.) *G.R.S.*

How to optimize hydrogen plant designs .... See Entry 103736

86.30S Photothermal conversion

103714 Solar energy in industry. M.Blandin.
Equip. Ind. Achats & Entretien (France), vol.32, no.354, p.49-51, 53-4 (July-Aug. 1983). In French.
The energy density of solar irradiation of the Earth's atmosphere, its spectal distribution and the percentage attaining ground level are summarised (the mean annual insolation on a horizontal plane in France is quoted as 1.3 GWh/m^2). Photothermal convertors are discussed (after a passing reference to photovoltaic cells) under the headings of low-temperature plane liquid absorbers with and without glazing and with vacuum tubes, and high-temperature absorbers with spherical or parabolic concentrators. Energy storage capacities for diurnal, short-term and long-term retention (using sensible heat, sensible plus latent heat, and underground storage) are compared. Integration with buildings is described. Sizes and costs of installations for space heating and for production of domestic or industrial hot water are contrasted. Design points needing special attention include degassing, pressurisation to prevent boiling, and dimensioning of heat exchangers. (no refs.) *M.B.D.*

103715 Linear stability analysis of double-diffusive solar pond. M.S.Sodha, A.Kumar (Dept. of Phys., Indian Inst. of Technol., New Delhi, India).
Energy Convers. & Manage. (GB), vol.23, no.2, p.67-71 (1983).
In this communication, the stability of the double-diffusive solar ponds has been investigated in the linear approximation. The corresponding linearised system of equations of motion is reduced to a single integro-differential equation using the Green-function technique. In contrast to the conclusions of Veronis that, initially, the instability occurs as an oscillatory mode and at a value of R_T (Rayleigh number for temperature) greater than R_S the motion becomes steady, the present analysis shows that, initially, as R_T increases from zero but remains considerably less than R_S, exponentially growing and decaying modes (steady motion) occur first; for a value of R_T more than a critical $R_T{}^c$, the motion becomes oscillatory. This oscillatory motion may, due to the basic non-linear dynamics of the system, even become aperiodic. Further, for $R_S \rightarrow \infty$, the minimum value of R_T for which steady motions can occur tends to $\mathcal{K}^{-1/2}.R_S$, where $\mathcal{K}=K_S/K_T$ where K_S and K_T are diffusivity coefficients for salt and temperature, respectively; as a contrast, according to Veronis, $R_T \rightarrow \sigma^{-1} R_S$; $\sigma=\nu/K_T$, ν being the kinematic viscosity. (8 refs.)

103716 Comparative study on performance of two models of solar device for melting wax during the winter season. P.B.L.Chaurasia, J.P.Gupta, B.V.Ramana Rao (Div. of Wind Power & Solar Energy Utilisation, Central Arid Zone Res. Inst., Jodhpur, India).
Energy Convers. & Manage. (GB), vol.23, no.2, p.73-5 (1983).
The paper describes the performance study of two similar solar devices of different capacities which melt paraffin wax to manufacture candles. These devices are based on a flat plate collector system having the same absorbing surface area (0.25 m^2) but different capacities of about 5.0 and 8.0 kg, respectively. It has been found that better results are obtained with the lesser capacity unit during the winter season at Jodhpur. (2 refs.)

103717 Transient analysis of forced circulation solar water heating system with collectors in series. S.N.Shukla, G.N.Tiwari (Centre of Energy Studies, Indian Inst. of Technol., New Delhi, India).
Energy Convers. & Manage. (GB), vol.23, no.2, p.77-82 (1983).
This communication presents an analysis of the thermal performance of a hot water system consisting of *N* collectors in series with a storage tank; forced circulation and withdrawal of hot water by displacement with cold water are built into the thermal model. Two modes of withdrawal of hot water, viz. (i) constant flow rate and, (ii) constant hot water temperature (during the day), have been considered. For a quantitative appreciation of the results, numerical calculations have been made for the two modes of hot water withdrawal corresponding to a typical cold day (26 January, 1980) in Delhi. (9 refs.)

103718 Transient analysis of double basin solar still. V.S.V.Bapeshwararao, U.Singh, G.N.Tiwari (Centre of Energy Studies, Indian Inst. of Technol., New Delhi, India).
Energy Convers. & Manage. (GB), vol.23, no.2, p.83-90 (1983).
The effect of water flowing over the upper glass cover of a double basin solar still on its transient performance has been presented. A comparative study of

the daily distillate production of a double basin solar still with and without water flowing over the upper glass cover has been made, and some interesting conclusions have been drawn. Numerical calculations have been made for a typical hot day (viz. 2 May 1980) in Delhi. (17 refs.)

103719 Year-round performance of an improved collector-cum-storage type solar water heater. N.M.Nahar (Solar Energy Section, Central Arid Zone Res. Inst., Jodhpur, India).
Energy Convers. & Manage. (GB), vol.23, no.2, p.91-5 (1983).
Systematic studies have been carried out on collector-cum-storage type solar water heaters, and efforts were made to minimise heat losses so that this type of water heater can be used for getting hot water at 40°-45°C for taking baths in the early morning hours of the next day. This paper reports year round performance, the performance equation and economics of this new improved solar water heater. This heater can supply 100 litres of hot water at 60°-70°C in the afternoon, and 40°-45°C temperature can be retained till next day morning. Its efficiency is 70.1%. (14 refs.)

103720 Theoretical study of tilted solar still as a regenerator for liquid desiccants. P.Gandhidasan (Dept. of Mech. Engng., Univ. of the West Indies, St. Augustine, Trinidad).
Energy Convers. & Manage. (GB), vol.23, no.2, p.97-101 (1983).
A closed type (tilted solar still) solar regenerator has been studied in application to regeneration with liquid desiccants. Essentially, it consists of a flat blackened, tilted surface with a transparent glazing as a covering. The absorbent solution which is to be regenerated trickles down as a thin film over the absorber and is heated by solar energy. The water vapor that evaporates from the liquid film is condensed on the underside of the glass cover and the solution leaving the regenerator becomes strong. A simple expression is derived, in this paper, to estimate the mass of water evaporated from the weak absorbent solution as a function of climatic conditions and initial conditions of the absorbent solution. A comparison is also made with a forced flow air circulation regenerator, and it was found that the closed type regenerator may be used for regeneration only in hot, humid climates. (11 refs.)

103721 Transient performance of normal/reverse flat plate collector with selective absorber surface. M.Madhusudan, G.N.Tiwari (Centre of Energy Studies, Indian Inst. of Technol., New Delhi, India), H.K.Sehgal.
Energy Convers. & Manage. (GB), vol.23, no.2, p.107-11 (1983).
The paper presents the performance of an optimised collector system [1], employing light heat transfer oil as working fluid, operated in normal and reverse configurations under simulated solar conditions. Expressions for transient and stagnation temperatures of the working fluid have been derived. Experimental and theoretical values of efficiencies for different incident intensities show good agreement. The results indicate that shallow (10 mm) liquid stream results in more efficient solar thermal performance for the normal and the reverse configurations. (6 refs.)

103722 Experimental and analytical performance study of a thermosyphon water heater. T.Muneer, M.M.Hawas, Y.Khalifa (Dept. of Mech. Engng., Garyounis Univ., Benghazi, Libya).
Energy Convers. & Manage. (GB), vol.23, no.2, p.119-24 (1983).
The performance of a thermosyphon solar water heater was studied analytically and experimentally. A finite-difference model was used to predict year-round performance. Tests were conducted on an experimental heater subjected to actual weather conditions in Benghazi, Libya. Satisfactory qualitative and quantitative agreement was found between experimental and predicted results. A storage volume of 60 litres per unit collector area was found to be optimum for Benghazi conditions. The day-end temperature was found to vary between 23° and 51°C for the test period, which occurred in winter, with an average of 41°C. (12 refs.)

103723 The total anodization of copper films on platinum: Use as selective surface absorbers at high temperature. A.A.Milgram (Weizmann Inst. of Sci., Rehovot, Israel).
J. Appl. Phys. (USA), vol.54, no.8, p.4692-3 (Aug. 1983).
A thin film of metallic copper deposited on an inert metallic conductor was totally anodized in a NaOH solution. The resulting anodic copper oxide film is shown to have excellent selective surface properties for use as a solar absorber at high temperatures. (5 refs.)

103724 Selective solar absorbers made from stainless steel: influence of the chemical composition and the metallurgical state of the alloy on the optical properties. L.Aries, J.P.Bonino, R.Benavente, J.P.Traverse (Lab. de Recherche sur l'Energie, Univ. Paul Sabatier, Toulouse, France).
Mater. Res. Bull. (USA), vol.18, no.7, p.781-95 (July 1983). In French.
Efficient photothermal converters exhibit high solar absorptance and low thermal emittance. An original method has allowed spectrally selective coatings to be obtained by chemical conversion of stainless steel. These coatings exhibit high selectivity (absorptance higher than 95% and emittance lower than 20%) and excellent durability. The dependence of the optical properties of these coatings on the chemical composition and metallurgical state of the substrate is studied. Low emittance appeared to be closely related to the corrosion resistance of the metallic surface in the treatment bath. Owing to this fact, convenient conditions can be found to produce selective coatings for each alloy. (20 refs.)

103725 A wind-mixed layer model for solar ponds. J.F.Atkinson, D.R.F.Harleman (MIT, Cambridge, MA, USA).
Sol. Energy (USA), vol.31, no.3, p.243-59 (1983).
A computer model is described which may be used for predicting transient salinity and temperature profiles in a salt gradient solar pond. It is intended for use in modeling larger surface area ponds where wind-mixing would be expected to play an important part in the dynamics of the upper layer. The formulation predicts the depth of the upper convecting zone using a mixed-layer model which incorporates the wind-mixing algorithm described by Bloss and Harleman. This is in contrast to earlier solar pond models which have generally assumed a constant value for this layer depth. Results have been obtained for a number of 1-yr simulations of a large hypothetical pond in Richmond, Virginia, and these have been used in testing the sensitivity of the model to several of the input parameters, including the radiation term and the form of the wind-mixing algorithm. The model output is also compared with field data from an operating solar pond and good agreement is found. Results have indicated that some measures will have to be taken to counteract the mixing action due to wind stress, if the upper mixed layer depth is to be maintained at an acceptable level. The model is expected to be useful in large-scale pond design. (39 refs.)

103726 Numerical optimization of a solar air heating system based on encapsulated PCM storage. P.-H.Theunissen, J.-M.Buchlin (von Karman Inst. for Fluid Dynamics, Rhode Saint Genese, Belgium).
Sol. Energy (USA), vol.31, no.3, p.271-7 (1983).
A Transient Solar Utility Network Simulation (TSUNS) code of a solar air heating system using rock bed energy storage (RBES) or phase change energy storage (PCES) is presented. Solar fraction obtained by TSUNS with RBES under Belgian climatic conditions are compared with Fchart results. The storage working times are compared between Belgium and US climates. Use of PCES in a solar air heating system provides an easy way to control overheating. Solar fraction of such systems can be improved by suitable adjustment of parameters such as phase change material (PCM) fusion temperature, latent heat and storage heat exchange properties. Comparisons between RBES and PCES ($CaCl_26H_2O$) are drawn in thermal and parasitical power field. (8 refs.)

103727 The thermal trap solar collector. J.P.Kenna (Solar Energy Unit, Univ. Coll. Cardiff, Cardiff, Wales).
Sol. Energy (USA), vol.31, no.3, p.335-8 (1983).
The purpose of this Technical Note is to show that although the thermal trap collector can theoretically perform better than a flat plate collector, in practice a 30 mm thick acrylic cover would be required to equal the performance of a typical single glazed flat plate collector with a selective absorber. The use of outer glazings allows improvements to be made for smaller trap thicknesses, for example 5 mm. The cost of thick acrylic sheets and the limitations which the use of acrylic sheet would place on the working temperature range of thermal trap collectors make it unlikely that designs based on acrylic thermal traps could be economically viable. New materials are required before this approach to collector design can be expected to succeed in the market place. (5 refs.)

103728 Spectrally selective black tungsten films. L.K.Thomas, E.E.Chain (Optically Sci. Center, Univ. of Arizona, Tucson, AZ, USA).
Thin Solid Films (Switzerland), vol.105, no.3, p.203-11 (22 July 1983).
Black tungsten thin films, combining significant solar absorptance with a high IR reflectance, were produced by the thermal decomposition of $W(CO)_6$ onto silicon substrates in the presence of an oxygen bleed. The effect of annealing treatments on the reflectance was investigated for annealing conducted in a reducing atmosphere at temperatures up to 1000°C. (30 refs.)

Optical constants of amorphous hydrogenated carbon and silicon-carbon alloy films and their application in high temperature solar selective surfaces .... See Entry 102977

Development of a point focusing collector farm system .... See Entry 103655

A simple analysis of an open regeneration system .... See Entry 103658

Solar heating of municipal pools .... See Entry 103659

Solar central receiver technology—what has been learned in the 70's .... See Entry 103663

Power from parabolic dishes: progress and prospects .... See Entry 103664

86.30Z Other topics

Direct charged-particle energy conversion in a system composed of a magnetic expander and planar collector .... See Entry 99727

86.40 ENERGY STORAGE (SECONDARY ENERGY)

86.40F Storage in thermal energy

103729 Heat buffer storage pays, but not long term storage. F.Scholz (KFA Julich, Julich, Germany).
Energie (Germany), vol.35, no.5, p.133-7 (May 1983). In German.
District and regional heating network heat availability is briefly discussed. Short term buffer storage for frequent peak demands with water as storage medium to avoid need for heat exchangers is more economic than costly seasonal storage. Heat container features and costs are considered, where costs rise steeply with storage pressure. Aspects of the Hamburg heat supply networks with buffer storage capacity, the Flensburg heat supply undertaking with its large 28000 m^3 atmospheric pressure heat buffer store, and the Lower Rhine Dinslaken/Duisburg network with considerably fluctuating heat availability from a number of industrial sources, and buffer storage implications, are presented. (24 refs.) *H.V.H.*

103730 Sensible heat storage in water. B.Harmsworth.
Heat. & Vent. Eng. (GB), vol.57, no.659, p.5-10 (July-Aug. 1983).
Of all the possible media for the storage of sensible heat, water is the most obviously attractive. The paper describes work undertaken for the Energy Technology Support Unit to study the variation of the costs of heat storage in water with the method of store construction, store volume and insulation, seeking to identify the lowest cost option, and with the operating strategy, including the sensitive parameter of storage time. (9 refs.)

Proportioning composites for efficient thermal storage walls .... See Entry 103657

Heat pump basics. I: heat pumps in large commercial buildings .... See Entry 103709

Solar energy in industry .... See Entry 103714

Transient analysis of forced circulation solar water heating system with collectors in series .... See Entry 103717

A wind-mixed layer model for solar ponds .... See Entry 103725

Numerical optimization of a solar air heating system based on encapsulated PCM storage .... See Entry 103726

86.40K Hydrogen storage and technology

103731 Hydrogen as the source of energy in internal combustion engines. K.Prescher.
OEIAZ Oesterr. Ing.- & Archit.-Z. (Austria), vol.128, no.6, p.226-32 (1983). In German.
Amongst the advantages of the use of hydrogen as fuel in internal combustion engines are those of availability and the absence of pollution problems. For the purposes of laboratory investigation an experimental single-cylinder air-cooled engine was used having a capacity of 1.6 l swept volume with a welded cylinder-head forming a combustion chamber of 58 mm diameter, and through a quartz glass window in which, and by a special optical arrangement, the conditions of ignition and combustion were recorded by a film camera. Views are given on the direction of future developments leading to diesel type engines and methods of fuel storage. (no refs.) *A.G.P.*

103732 Thermal efficiency of the magnesium-iodine cycle for thermochemical hydrogen production. Y.Shindo, N.Ito, K.Haraya, T.Hakuta, H.Yoshitome (Process Res. & Dev. Div., Nat. Chem. Lab. for Industry, Ibaraki, Japan).
Int. J. Hydrogen Energy (GB), vol.8, no.7, p.509-13 (1983).
The cycle consisting of the redox reaction of iodine with magnesium oxide, the thermal decomposition of magnesium iodate, the hydrolysis of magnesium iodide and the thermal decomposition process was calculated on material and

energy balances for three proposed flow-sheets varying according to the method used (quenching, selective absorption of HI by magnesium oxide and the two-step chemical decomposition of HI by magnetite) to separate the products of hydrogen iodide decomposition. Values of 19-37% for the MgO method and 16-35% for the Fe_3O_4 method. In order to obtain more than 25-30% of the thermal efficiency, heat recovery must be more than 80%. (18 refs.)

103733 Thermochemical hydrogen production based on magnetic fusion. O.H.Krikorian (Lawrence Livermore Nat. Lab., Livermore, CA, USA), L.C.Brown.
Int. J. Hydrogen Energy (GB), vol.8, no.7, p.515-28 (1983).
Conceptual design studies have been carried out on an integrated fusion/chemical plant system using a Tandem Mirror Reactor fusion energy source to drive the General Atomic Sulfur-Iodine Water-Splitting Cycle and produce hydrogen as a future feedstock for synthetic fuels. Blanket design studies for the Tandem Mirror Reactor show several alternatives available for providing heat at sufficiently high temperatures. The concept of a Joule-boosted decomposer is introduced in one of the systems investigated to provide heat electrically for the highest temperature step in the cycle (the SO_3 decomposition step), and thus lower blanket design requirements and costs. Flowsheeting and conceptual process designs have been developed for a complete fusion-driven hydrogen plant, and the information has been used to develop a plot plan for the plant and to estimate hydrogen production costs. (12 refs.)

103734 Design studies of the sulfur trioxide decomposition reactor for the Sulfur Cycle hydrogen production process. S.S.Lin, R.Flaherty (Advanced Energy Systems Div., Westinghouse Electric Corp., Pittsburgh, PA, USA).
Int. J. Hydrogen Energy (GB), vol.8, no.8, p.589-96 (1983).
The Sulfur Cycle is a two-step hybrid electrochemical/thermochemical process for decomposing water into hydrogen and oxygen. Integration of a complex chemical process with a solar heat source poses unique challenges with regard to process and equipment design. The conceptual design for a developmental test unit demonstrating the sulfur cycle was prepared in 1980. The test unit design is compatible with the power level of a large parabolic solar collector. One of the key components in the process is the sulfur trioxide decomposition reactor. The design studies of the sulfur trioxide decomposition reactor encompassing the thermodynamics, reaction kinetics, heat transfer and mechanical considerations, are described along with a brief description of the test unit. (4 refs.)

103735 Production of hydrogen by direct thermal decomposition of water. J.Lede, F.Lapicque, J.Villermaux (Lab. des Sci. du Genie Chimique, CNRS-ENSIC, Nancy, France).
Int. J. Hydrogen Energy (GB), vol.8, no.9, p.675-9 (1983).
This paper reports the first results of a study on the feasibility of producing hydrogen by direct thermal splitting of water by use of concentrated radiation. Relative amounts of H, O, OH, H_2, O_2 and H_2O have been computed between 1500 and 4000K at thermodynamic equilibrium. In addition, the rate of the overall reaction has been estimated assuming a kinetic model: 90% of equilibrium concentrations are reached after about 10^{-2}, 10^{-3} and 10^{-4} s at 2200, 2500 and 3000K respectively. The dissociation experiments have been carried out in an image furnace, simulating the future use of a solar furnace. Water is injected through a zirconia nozzle heated at the focus. The hot jet containing active species is then quenched by turbulent cold jets in order to minimize recombinations. Several shapes of zirconia nozzles and quenching devices have been tested in order to maximize the net production of hydrogen, which reaches 1. 7 $STPl.h^{-1}$ in continuous operation. Modelling of the hot nozzle allows the calculation of the gas temperature and shows that thermodynamic equilibrium conditions are reached under certain conditions. Parallel experiments show that cooling rates up to $10^6 K\ s^{-1}$ can be obtained by quenching. (23 refs.)

103736 How to optimize hydrogen plant designs. W.F.Van Weenen (Kinetics Technol. Internat. Corp., Monrovia, CA, USA), J.Tielrooy.
Int. J. Hydrogen Energy (GB), vol.8, no.9, p.689-700 (1983).
In a typical hydrogen plant of the type which will be discussed, methane or higher hydrocarbons are reformed with steam in a steam hydrocarbon reformer operating at a pressure of 250-400 psig, a temperature of 1500-1600°F, and with a ratio of steam to carbon in the feed of about 3.0. Following the reformer and cooling, there is a single stage of high temperature carbon monoxide shift conversion. Optionally, after further cooling, this may be followed by a second stage of carbon monoxide shift conversion operating at a lower temperature to obtain a more favourable equilibrium; this is called low temperature shift conversion. After cooling to ambient temperature, the separation of the condensate, the gas is passed through a Pressure Swing Adsorption (PSA) unit which removes all the impurities along with a small amount of hydrogen. The waste gas from the PSA unit containing all the impurities is used as fuel to the reformer. Heat is recovered from the reformer flue gas, reformer product, high temperature shift converter product and low temperature shift converter product. This paper discusses some of the process variables and design variables which must be considered in arriving at an optimized design. Seven different flow schemes are discussed in the. (no refs.)

103737 The $Mg_2Ni_{0.75}M_{0.25}$ alloys (M=3d element): their application to hydrogen storage. J.P.Darbaudery, B.Darriet, M.Pezat (Lab. de Chimie du Solide, Univ. de Bordeaux I, Talence, France).
Int. J. Hydrogen Energy (GB), vol.8, no.9, p.705-8 (1983).
The solid solutions of $Mg_2Ni_{1-x}M_x$ (when M=V, CR, Fe, Co, Cu and Zn) have a Mg_2Ni-type structure with a large homogeneity range. A comparative study of the action of hydrogen has been carried out on all alloys corresponding to an x=0.25 formulation. The absorption-desorption process of hydrogen is reversible and after dissociation of the hydride the starting material is regenerated except for copper which has not been examined. Hydriding leads for all other alloys to formation of quaternary hydrides. The thermal stability is very close to that of Mg_2NiH_4 stability: partial substitution of nickel by cobalt in Mg_2Ni leads at given temperature to a lower dehydriding rate. (7 refs.)

Production of hydrogen by direct thermal decomposition of water with the aid of a semipermeable membrane .... See Entry 103502

The case for solar/hydrogen energy .... See Entry 103652

Economic aspects of the utilization of solar energy by means of solar cells .... See Entry 103683

86.70 ENVIRONMENTAL SCIENCE

(see also 87.60R Radioactive pollution; for oceanographic aspects, see 92.10; for hydrological aspects see 92.40; for meteorological aspects see 92.60)

103738 Ecological effects with the use of combined heat and power systems. A.Schmidt, W.B.Kim.
Brennst.-Waerme-Kraft (BWK) (Germany), vol.35, no.6, p.294-7 (June 1983). In German.
Describes the effect of a combined heat and power system on the emissions of noxious matter, if this system is substituted for the usual low-temperature heating systems which are operated as individual furnaces. Taking Vienna as an example, the author calculates the emitted amounts of noxious matter (SO_2 and dust) and proves that the installation of combined heat and power stations would reduce the emissions of noxious matter considerably. The course of calculation is mentioned and charts and diagrams contain the results. (4 refs.)

Field Measurement and Calibration Using Electro-Optical Equipment: Issues and Requirements .... See Entry 98622

86.70C Soil

The measurement of fluorine concentration in environmental samples by using $^{19}F(p,\alpha\gamma)^{16}O$ prompt nuclear reaction analysis .... See Entry 103773

86.70E Water

103739 Henry's Law constants and the air-sea exchange of various low molecular weight halocarbon gases. R.J.Hunter-Smith, P.W.Balls, P.S.Liss (School of Environmental Sci., Univ. of East Anglia, Norwich, England).
Tellus Ser. B (Sweden), vol.35B, no.3, p.170-6 (July 1983).
The McAuliffe (1971) multiple equilibration technique has been used to measure the Henry's Law constants for a variety of low molecular weight halocarbon gases in distilled and sea waters at a number of temperatures. Halocarbon measurements made on a cruise from 48°N to 65°S in the Atlantic in late 1981 indicate a small but statistically significant difference in atmospheric concentrations of freon-11 between N and S hemispheres. Similar measurements for carbon tetrachloride show no significant inter-hemispheric gradient. (15 refs.)

103740 Health effects guidance for uranium in drinking water. C.R.Cothern, W.L.Lappenbusch, J.A.Cotruvo (US Environmental Protection Agency, Washington, DC, USA).
Health Phys. (GB), vol.44, suppl.1, p.377-84 (1983). (Proceedings of an International Conference on Radiobiology of Radium and the Actinides in Man, Lake Geneva, WI, USA, 11-16 Oct. 1981).
The interim regulations for radioactivity in drinking water were promulgated in 1976 (Federal Register, Friday, 9 July, 1976, p.28402). These regulations specifically excluded uranium because of uncertainties concerning its toxicology, treatment technology and occurrence. At this time, EPA's Office of Drinking Water is considering proposing a health effects guidance level of 10 pCi/l. (0.37 Bq/l.) for uranium in drinking water. This paper describes the approach that EPAs Office of Drinking Water is considering in developing the guidance level. This value has not yet been officially determined to be EPA's formal guidance, but is presented as a working hypothesis for review and comments. Included here is a discussion of occurrence, pharmacokinetics and health effects. The calculation of doses uses the ICRP 30 model and the risk determination uses EPA's newly developed life table approach. The risk level from ingesting drinking water with a uranium content of 10 pCi/l. is estimated to be about 3×10^{-5} excess cancers/lifetime. (16 refs.)

103741 Occurrence of uranium in drinking water in the US. C.R.Cothern, W.L.Lappenbusch (US Environmental Protection Agency, Washington, DC, USA).
Health Phys. (GB), vol.45, no.1, p.89-99 (July 1983).
Uranium is found in ground and surface waters due to its natural occurrence. In some cases, its presence is due to human activities such as mining and milling uranium. Thus, it is also found in drinking water. The range of concentrations existing in drinking water supplies in the US is tabulated and examined. The range of isotopic abundances are also listed. Projections from the available data lead to estimates that of the 59812 community drinking water supplies in the US, 25-650 would exceed a uranium concentration of 20 pCi/l, 100-2000 would exceed 10 pCi/l and 2500-5000 would exceed 5 pCi/l. (29 refs.)

103742 Oil pollution on the Egyptian Red Sea coast. R.G.M.Hanna (Inst. of Oceanography & Fisheries, Cairo, Egypt).
Mar. Pollut. Bull. (GB), vol.14, no.7, p.268-71 (July 1983).
A simple weighing method using carbon tetrachloride as solvent was used to survey the dissolved hydrocarbon and tarball levels in the area of the Egyptian Red Sea coast. The area of investigation covers the coastal area from Ras-Gharib down to the port of Qosier during the period from September 1979 to February 1981. The survey confirms the presence of extensive oil pollution in the area, especially at Ras-Gharib and Ras-Shukhair. Minimum concentrations were obtained at Ghardaqa where no dissolved hydrocarbons were detected in 1979-80 but an increase to 20 $\mu g\ l^{-1}$ in 1981 was recorded. The high levels of pollution recorded in the southern part of the Gulf of Suez are related to the presence of the offshore oil fields, most of which are located at Ras-Gharib. (8 refs.)

103743 Simulation of water exchange and pollutant dispersal in the Gulf of Neva. L.A.Rukhovets (Inst. of Social Economic Problems, Acad. of Sci., USSR).
Sov. Meteorol. & Hydrol. (USA), no.7, p.61-9 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.7, p.78-87 (1982).
A numerical solution to simplified shallow water equations provides a picture of the stationary currents in the Gulf of Neva under natural and dammed conditions. A theoretical solution has been constructed for the two-dimensional equation for turbulent diffusion of persistent pollutants coming from purification plants. An estimate is made of the possible effects of a proposed dam on the pollutant distribution. (11 refs.)

103744 The computation and reporting of dissolved gas levels. J.E.Colt (Dept. of Civil Engng., Univ. of California, Davis, CA, USA).
Water Res. (GB), vol.17, no.8, p.841-9 (1983).
Provisional standards are proposed for the computation and reporting of dissolved gas levels in freshwater and seawater. Total gas pressure should be reported in terms of excess pressure (ΔP), while component gases such as nitrogen, argon, oxygen and water vapor should be reported in terms of partial or excess pressure. Barometric pressure, dissolved oxygen, water temperature and salinity must also be reported. (33 refs.)

103745 MICRO-RSMM: a microcomputer-based network simulation language for modeling pollutants in river systems. N.B.Rao (Dept. of Information Systems & Decision Sci., California State Univ., Fresno, CA, USA).
Modeling and Simulation on Microcomputers: 1983, San Diego, CA, USA, 1983 (La Jolla, CA, USA: SCS 1983), p.112-16
The prediction of steady state profiles of environmental pollutants in rivers is an important aspect of water quality modeling. The River Sysstem Modeling Methodology (RSMM) provides a framework for conceptualizing and constructing simulation models for analyzing pollution in rivers. In RSMM, a river system is represented by a set of nodes and branches which form a network diagram. Nodes represent river elements such as junctions and pollutant sources; branches represent homogeneous segments, reaches. The RSMM processor has been implemented as a FORTRAN program on larger machines. Another implementation of RSMM, called micro-RSMM has now been developed for the Apple-II microcomputer. In micro-RSMM, the user describes a river system through a set of statements which are interpreted by the micro-RSMM processor, which is written in Applesoft BASIC. Based on the user described system, micro-RSMM generates spatial profiles of various pollutants on the river. These outputs can be viewed either in the form of a table, or in the form of a plot which uses Apple's High Resolution Graphics. (9 refs.)

Niagara River-Lake Ontario Pollution Problem .... See Entry 98615

Determination of arsenic and phosphorus compounds in groundwater with reduced molybdenum blue .... See Entry 103766

Preconcentration of trace elements in natural water with cellulose piperazinedithiocarboxylate and determination by neutron activation analysis .... See Entry 103767

Vertical concentration profiles of lead in the Central Pacific at 15°N and 20°S .... See Entry 104397

Uptake of excess CO_2 by an Outcrop-diffusion model of the ocean .... See Entry 104398

Dispersal by randomly varying currents .... See Entry 104400

Oyster (Crassostrea virginica) as indicator of heavy metal pollution in some lagoons of the Gulf of Mexico .... See Entry 104402

Selected man-made halogenated chemicals in the air and oceanic environment . ... See Entry 104476

The recent ^{14}C record in the north-west Mediterranean atmosphere .... See Entry 104504

86.70G Atmosphere

103746 Air quality network design for Saudi Arabia using long-range transport model. T.Husain, S.M.Khan (Res. Inst., Univ. of Petroleum & Minerals, Dhahran, Saudi Arabia).
Atmos. Environ. (GB), vol.17, no.5, p.921-6 (1983).
The need for air quality surveillance is growing during the third five-year plan in Saudi Arabia. The main emphasis in the initial stage of this plan is to select the sites of air monitoring stations on the basis of scientific principles. To carry out this study, emission inventories of major point sources are compiled. Meteorological data for synoptic and upper air stations within the Kingdom of Saudi Arabia on wind speed, wind direction, temperature and pressure are collected and processed. Air Resources Laboratories (ARL) model is used to calculate long range trajectories of air parcels and to estimate concentration levels at various grid points within the region. Concentration contour maps are then prepared to identify adversely affected zones and potential air monitoring sites. (20 refs.)

103747 Analysis of the error associated with grid representation of point sources. P.Karamchandani, L.K.Peters (Dept. of Chem. Engng., Univ. of Kentucky, Lexington, KY, USA).
Atmos. Environ. (GB), vol.17, no.5, p.927-33 (1983).
The steady-state, three-dimensional transport equation for inert pollutant dispersion in the atmosphere is solved analytically to obtain expressions for pollutant concentrations from both a point source and a rectangular area source. The results of this analysis have application to numerical grid models in which the smallest resolvable source is the size of a single grid. (13 refs.)

103748 Intermediate-range grid model for atmospheric sulfur dioxide and sulfate concentrations and depositions. K.W.Ragland, K.E.Wilkening (Dept. of Mech. Engng., Univ. of Wisconsin-Madison, Madison, WI, USA).
Atmos. Environ. (GB), vol.17, no.5, p.935-47 (1983).
A three-dimensional time-dependent grid type model for two chemically reacting species which undergo atmospheric transport, diffusion and wet and dry deposition over a region of several hundred km is presented. Accuracy and sensitivity of the model are discussed. The model is applied to the Rainy Lake Watershed using the available emissions and meteorological data. The model calculations are compared to National Atmospheric Deposition Program wet deposition data and snow core data. (6 refs.)

103749 Mathematical modeling of the formation and transport of ammonium nitrate aerosol. A.G.Russell, G.J.McRae, G.R.Cass (California Inst. of Technol., Pasadena, CA, USA).
Atmos. Environ. (GB), vol.17, no.5, p.949-64 (1983).
A mathematical model describing the transport and formation of aerosol NH_4NO_3 is presented. Based on a vertically resolved Lagrangian trajectory formulation incorporating gas phase kinetics, NH_4NO_3 concentrations are computed at thermodynamic equilibrium with precursor HNO_3 vapor and NH_3 concentrations. A brief description of the NH_3 emissions inventory used in this study is included to indicate the important sources. The model was tested by comparison to ambient NH_3, NH_4^+ and NO_3^- concentrations measured at El Monte, California during June 1974. Potential applications model to control strategy decisions and to study the fate of NO_x are discussed. (63 refs.)

103750 Solution of the advection-diffusion equation by the moments method. R.Lupini (Istituto di Fisica, Univ. di Bologna, Bologna, Italy), T.Tirabassi.
Atmos. Environ. (GB), vol.17, no.5, p.965-71 (1983).
A general technique for solving the *K*-equation is developed on the basis of the truncated Gram-Charlier expansion of the concentration field, and of the finite set of equations for the corresponding moments. Such a 'moments method' can be applied to diffusion problems involving point sources and horizontally homogeneous boundary layer structures. It is suggested that this method may be more practical to use than the conventional grid model, particularly for routine applications. The fourth-order moments method is applied to a case of continuous plumes in a sheared atmosphere and the predicted concentration patterns are compared with the solutions obtained by a conventional grid model. (12 refs.)

103751 Trace gas profiles to 3000 m over Antarctica. E.Robinson, D.R.Cronn, F.Menzia, D.Clark, R.Legg, R.Watkins (Air Pollution Res. Section, Washington State Univ., Pullman, WA, USA).
Atmos. Environ. (GB), vol.17, no.5, p.973-81 (1983).
During October-December, 1980 air samples were collected on 13 helicopter flights between 30 and 3000 m above the Ross Ice Shelf, Antarctica were analyzed in McMurdo for N_2O and the halocarbons, F-11, F-12, CCl_4 and CH_3CCl_3 using electron capture gas chromatography. Average profiles differed when flights were classified on the basis of low-level inversion conditions, the magnitude of the temperature lapse rate, or the direction of upper level winds. These differences in trace chemical profiles above 200 m are postulated to result from a combination of mid latitude air mass advection and subsequent dilution over Antarctica with stratospheric air. Lower boundary layer gradients may indicate a surface source from an unknown physical enrichment process. (22 refs.)

103752 Prediction of cloud effects in chimney plumes. K.T.Spillane, C.C.Elsum (CSIRO Div. of Atmospheric Phys., Mordialloc, Victoria, Australia).
Atmos. Environ. (GB), vol.17, no.5, p.983-90 (1983).
A numerical model to predict the occurrence of visible condensation and cloud length in chimney plumes is tested against observations of the plume from a 500 MW natural gas-fired power station at Melbourne, Australia. The model employs two entrainment parameters selected from the literature on plume trajectories and not fitted to the observations reported. A criterion for a plume to be visible is developed for droplets around 5 μm radius and plume distribution of condensed water determined from Gaussian two-dimensionalization of temperature and total water. (27 refs.)

103753 Processing the turbulent diffusion problem in the atmospheric boundary layer by use of stochastic differential equations. Ye Wenhu, Lu Chongfei, Zhang Aichen (Peking Univ., Peking, China).
Acta Meteorol. Sin. (China), vol.41, no.1, p.69-78 (Feb. 1983). In Chinese.
On the basis of physical mechanics of turbulent diffusion, the turbulent diffusion process is described with Ito's stochastic differential equation, and the concentration model of the continuous point source is obtained. Its first order approximate solution is expressed as a form of analytical function. The special cases of the first order approximate solution are identified with the form which is commonly used. (15 refs.)

103754 Increase and seasonal cycles of nitrous oxide in the Earth's atmosphere. M.A.K.Khalil, R.A.Rasmussen (Dept. of Environmental Sci., Oregon Graduate Center, Beaverton, OR, USA).
Tellus Ser. B (Sweden), vol.35B, no.3, p.161-9 (July 1983).
Based on about nine thousand ground-level measurements at Cape Meares, Oregon (45°N), and Cape Grim, Tasmania (42°S), spanning three years, it is shown that nitrous oxide (N_2O) is increasing at about 0.9 p.p.b. yr^{-1} in the northern hemisphere, and at 0.7 p.p.b. yr^{-1} in the southern hemisphere. It is also shown that N_2O concentrations vary with the season. (29 refs.)

103755 Strong and weak acidity of aerosols collected over the Northeastern United States. R.J.Ferek (Dept. of Oceanography, Florida State Univ., Tallahassee, FL, USA), A.L.Lazrus, P.L.Haagenson, J.W.Winchester.
Environ. Sci. & Technol. (USA), vol.17, no.6, p.315-24 (June 1983).
Total sulfate, acidity, and principal cations were measured in aerosol samples collected from an aircraft over the northeastern United States and at ground level on filters protected by a denuder tube for NH_3. Aerosol acidity was determined by aqueous extraction of the filters and titration with NaOH. Strong and weak acid components were resolved by using Gran plots. (43 refs.)

103756 Tracing bomb ^{14}C in the atmosphere 1962-1980. R.Nydal, K.Lovseth (Radiological Dating Lab., Norwegian Inst. of Technol., Trondheim, Norway).
J. Geophys. Res. (USA), vol.88, no.C6, p.3621-42 (20 April 1983). (Analysis and Interpretation of Atmospheric CO_2 Data, Bern, Switzerland, 14-18 Sept. 1981).
When the ever greater series of nuclear tests were exposed to the atmosphere at higher northern latitudes during 1961 and 1962, an attempt was made at this laboratory to trace the distribution of bomb-produced ^{14}C down to lower latitudes and into the ocean surface. Several ground level stations were established for this purpose in the early 1960s, from Spitsbergen to Madagascar. Measurements were also gradually extended to the ocean surface. The tropospheric measurements which partly have been performed during the past 18 years have proved to be important for testing exchange models for industrial CO_2 in the atmosphere and more generally for studying the carbon cycle in nature. The present paper includes tables of all the atmospheric ^{14}C data measured at the laboratory during 18 years. (23 refs.)

103757 Uranium and plutonium isotopes in the atmosphere. Y.Sakuragi, J.L.Meason, P.K.Kuroda (Dept. of Chem., Univ. of Arkansas, Fayetteville, AR, USA).
J. Geophys. Res. (USA), vol.88, no.C6, p.3718-24 (20 April 1983).
Uranium 234 and 235 were found to be highly enriched relative to uranium 238 in several rain samples collected at Fayetteville, Arkansas, during the months of April and May 1980. The anomalous uranium appears to have originated from the Soviet satellite Cosmos-954, which fell over Canada on January 24, 1978. The uranium fallout occurred just about the time Mount St. Helens erupted on May 18, 1980. The concentration of ^{238}U in rain increased markedly after the eruption of Mount St. Helens, and it appeared as if a large quantity of natural uranium was injected into the atmosphere by the volcanic eruption. The pattern of variation of the concentrations of uranium in rain after the eruption of Mount St. Helens was found to be similar to that of plutonium isotopes. (13 refs.)

103758 Soot carbon and excess fine potassium: long-range transport of combustion-derived aerosols. M.O.Andreae (Dept. of Oceanography, Florida State Univ., Tallahassee, FL, USA).
Science (USA), vol.220, no.4602, p.1148-51 (10 June 1983).
During a cruise from Hamburg to Montevideo, aerosol samples representing air masses from Europe, the Sahara, tropical Africa, South America, and open oceanic regions were collected. They showed significant amounts of soot carbon over large areas of the remote Atlantic, often similar to concentrations in rural continental areas. Back-tracjectories and the ratios of soot carbon to total fine carbon and of excess fine potassium to soot carbon indicate that biomass burning in tropical regions is an important source of soot carbon to the world atmosphere. (31 refs.)

103759 Release of man-made krypton 85 to the atmosphere. Yu.A.Izrael', I.M.Nazarov, A.G.Ryaboshapko (Inst. of Appl. Geophys., USSR).
Sov. Meteorol. & Hydrol. (USA), no.6, p.1-9 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.6, p.5-15 (1982).
It is shown that the main adverse consequence of krypton 85 release in an increase in the electrical conductivity of the atmosphere. Undesirable changes in the conductivity will occur when the atmosphere accumulates about 1.2×10^4 MCi of krypton 85, which corresponds to an input of 7.8×10^2

MCi/y. This is only six times the annual input that may be attained by the year 2000. (20 refs.)

103760 The dispersion of pollution particle coordinates in the ground layer of the atmosphere. E.K.Garger (Inst. of Experimental Meteorology, USSR).
Sov. Meteorol. & Hydrol. (USA), no.6, p.26-33 (1982). Translation of: *Meteorol. & Gidrol. (USSR),* no.6, p.35-44 (1982).
Results are presented on the absolute and relative coordinates of particles in the ground-level layer of the atmosphere obtained by means of balloons. The data are compared with the hypothesis of similarity in the Lagrange characteristics of the turbulence in that layer for neutral or unstable stratification. The coefficients in the similarity formulas are estimated for the relative and absolute dispersions, and these are compared with other experimental and theoretical estimates. (16 refs.)

103761 Propagation of a heavy pollutant in the boundary layer of the atmosphere with nonstationary penetrating convection. P.Yu.Pushistov, V.M.Mal'bakhov, S.M.Kononenko (West Siberian Regional Res. Inst., USSR).
Sov. Meteorol. & Hydrol. (USA), no.6, p.34-40 (1982). Translation of: *Meteorol. & Gidrol. (USSR),* no.6, p.45-53 (1982).
A two-dimensional numerical hydrodynamic model for penetrating convection is used to examine the propagation of a heavy pollutant in the boundary layer. The source of the pollutant is a dust-covered surface. The spatial and temporal changes in the pollutant concentration are examined in relation to convection. Transport by convection and diffusion is examined, and also the effects of gravitational deposition. The numerical solution to the equations for the pollutant concentration are compared with the analytical solution obtained for conditions without convection. (15 refs.)

103762 Background observations on the chemical composition of atmospheric fallout at Mirnyi observatory. S.A.Mel'nikov, V.P.Rusanov (Arctic & Antarctic Res. Inst., USSR).
Sov. Meteorol. & Hydrol. (USA), no.9, p.41-5 (1982). Translation of: *Meteorol. & Gidrol. (USSR),* no.9, p.56-61 (1982).
Chemical compositions are reported for atmospheric fallout and samples from surface snow cover and continental ice measured during the Twenty-Fourth Soviet Antarctic Expedition. The data can be used to follow the seasonal course of the composition of precipitation in the region of Mirnyi observatory. (8 refs.)

103763 Use of the method of isotope glaciology for studying nuclear explosion products in Antarctica. E.N.Davydov, K.P.Makhon'ko (Inst. of Experimental Meteorology, USSR).
Sov. Meteorol. & Hydrol. (USA), no.5, p.36-42 (1982). Translation of: *Meteorol. & Gidrol. (USSR),* no.5, p.48-55 (1982).
Data on the content of radioactive nuclear explosion products in annual ice layers at the Mirnyi, Molodezhnaya, Bellinshausen, and Vostok stations in Antarctica are used for calculating atmospheric fallout P and concentration in the air q of these products in preceding years when direct measurements of P and q were not carried out. The transformation of the aerosol contaminant during its transport from the Northern Hemisphere to the Antarctic coast is discussed. The time of transport of air masses from the Northern Hemisphere to the Southern in the troposphere and stratosphere, half time of the contaminant in the stratosphere in the southern polar region, and its effective settling rate are determined. (17 refs.)

103764 Electric potential gradient under conditions of industrial air pollution. A.A.Krechetov, A.Kh.Filippov, V.K.Tatarnikov (Irkutsk State Univ., Irkutsk, USSR).
Sov. Meteorol. & Hydrol. (USA), no.5, p.92-5 (1982). Translation of: *Meteorol. & Gidrol. (USSR),* no.5, p.108-11 (1982).
The results of measuring the potential gradient under conditions of industrial air pollution are analyzed. The characteristics of the diurnal variation of the potential gradient at various distances from the pollution source are examined. The spatial correlation of the mean hourly values of the potential gradient is investigated. (5 refs.)

103765 Atmospheric diffusion experiments performed in October 1980 at the Turbigo ENEL power plant. P.Bacci, G.Carboni, M.De Bortoli, P.Gaglione, P.Thomas, S.Vogt.
Report EUR 8334 EN, Comm. European Communities, Luxembourg (1983), 30 pp.
Describes tracer atmospheric dispersion experiments carried out during October 1980 at the ENEL power plant of Turbigo (Po Valley, Northern Italy). The tracer was released from one of the plant stacks and near-ground concentrations were determined on air samples collected by automatic samplers at downwind source distances up to about 10 km. Several meteorological observations were performed simultaneously. The data obtained were evaluated by a least squares fit to deduce dispersion parameters. A reconstruction on the x-y plane of the plume is also computed. (8 refs.)

Response characteristics of cellulose nitrate track-detectors to radon and radon-daughter mixtures .... See Entry 100188

Determination of hexachloroacetone in air .... See Entry 103768

Time-resolved laser-induced breakdown spectrometry of aerosols .... See Entry 103769

Eye-safe tracking of oil fog plumes by UV lidar .... See Entry 103770

Determination of ethylene and other reactive hydrocarbons in the atmospheric air at Trombay, Bombay by gas chromatography using a chemiluminescent detector .... See Entry 103771

Radon concentration and exhalation measurement with a semiconductor detector and an electrostatic precipitator working in a closed circulation system .... See Entry 103772

Site specific derived limits for stack discharges .... See Entry 104075

Uptake of excess CO_2 by an Outcrop-diffusion model of the ocean .... See Entry 104398

Temporal variations in acid precipitation over New York State—what the 1965-1979 USGS data reveal .... See Entry 104423

Acid clouds and precipitation in Eastern Colorado .... See Entry 104424

A regional scale modelling study of the sulfur oxides with a comparison to ambient and wet deposition monitoring data .... See Entry 104425

Past and present sulphur pollution in the southern Pennines . See Entry 104427

Turbulence structure in convective boundary layers and implications for diffusion .... See Entry 104437

Wind fluctuations in stable air at the Boulder Tower .... See Entry 104438

Photochemical reactivity of perchloroethylene: a new appraisal .... See Entry 104457

Evidence of an additive effect for ozone plumes from small cities .... See Entry 104464

The global distribution of atmospheric carbon dioxide. II. A review of provisional background observations, 1978-1980 .... See Entry 104470

A deconvolution of the tree ring based δ^{13}C record .... See Entry 104471

Nonlinear response of Stratospheric ozone column to chlorine injections .... See Entry 104473

Aqueous oxidation of SO_2 by hydrogen peroxide .... See Entry 104475

Selected man-made halogenated chemicals in the air and oceanic environment . ... See Entry 104476

A general circulation model study of atmospheric carbon monoxide .... See Entry 104477

Stratospheric N_2O, CF_2Cl_2, and $CFCl_3$ composition studies utilizing in situ cryogenic, whole air sampling methods .... See Entry 104485

The recent ^{14}C record in the north-west Mediterranean atmosphere .... See Entry 104504

A statewide screening for acid rainfall in Iowa .... See Entry 104527

A separator for obtaining samples of cloud water in aircraft .... See Entry 104574

86.70J Noise

(see also 43.50 Noise, its effects and control)

Theoretical foundations of urban noise control .... See Entry 100970

86.70L Measurement techniques in environmental science

103766 Determination of arsenic and phosphorus compounds in groundwater with reduced molybdenum blue. R.E.Stauffer (Water Chem. Lab., Univ. of Wisconsin, Madison, WI, USA).
Anal. Chem. (USA), vol.55, no.8, p.1205-10 (July 1983).
Chemical studies were made to optimize reduced molybdenum blue for arsenic and phosphorus determinations in chemically diverse groundwaters. Phosphate strongly catalyzes the development of the arsenic(V) molybdate complex; increasing H^+ or H^+:Mo retards complexation, but the effect is greater for the potentially interfering silicomolybdate complex. The oxidation of As(III) to As(V) by iodate partially inhibits the subsequent color development of silica. Iodide has no effect. Fluoride ion partially suppresses silica color development, probably because of competitive Si-F complexing at low pH. The molybdate responses of As(V), P, and SiO_2 mixtures are not color additive. Optimum reaction conditions are $H^+=0.30$ N; H^+:Mo$=88$ for arsenic and phosphorus determinations in the presence of silica. (30 refs.)

103767 Preconcentration of trace elements in natural water with cellulose piperazinedithiocarboxylate and determination by neutron activation analysis. S.Imai, M.Muroi, A.Hamaguchi (Public Health Res. Inst., Kobe, Japan), M.Koyama.
Anal. Chem. (USA), vol.55, no.8, p.1215-19 (July 1983).
To prepare cellulose piperazinedithiocarboxylate (PID), tosylcellulose was reacted with piperazine to give the amino-cellulose which was then reacted with carbon disulfide. The preconcentration of the trace elements was accomplished by the PID column operations. Ten liters of river water or spring water sample was passed through the column at a given pH. The packings were taken out of the column, dried at 110°C, and then burned to ashes in a low-temperature plasma asher. The ashes were encapsulated in polyethylene rabbits of the pneumatic tube system and subjected to neutron irradiation in a reactor. γ-ray spectrometry was then performed on the irradiated sample and the concentration of 18 elements in natural water samples was determined. (4 refs.)

103768 Determination of hexachloroacetone in air. E.Kissa (Chem. & Pigments Dept., E.I. du Pont de Nemours & Co., Wilmington, DE, USA).
Anal. Chem. (USA), vol.55, no.8, p.1222-5 (July 1983).
Hexachloroacetone in air is collected in anhydrous methanol which reacts rapidly and quantitatively with hexachloroacetone. The reaction products, methyl trichloroacetate and chloroform, are determined by gas chromatography using an electron capture detector. The method can detect as little as 0.003 mg/m^3 hexachloroacetone in air. Moisture in air hydrolyzes hexachloroacetone to trichloroacetic acid and chloroform. The extent of hydrolysis can be calculated from the amounts of chloroform and methyl trichloroacetate found in methanol, if chloroform in air originates only from hydrolysis of hexachloroacetone. Unlike primary alcohols, secondary or tertiary alcohols do not reach with hexachloroacetone. (6 refs.)

103769 Time-resolved laser-induced breakdown spectrometry of aerosols. L.J.Radziemski, T.R.Loree, D.A.Cremers, N.M.Hoffman (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
Anal. Chem. (USA), vol.55, no.8, p.1246-52 (July 1983).
The repetitive breakdown spark from a focused laser beam was used to generate analytically useful emission spectra of aerosols in air. The apparatus is simple; a pulsed laser and optics, a spectrometer, and some method for time resolution of the spark light. High temperatures in the spark result in vaporization of small particles, dissociation of molecules, and excitation of atomic and ionic spectra. The plasma acts as if it were in local thermodynamic equilibrium at least after 1 μs. Spectroscopic methods have been used to measure the time-resolved temperatures and electron densities. A simple one-dimensional hydrodynamic model predicts the temperature and diameter of the spark. Beryllium in atmospheric pressure air has been detected at 0.7 μg/m^3, which is 0.6 ng/g of air (RSD=30%). Limits of detection have also been established for Na, P, As, and Hg in air. (36 refs.)

103770 Eye-safe tracking of oil fog plumes by UV lidar. W.L.Eberhard (Wave Propagation Lab., NOAA, Boulder, CO, USA).
Appl. Opt. (USA), vol.22, no.15, p.2282-5 (1 Aug. 1983).
NOAA's Wave Propagation Laboratory operated a plume-tracking lidar during two field experiments investigating atmospheric dispersion in complex terrain. The lidar successfully acquired data on oil fog plume behavior by detecting the elastic backscatter of the pulsed output of a frequency-doubled ruby laser. This UV wavelength (0.3472 μm) met stringent eye safety restrictions. An analysis of signal and noise levels demonstrates that plume definition at a wavelength of 0.3472 μm is superior in many cases to that at 0.6943 μm when pulse energies are low enough to be eye-safe at the range to the plume. This is often true in spite of the high threshold set by the large molecular scatter from the ambient air at the UV wavelength. Backscatter coefficients of oil fog at the shorter wavelength were 1-4× larger than at the longer wavelength. (7 refs.)

103771 Determination of ethylene and other reactive hydrocarbons in the atmospheric air at Trombay, Bombay by gas chromatography using a chemiluminescent detector. A.M.Mohan Rao, A.J.Netravalkar, P.K.Arora, K.G.Vohra (Div. of Radiological Protection, Bhabha Atomic Res. Centre, Bombay, India).
Atmos. Environ. (GB), vol.17, no.6, p.1093-7 (1983).
A gas chromatographic method is described for the determination of reactive hydrocarbons in the atmospheric air at Trombay, Bombay. Pre-concentration of the atmospheric hydrocarbons is carried out on short U-columns of silica gel kept at dry-ice temperature. The detector is based on the measurement of light intensity due to chemiluminescent reactions between O_3 and the reactive hydrocarbons in the detector and is thus selectively sensitive to reactive hydrocarbons. Data on atmospheric concentrations of these hydrocarbons at Trombay is reported. (11 refs.)

103772 Radon concentration and exhalation measurement with a semiconductor detector and an electrostatic precipitator working in a closed circulation system. M.Wojcik, L.Morawska (Inst. of Phys., Jagellonian Univ., Cracow, Poland).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.212, no.1-3, p.393-402 (1 July 1983).
An apparatus is described and a method presented for the determination of concentrations of radon emanated from solid and liquid samples. In this method an object under consideration or a sample of air is enclosed in an hermitically sealed chamber. The air contaminated by radon and its daughters is circulated in a closed system a few times through an electrostatic precipitator mounted in the same housing as a semiconductor Si(Li) detector. The concentration of radon is determined by measuring the alpha activity of its daughters. With the application of an electrostatic precipitator and a silicon detector it is possible to perform alpha spectrometric measurements and thus separate activities of RaA, RaC′, and ThC, and to calculate ^{222}Rn of ^{220}Rn concentrations. The sensitivity of the apparatus is high. The minimum detectable radon concentration calculated from an activity measurement of RaA (fast method), is about 0.46 pCi/1 and when measuring the activity of RaC′ (slow method), it is 0.028 pCi/1. (10 refs.)

103773 The measurement of fluorine concentration in environmental samples by using $^{19}F(p,\alpha\gamma)^{16}O$ prompt nuclear reaction analysis. Shen Guantao, Liang Daihua, Li Deyi (Shanghai Inst. of Nuclear Res., Acad. Sinica, Shanghai, China), Zhou Muyao, Zhang Yongfa, Chen Yitai, Wang Chuanshan, Zhou Shuxin, Zhang Shengjun.
Nucl. Tech. (China), no.2, p.34-5, 33 (April 1983). In Chinese.
The paper gives a brief account about the principle of the method, sample treatment and apparatus in the measurement of the fluorine concentration of the environmental pollution by using the prompt nuclear reaction, $^{19}F(p,\alpha\gamma)^{16}O$. Results for two groups of soil samples are given, which to a certain degree reflect the fluorine pollution around the steel works. (3 refs.)

103774 In-flight radiometric calibration of advanced remote sensing systems. C.J.Kastner, P.N.Slater (Optical Sci. Center, Univ. of Arizona, Tucson, AZ, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.356, p.158-65 (1983). (Field Measurement and Calibration Using Electro-Optical Equipment: Issues and Requirements, San Diego, CA, USA, 24-25 Aug. 1982).
Several methods for the in-flight calibration of advanced remote sensing systems are reviewed. Pre-flight and in-flight detector-based calibration are discussed. Calibration by reference to instrumented ground targets is suggested for current systems. Preliminary data are presented on the accuracy and sensitivity required of measurements of ground targets and the atmosphere between the targets and the sensor to achieve an uncertainty in absolute terms of less than ±3% in the calibration of Landsat-4 systems. (31 refs.)

103775 Statistical characteristics of millimeter waves reflected from vegetation. G.A.Andreyev, A.A.Potapov, G.I.Khokhlov.
Radio Eng. & Electron. Phys. (USA), vol.27, no.10, p.6-11 (Oct. 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.10, p.1863-9 (Oct. 1982).
Time-domain and spectral characteristics of millimeter waves reflected from vegetation are investigated experimentally and theoretically. The experiment is conducted at short millimeter wavelengths. The transmit-receive equipment had an energy potential of 140 dB and a circular polarization of radiation. A phenomenological description of correlation coefficient and spectra of such waves is proposed and verified experimentally. Formulas are derived which relate the spectral width of reflected millimeter waves to the average wind velocity. Average effect scattering areas of foliage and coniferous forests in the rain are determined experimentally. (12 refs.)

Response characteristics of cellulose nitrate track-detectors to radon and radon-daughter mixtures .... See Entry 100188

87.00 BIOPHYSICS, MEDICAL PHYSICS, AND BIOMEDICAL ENGINEERING

87.10 GENERAL, THEORETICAL, AND MATHEMATICAL BIOPHYSICS

(inc. logic of biosystems, quantum biology, and relevant aspects of thermodynamics, information theory, cybernetics, and bionics)

Orthogonal collocation for the analysis of immobilized enzyme systems .... See Entry 103492

Linearisation by optimal control .... See Entry 103804

Estimating kinetic constants from single channel data .... See Entry 103819

Stationarity, randomness, and serial dependence in neuronal spike trains .... See Entry 103832

A survey of finite element analysis in orthopedic biomechanics: the first decade .... See Entry 103919

Mathematical modeling of the stress strain-strain rate behavior of bone using the Ramberg-Osgood equation .... See Entry 103923

A demographic model for performing site-specific health risk projections .... See Entry 103973

87.15 MOLECULAR BIOPHYSICS

(see also 36.20 Macromolecules and polymer molecules)

103776 Study of the binding of Mg ions by α-lactalbumin using fluorescent spectroscopy. Ye.A.Permyakov, L.P.Kalinichenko, L.A.Morozova, V.V.Yarmolenko, E.A.Burshtein (Inst. of Biological Phys., Acad. of Sci., Puschino, USSR).
Biophysics (GB), vol.27, no.4, p.597-602 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.4, p.578-83 (1982).
Titration with Mg^{2+} ions against bovine lactalbumin first freed of metal ions gives a two-step fall in the quantum yield of its tryptophan fluorescence and heavy shift of the fluorescence spectrum to the shortwave region. These changes appear to reflect conformational changes induced in the protein molecule by binding of two Mg^{2+} ions as a result of which the tryptophan residues localized in the metal-free form on the surface of the globule pass within the molecule into rigid nonpolar surroundings. The binding constants of Mg^{2+} evaluated from the curve of fluorometric titration of protein against magnesium are 2×10^3 and 2×10^2 M^{-1}. Mg^{2+} ions in millimolar concentrations barely influence the binding of Ca^{2+} ions by protein. Apha-lactalbumin in the state with one bound Ca^{2+}, one bound Mg^{2+}, two bound Mg^{2+} and without metals possess different fluorescence properties, which indicates a difference in the conformations of the protein in these states. It is postulated that Ca^{2+} and Mg^{2+} ions are bound by different centres of α-lactalbumin. The binding of Ca^{2+} and Mg^{2+} ions by α-lactalbumin must significantly modulate its function. (15 refs.)

103777 Interaction of collagen with sodium ions. Yu.P.Meshalkin, S.P.Gabuda, V.N.Shcherbakov, R.I.Aizman (Novisibirsk State Medical Inst., Acad. of Sci., Novisibirsk, USSR).
Biophysics (GB), vol.27, no.4, p.608-13 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.4, p.590-4 (1982).
Change in the ratio of the donor and acceptor adsorption centers on the surface of collagen is found on treatment with NaCl solutions. From the constant α of the spin-spin interaction of native collagen (0.15 ± 0.01) Oe and collagen treated with 3 per cent NaCl solution (0.115 ± 0.01) Oe the authors evaluate the number of binding centres at ~12.5 centres per 100 amino acid residues. Fall in the freezing point of water in the channels of the structure is found to have an unspecified effect on entry into them of Na^+ and K^+ ions in concentrations of over 3 per cent. (8 refs.)

103778 Fast diffusion along defects and corrugations in phospholipid $P_{\beta'}$ liquid crystals. M.B.Schneider, W.K.Chan, W.W.Webb (Dept. of Phys., Cornell Univ., Ithaca, NY, USA).
Biophys. J. (USA), vol.43, no.2, p.157-65 (Aug. 1983).
The diffusion of a fluorescent lipid analogue in liquid crystals of the anisotropic $P_{\beta'}$ phase of dimyristolyphosphatidylcholine had been found to be highly variable, suggesting structural defect pathways. Fluorescence photobleaching recovery (FPR) experiments imply two effective diffusion pathways with coefficients differing by at least 100. This is consistent with fast diffusion along submicroscopic bands of disordered material ('defects') in the bilayer corrugations characteristic of this phase. Due to strains during transformation from the L_α phase, the axis of the corrugations is ordinarily disrupted by mosaic patches rotationally disoriented with the mean plane of the molecular bilayers, although larger oriented domains are sometimes adventitiously aligned into microscopically visible striped textures. The corrugations are also systematically aligned along positive disclinations pairs or 'oily streaks'. Thus, fast diffusion occurs parallel to the disclination lines and along the textured stripes. FPR results yield an upper limit on the effective diffusion coefficient in the ordered material of $D\leq2\times10^{-16}$ cm^2/s at 22°C, $D\leq3\times10^{-17}$ cm^2/s at 13°C. In contrast the diffusion coefficient along defect pathways where disordered ribbons are aligned is $D\sim4\times10^{-11}$ cm^2/s at 16°C. (59 refs.)

103779 Pair distribution functions of bacteriorhodopsin and rhodopsin in model bilayers. L.T.Pearson, S.I.Chan (A.A. Noyes Lab. of Chem. Phys., California Inst. of Technol., Pasadena, CA, USA), B.A.Lewis, D.M.Engelman.
Biophys. J. (USA), vol.43, no.2, p.167-74 (Aug. 1983).
The pair distribution functions have been measured from freeze-fracture pictures of bacteriorhodopsin and rhodopsin recombinants with diacyl phosphatidylcholines (PC) of various hydrocarbon chain lengths. Pictures were used of samples that had been frozen from above the phase transition temperature of the lipid. Measured functions were compared with those calculated from two model interparticle potential energy functions, (*a*) a hard-disk repulsion only, and (b) a hard-disk repulsion pulse electrostatic repulsion for a point charge buried in the membrane. The measured functions for bacteriorhodopsin di 12:0 PC, di 14:0 PC, and di 16:0 PC recombinants can be simulated using an interparticle hard-disk repulsion only. Bleached rhodopsin di 12:0 PC and di 18:1 trans-PC recombinants, and dark-adapted rhodopsin di 10:0 PC recombinants yield functions that are better simulated by assuming an additional repulsive interaction. The measured functions resemble those calculated using the hard-disk plus electrostatic repulsion model. (22 refs.)

103780 Dynamics of a small globular protein in terms of low-frequency vibrational modes. N.Go, T.Noguti, T.Nishikawa (Dept. of Phys., Kyushu Univ. 33, Fukuoka, Japan).
Proc. Natl. Acad. Sci. USA, vol.80, no.12, p.3696-700 (June 1983).
Normal modes of low-frequency vibrations are calculated for a small globular protein, bovine pancreatic tryspin inhibitor. In modes with frequencies below 120 cm^{-1} the protein molecule behaves like a continuous elastic body. Most modes with frequencies above 50 cm^{-1} are shown to behave harmonically within the range of thermal fluctuations at room temperature. Those with frequencies below 50 cm^{-1} show some anharmonicity. Magnitudes of displacements of atoms are mainly determined by the modes with frequencies below 30 cm^{-1}. These very-low-frequency modes contribute significantly to the entropy of the system. The dynamic structure of the globular protein is described as a superposition of harmonic high-frequency motions and coupled anharmonic low-frequency motions of collective variables corresponding to the normal modes of vibration. (17 refs.)

103781 Intermolecular interactions in collagen self-assembly as revealed by Fourier transform infrared spectroscopy. R.J.Jakobsen, L.L.Brown (Biological Spectroscopy Facility, Battelle Columbus Labs., Columbus, OH, USA), T.B.Hutson, D.J.Fink, A.Veis.
Science (USA), vol.220, no.4603, p.1288-90 (17 June 1983).
When a solution of collagen molecules, at neutral pH and moderate ionic strength, is warmed from 4° to 30°C, a spontaneous self-assembly process takes place in which native-type collagen fibers are produced. Events occurring during thermally induced fibrillogenesis process can be monitored, in aqueous media and in real time, by Fourier transform infrared spectroscopic techniques. Tentative assignments of observed spectral bands are given. (18 refs.)

Cosmochemistry and the Origin of Life. Proceedings of the NATO Advanced Study Institute .... See Entry 98647

Orthogonal collocation for the analysis of immobilized enzyme systems .... See Entry 103492

Structural domains in proteins and their role in the dynamics of protein function .... See Entry 103783

Generation of a potential on the bilayer lipid membrane in the reaction of proton attachment—separation in the near membrane layers .... See Entry 103798

Thermodynamics and kinetics of protein incorporation into membranes .... See Entry 103801

The biomedium. Adsorbed water as a model for the aqueous medium supporting life functions .... See Entry 103805

Symmetry of the process of electron transfer on the donor and acceptor sides of the photosynthetic reaction centre .... See Entry 103811

87.15B Structure, configuration, conformation, and active sites at the biomolecular level

103782 Commensurate, incommensurate and chaotic phase in DNA double helices. H.Toyoki, S.Yomosa (Faculty of Sci., Nagoya Univ., Nagoya, Japan), S.Takeno, S.Homma.
Phys. Lett. A (Netherlands), vol.97A, no.1-2, p.70-2 (8 Aug. 1983).
It is shown numerically that in the DNA double helix model there exist metastable states other than B-form. Depending on the strength of base pair coupling in double helices, it is found that the phase diagram consists of regimes with commensurate, incommensurate and chaotic phases, indicating the existence of a complex open state in DNA double helices. (4 refs.)

103783 Structural domains in proteins and their role in the dynamics of protein function. J.Janin, S.J.Wodak (Lab. de Biologie Physicochimique, Univ. Paris-Sud, Orsay, France).
Prog. Biophys. & Mol. Biol. (GB), vol.42, no.1, p.21-78 (1983).
This review deals with the following topics: definition of structural domains; analysis of domain movements and segmental flexibility; domain movements in enzyme catalysis and ligand binding; segmental mobility in proteins and t-RNA; domains in protein folding and evolution. (326 refs.)

103784 Splice junctions: association with variation in protein structure. C.S.Craik, W.J.Rutter, R.Fletterick (Dept. of Biochem. & Biophys., Univ. of California, San Francisco, CA, USA).
Science (USA), vol.220, no.4602, p.1125-9 (10 June 1983).
A comparison between eukaryotic gene sequences and protein sequences of homologous enzymes from bacterial and mammalian organisms shows that intron-exon junctions frequently coincide with variable surface loops of the protein structures. The altered surface structures can account for function differences among the members of a family. Sliding of the intron-exon junctions may constitute one mechanism for generating length polymorphisms and divergent sequences found in protein families. Since intron-exon junctions map to protein surfaces, the alterations mediated by sliding of these junctions can be effected without disrupting the stability of the protein core. (42 refs.)

Circular dichroism studies on azole nucleosides. The solution conformation of 5-amino-1-β-D-ribofuranosylimidazole-4-carboxamide, bredinin, pyrazofurin, ribavirin, and related nucleosides .... See Entry 100435

Spectra of circular dichroism of myocardial actin in respiratory hypoxia .... See Entry 103789

Study of monomolecular layers of immunoglobulin G by infrared spectroscopy .... See Entry 103790

Structure-function relationships for a voltage-dependent ion channel: properties of COOH-terminal fragments of colicin E1 .... See Entry 103803

Effect of plant 'hardening' on the crystallization of intracellular water in the tissues .... See Entry 103812

Mechanism of radiation-induced damage of secondary DNA structure .... See Entry 103955

87.15M Interactions with radiations at the biomolecular level

103785 Temperature dependence of the 735 nm fluorescence kinetics from spinach measured by picosecond laser-stream camera system. F.Pellegrino, A.Dagen, P.Sekuler, R.R.Alfano (Phys. Dept., City Coll. of New York, New York, NY, USA).
Photobiochem. & Photobiophys. (Netherlands), vol.6, no.1, p.15-23 (July 1983).
The 735 nm fluorescence lifetime (τ) and relative quantum yield (ϕ) of spinach were measured at 90K as a function of excitation fluence. The 735 nm risetime, defined as the time required for the intensity to increase from 10 to 90% of tis maximum value was measured to be 19.6 ± 3 ps at 106K for excitation fluence below 10^{14} photons/cm^2. The fluorescence quantum yield for wavelengths greater than 720 nm revealed no apparent intensity-dependent behaviour over the excitation fluence of 10^{13} to 10^{15} photons/cm^2. The fluorescence decay profile, however, was found to change from a single exponential to a non-exponential behaviour above 3×10^{14} photons/cm^2 per pulse. These results are interpreted in terms of energy transfer from accessory pigments or optically excited antennae of PS I and a lack of energy transfer from the light harvesting 685 nm antennae to the C-705. The temperature dependence of the 735 nm fluorescence lifetime was measured and the excitation energy transfer from C-705 to P-700 reaction centers of PS I is discussed in terms of the electron multiphonon formalism of Jortner (1978) and Yomosa (1976). From the analysis of the data the authors have obtained a mean phonon energy $\langle \hbar\omega \rangle \sim 418$ cm^{-1} and an electron-phonon coupling strength $S=3.7$. (30 refs.)

103786 Evidence against the stage of electron localization on monomeric bacteriochlorophyll (*P*-800) under charge separation in reaction centers. A.Yu.Borisov (Photosynthesis Dept., A.N. Belozersky Lab. of Molecular Biology & Bioorganic Chem., M.V. Lomonosov Moscow State Univ., Moscow, USSR), R.V.Danielius, S.P.Kudzmauskas, A.S.Piskarskas, A.P.Razjivin, V.A.Sirutkaitis, L.L.Valkunas.
Photobiochem. & Photobiophys. (Netherlands), vol.6, no.1, p.33-8 (July 1983).
Some theoretical and experimental picosecond data that are in contradiction with the assumption that there exists a stage with electron localization on P-800 in reaction centers during charge separation are presented. (15 refs.)

103787 The effect of external charges on the absorption spectra of porphyrins. Quantum chemical discussion. P.Pancoska, M.Kapoun, L.Skala (Dept. of Chem. Phys., Faculty of Math. & Phys., Charles Univ., Prague, Czechoslovakia).
Photobiochem. & Photobiophys. (Netherlands), vol.6, no.1, p.39-46 (July 1983).
The effect of external charges on the absorption spectra of porphyrins in theoretically discussed. The porphyrin chromophore is modeled by the porphin molecule. Three quantum chemical approaches are used: the square-well potential model, and the FEMO-CI and CNDO/S-CI methods. For positive external charges all three methods predict a blue shift of the absorption band; induced changes in the more complex Soret region lead to the red shift of this band. For negative charge, the effect is just opposite. The results agree with available experimental observations on two porphyrin model systems. The effect is discussed from the point of view of the origin of the porphyrin spectral forms in photosynthetic systems in vivo. (20 refs.)

103788 Energy transfer in biflavinyl compounds as studied with fluorescence depolarization [biological light transformation]. A.J.W.G.Visser, J.S.Santema, A.van Hoek (Dept. of Biochem., Agricultural Univ., Wageningen, Netherlands).
Photobiochem. & Photobiophys. (Netherlands), vol.6, no.1, p.47-55 (July 1983).
Light absorption, fluorescence and fluorescence anisotropy measurements were performed on two different, dimeric flavin models and on the parent isoalloxazine derivative, either dissolved in chloroform or in the rigid matrix polymethylmethacrylate (PMMA). The optical results in fluid solution and the fluorescence depolarization in PMMA could be well explained by a different intramolecular equilibrium orientation of the flavin constituents. The rate constant for radiationless energy transfer among the flavins within the dimers followed directly from an analysis of the anisotropy decay. (17 refs.)

103789 Spectra of circular dichroism of myocardial actin in respiratory hypoxia. B.G.Dzhinchevedashvili.
Biophysics (GB), vol.27, no.4, p.606-8 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.4, p.587-9 (1982).
It is shown that the secondary structure of Straub actin of the myocardium of dogs with respiratory hypoxia does not differ from normal. The spectra of circular dichroism (CD) at 250-300 nm substantially differ. The fractional composition of pathological actin is practically identical to normal. Change in the CD spectra is apparently due to change in the conformation of the microsurroundings of the aromatic amino acids forming part of the active centres of actin responsible for polymerization. (9 refs.)

103790 Study of monomolecular layers of immunoglobulin G by infrared spectroscopy. V.Ya.Ppopov, A.K.Kurek, L.V.Chasovnikova, N.A.Matveyeva, V.V.Lavrent'ev (Second Pirigiv State Medical Inst., Moscow, USSR).
Biophysics (GB), vol.27, no.4, p.624-9 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.4, p.604-8 (1982).
Infrared spectroscopy of multiple disturbed total internal reflection (MDTIR) has been used to study transferred monomolecular layers of immunoglobulin G (IgG) consisting of native protein molecules oriented horizontally or vertically to the surface of the MDTIR element and also molecules exposed to surface denaturing. It is shown that on transfer of the IgG monolayer from the water-air interface to a solid surface the conformation and orientation of the molecules in the monolayer does not change. The values of the thickness of the monolayers consisting of the horizontally or vertically oriented molecules correspond to the sizes of the native IgG molecule. Disturbance of the β-structure of the polypeptide chains during surface enaturing is not recorded. (20 refs.)

103791 Light-induced dynamics of chlorophyll systems studied by neutron spectroscopy. A.Furrer, A.Stockli, W.Halg (Inst. fur Reaktortech., Eidgenoessische Tech. Hochschule, Zurich, Switzerland), W.Kuhlbrandt, K.Muhlethaler, E.Wehrli.
Helv. Phys. Acta (Switzerland), vol.56, no.1-3, p.655-62 (1983). (Proceedings of the 3rd General Conference of the Condensed Matter Division of the EPS, Lausanne, Switzerland, 28-30 March 1983).
Energy spectra of three chlorophyll-protein systems and of chlorophyll-a in solution were measured using the inelastic neutron scattering technique. The intensities of the observed energy spectra changed significantly when the sample was irradiated by light. This effect is interpreted in terms of electronic-vibrational relaxation mechanisms giving rise to radiationless transitions which enhance the population of the vibrational modes of all the constituents forming the sample either directly or by dissipation. (4 refs.)

103792 Photoabsorption and photoelectron-yield spectra of polypeptides in the vacuum-UV region. S.Iwanami, N.Oda (Res. Lab. of Nuclear Reactor, Tokyo Inst. of Technol., Tokyo, Japan).
Radiat. Res. (USA), vol.95, no.1, p.24-31 (July 1983).
The photoabsorption spectra and the photoelectron-yield spectra in the vacuum-UV region between 1050 and 2400 Å have been measured for the aliphatic homopolypeptide films poly(glycine), poly(L-alanine), and poly(L-valine). By comparing the photoabsorption spectra with the photoelectron-yield spectra, the existence of highly excited states at excitation energies above the first ionization potentials in these polypeptides is conjectured. Implications of these highly excited states are discussed in connection with the concept of the superexcited states in macromolecules such as polypeptides. (25 refs.)

Anion radicals of bacteriochlorophylls c, d, and e. Likely electron acceptors in the primary photochemistry of green and brown photosynthetic bacteria .... See Entry 100409

Study of the binding of Mg ions by α-lactalbumin using fluorescent spectroscopy .... See Entry 103776

Intermolecular interactions in collagen self-assembly as revealed by Fourier transform infrared spectroscopy .... See Entry 103781

Symmetry of the process of electron transfer on the donor and acceptor sides of the photosynthetic reaction centre .... See Entry 103811

Blue light effect on proton pumping by bacteriorhodopsin ..... See Entry 103949

Mechanism of radiation-induced damage of secondary DNA structure .... See Entry 103955

Circulating macromolecular complexes in rats surviving radiation, thermal and mixed radiation-and-thermal traumas .... See Entry 103958

Effects of ionizing radiation on nitric oxide myoglobin. I. Effects on the NO-haem moiety .... See Entry 103976

Effects of ionizing radiation on nitric oxide myoglobin. II. Effects on the globin moiety .... See Entry 103977

Determination of ^{18}O trapping in X-irradiated amino acids by means of nuclear reactions .... See Entry 104148

87.16 BIOTHERMICS

103793 Hyperthermia, immunity and metastasis. V.F.Lopatin.
Med. Radiol. (USSR), vol.28, no.7, p.60-5 (July 1983). In Russian.
The problem of the dependency of immunological reactions and metastasis on the conditions of hyperthermial action is reviewed, with reference to the data of many clinical and experimental studies during the past two decades. Literary data on the subject is rather incomplete and often contradictory, largely because, in some analyses of the results of hyperthermial action on immunity and metastasis, inadequate allowance is made for the influence of such factors as the method of heating, the volume of tissue being heated in general of local hyperthermia, and the temperature conditions in a tumour and in healthy tissues. It is concluded that, by the achievement of thermal or thermoradiative action on a tumour, one can expect not only more complete inactivation of the malignant cells of the primary focus, but also the stimulation of antitumoral immunity and decreased probability of the onset of metastasis. (62 refs.) *A.J.B.*

103794 Temperature dependence of spin-label intensity in solutions and its implication in spin-labeled erythrocyte membrane studies. L.W.M.Fung (Dept. of Chem., Loyola Univ. of Chicago, Chicago, IL, USA), M.E.Johnson.
Biophys. J. (USA), vol.43, no.2, p.255-7 (Aug. 1983).
Presents data showing that the increase in intensity upon increasing temperature is primarily related to EPR cavity sensitivity rather than to an increase in concentration of the bound spin labels that are EPR active. (12 refs.)

103795 Handwarming and relaxation in temperature feedback: positive placebo effects. L.Onoda (California State Univ., Northridge, CA, USA).
Biofeedback & Self-Regul. (USA), vol.8, no.1, p.109-14 (March 1983).
Sixteen males and females were randomly assigned to either temperature feedback groups warm-relax (WR) or cool-relax (CR) to determine how successful hand-warming and -cooling alters the subjective report of relaxation. After eight $^1/_2$-hour sessions the WR and CR demonstrated a significant difference in temperature change, but there were no significant main effects in reported subjective relaxation. The reported feelings of relaxation were negatively correlated to the directionality of temperature change and were primarily attributed to nonspecific expectancies. (5 refs.)

103796 How far does thermal damage extend beneath the surface of CO_2 laser incisions?. A.L.McKenzie (Wessex Regional Medical Phys. Dept., Royal South Hants Hospital, Southampton, England).
Phys. Med. & Biol. (GB), vol.28, no.8, p.905-12 (Aug. 1983).
One of the principal advantages of the CO_2 surgical laser over other types available is that there is little evidence of thermal injury extending very far beyond the surface of the laser wound. The degree of such damage is of interest because it affects tissue healing and the likelihood of post-operative infection. This paper presents a simple physical model of tissue irradiated by a CO_2 laser beam. The depth of damage is predicted for the case where the ablation front and the damage wave ahead of it advance together at the same speed. The depth of damage is also calculated for the case of laser pulses of short duration where there has not been time to establish dynamic equilibrium. The results are plotted against local laser power density and show a trend of narrower damage depths with short laser pulses and high power densities. As a consequence, care should be taken not to ablate tissue at low power densities, as occurs when the laser beam is defocused. The predicted damage depths are in broad agreement with histopathological experience. (11 refs.)

103797 Effect of hyperthermia on isolated DNA polymerase-β. I.J.Spiro (Dept. of Radiology, George Washington Univ. Medical Center, Washington, DC, USA), D.L.Denman, W.C.Dewey.
Radiat. Res. (USA), vol.95, no.1, p.68-77 (July 1983).
Hyperthermia has been shown to inhibit the activity of DNA polymerase-β when either the intact Chinese hamster cells or partially purified enzyme samples from CHO cells are heated (42.2 or 45.5°C). However, the loss of activity from heating isolated enzyme samples can be either greater or less than the loss from heating intact cells. For example, treating cells with the membrane-active agent procaine-HCl greatly sensitizes the cells to heat-induced loss of enzyme activity but has no effect on the heat sensitivity of isolated enzyme. Furthermore, the heat sensitivity of the isolated enzyme depends greatly on the purification steps and can be reduced by heating the enzyme in the presence of bovine serum albumin, activated DNA, or Langendorf salts. These observations, considered in relation to others in the literature, suggest that heat inactivation of polymerase-β occurs from heat-induced changes in the intracellular environment, which in turn modify the direct thermal denaturation of the enzyme within the cell. (27 refs.)

Temperature dependence of the 735 nm fluorescence kinetics from spinach measured by picosecond laser-stream camera system ....See Entry 103785

Thermodynamics and kinetics of protein incorporation into membranes ....See Entry 103801

Effect of plant 'hardening' on the crystallization of intracellular water in the tissues ....See Entry 103812

The effect of hyperthermia on hemopoietic progenitor cells of the mouse ....See Entry 103816

The induction of hyperthermia by ultrasound: its value and associated problems. I. Single, static, plane transducer ....See Entry 103947

Circulating macromolecular complexes in rats surviving radiation, thermal and mixed radiation-and-thermal traumas ....See Entry 103958

Changes in the small intestine functions of rats after radiation and thermal affection ....See Entry 103964

Hyperthermia by magnetic induction: experimental and theoretical results for coaxial coil pairs ....See Entry 104012

Thermometry in radiofrequency hyperthermia of malignant tumours ....See Entry 104015

Operator exposure to radiofrequency fields near a hyperthermia device ....See Entry 104016

Radiometer receivers for microwave thermography ....See Entry 104019

Substantiation of local hyperthermia in radiation therapy ..... See Entry 104110

Thermal characterization of electrosurgery .... See Entry 104111

'Thermal mapping' in experimental cancer treatment with hyperthermia: description and use of a semi-automatic system .... See Entry 104115

Peripheral nerve fiber group separation in evoked potential research using cooling and polarization .... See Entry 104136

87.20 MEMBRANE BIOPHYSICS

103798 Generation of a potential on the bilayer lipid membrane in the reaction of proton attachment—separation in the near membrane layers. Yu.N.Antonenko, L.S.Yaguzhinskii (Belozerskii Interfaculty Problem Res. Lab. of Bio-organic Chem. & Molecular Biology, Lomonosov State Univ., Moscow, USSR).
Biophysics (GB), vol.27, no.4, p.658-65 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.4, p.635-40 (1982).
It has been found that addition of an uncoupler opposing the concentration gradient of salts of weak acids or bases (sodium acetate and ammonium chloride) leads to the formation of a potential on the BLM, with the plus sign on that side of the membrane where the high concentration of sodium acetate is present, and the minus sign where the concentration of ammonium chloride is high. It is shown that the formation of the potential is due to the appearance of a pH gradient in the unmixed layers. The observed effects are described by an earlier developed model of transfer of weak acids and bases across the BLM. The results indicate that in the presence of gradients of salts of weak acids and bases on the membranes, including biological, potentials may appear in the presence of a protonophore. (11 refs.)

103799 Use of phosphorescent probes for studying model and biological membranes. V.M.Mekler, A.I.Kotel'nikov, G.I.Lihtenshtein, M.A.Berkovich (Inst. of Chem. Phys., Acad. of Sci., Chernogolovka, USSR).
Biophysics (GB), vol.27, no.4, p.665-70 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.4, p.641-5 (1982).
Egg lecithin liposomes and rat liver microsomes have been used to analyse the possibilities of phosphorescent probes for investigating membranes. It is shown that to record the diffusion controlled quenching of phosphorescence of erythrosin by stable nitroxyl radicals it suffices to introduce into the liposomes one quencher molecule per 10^4 lecithin molecules. This makes it possible to study the diffusion processes with $D=10^{-5}$-10^{-9} cm^2.sec^{-1}. The use of quenchers of different polarity suggests that the triplet probe erythrosin is incorporated into the liposomes in the region of the polar heads of phosphatidyl choline. The microviscosity of the membrane determined from the rate of quenching of the phosphorescence by the radicals at 20°C is 0.1 M.sec/m^2. The coefficient of lateral diffusion of erythrosin in the liposomes determined from its concentration self-quenching is 1.1×10^{-8} cm^2.sec^{-1}. In the microsomes erythrosin is located in the hydrophobic protions of the proteins and is not accessible to the quencher molecules. (13 refs.)

103800 Transverse deformation of bilayer lipid membranes on electrostriction. V.I.Pasechnik (Phys. Faculty, Lomonosov State Univ., Moscow, USSR).
Biophysics (GB), vol.27, no.4, p.762-3 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.4, p.726-7 (1982).
It is shown that a necessary condition for the existence of small values of Young's modulus for bilayer lipid membranes measured in the transverse direction (less than Young's modulus in the longitudinal direction) is the variable thickness of the membrane. The physical meaning of the transverse deformation of the membrane is clarified. (6 refs.)

103801 Thermodynamics and kinetics of protein incorporation into membranes. F.Jahnig (Max-Planck-Inst. fur Biologie, Tubingen, Germany).
Proc. Natl. Acad. Sci. USA, vol.80, no.12, p.3691-5 (June 1983).
The free energy and enthalpy of protein incorporation into membranes are calculated with special emphasis on the hitherto neglected effects of immobilization of protein and perturbation of lipid order in the membrane. The free energy change is found to be determined by the hydrophobic effect as the driving force for incorporation and the protein immobilization effect which leads to a considerable reduction of the free energy gained from the hydrophobic effect. For incorporation of a hydrophobic, bilayer-spanning α-helix, the free energy change obtained is of the order of -15 kcal/mol (1 cal=4.184 J) in agreement with experimental results. The lipid perturbation effect yields only a small contribution to the free energy change due to an energy/entropy compensation inherent in lipid order. This effect dominates the enthalpy change, giving rise to values of the order of 100 kcal/mol with a pronounced temperature dependence around the lipid phase transition as observed experimentally. The kinetics of protein incorporation are even more strongly affected by the lipid perturbation effect, leading to an abrupt decrease of the rate of incorporation below the lipid phase transition. (33 refs.)

103802 Translocation pathway in the catalysis of active transport. C.Tanford (Dept. of Physiology, Duke Univ. Medical Center, Durham, NC, USA).
Proc. Natl. Acad. Sci. USA, vol.80, no.12, p.3701-5 (June 1983).
Possible pathways for translocation across a membrane in active transport processes are examined theoretically. Thermodynamic and kinetic requirements are readily satisifed by an alternating-access mechanism of the kind that has been proposed in the past by several investigators. The essential features of this mechanism (for transport of a single species) are shown to be defined by four explict conditions. (i) The transport protein must have at least two distinct conformation states, each accessible from only one side of the membrane. (ii) Binding affinity for the transported species is high in the state accessible from the uptake side of the membrane and much lower in the state accessible from the discharge side. (iii) The change from one conformation to the other involves movement of the binding site itself (with the transported species remaining attached) or rearrangement within the site that is topologically equivalent to such movement. (iv) Return to the original conformation occurs with unoccupied binding sites. The analysis demonstrates that a passage through the membrane that is simultaneously accessible from both sides cannot be used for active transport regardless of what the energetics of opening or closing of the passage may be. (22 refs.)

103803 Structure-function relationships for a voltage-dependent ion channel: properties of COOH-terminal fragments of colicin E1. M.vB.Cleveland (Dept. of Biological Sci., Columbia Univ., New York, NY, USA), S.Slatin, A.Finkelstein, C.Levinthal.
Proc. Natl. Acad. Sci. USA, vol.80, no.12, p.3706-10 (June 1983).
The effects of planar lipid bilayer membranes of carboxyl-terminal fragments derived from the bacteriocin colicin E1 by either proteolysis or CNBr cleavage are indistinguishable from those of the voltage-dependent parent colicin molecule. An upper limit to the length of the COOH-terminal peptide required for channel formation is 152 amino acid residues from the COOH-terminal end, as indicated by the CNBr fragment. In addition, use of carboxypeptidase shows that the COOH-terminal end of the molecule remains on the side of the membrane to which it was added. COOH-terminal peptides of colicin E1 spontaneously associate with oil or hexane droplets in an aqueous system and remain at the interface between the two phases to a significantly greater degree than other colicin E1 fragments or cytochrome *c*. These results, together with the amino acid sequence, suggest a model wherein the colicin E1 channel is formed first by spontaneous attachment to a membrane of an α-helical hairpin centered at a 35-residue hydrophobic region near the COOH-terminal end. Application of a potential of the correct polarity then

facilitates a major conformational change in the protein, allowing insertion of the remainder of the COOH-terminal end to form the open channel. (20 refs.)

103804 Linearisation by optimal control. C.L.Simionescu (Dept. of Analysis, Univ. of Brasov, Brasov, Rumania).
Control of Distributed Parameter Systems 1982. Proceedings of the Third IFAC Symposium, Toulouse, France, 29 June-2 July 1982 (Oxford, England: Pergamon 1983), p.443-50
The electrochemical equilibrium of some excitable membranes is described by a quasilinear system of differential and partial differential equations, the unknowns being the electrical potential and the functions describing the chemical properties of the excitants. The model has been established by Hodgkin and Huxley (1952) and then reconsidered by Noble (1962) and Besseau (1971). The aim of the paper is to obtain approximations for the solution of the Hodgkin-Huxley and Korteweg-de Vries-Burgers equations, by means of both concepts. (16 refs.)

Fast diffusion along defects and corrugations in phospholipid $P_{\beta'}$ liquid crystals .... See Entry 103778

Pair distribution functions of bacteriorhodopsin and rhodopsin in model bilayers .... See Entry 103779

Temperature dependence of spin-label intensity in solutions and its implication in spin-labeled erythrocyte membrane studies .... See Entry 103794

On the slow component of P-515 and the flash-induced reduction of cytochrome *b*-563 in chloroplast membranes .... See Entry 103806

Spectroscopic discrimination of the three rhodopsinlike pigments in Halobacterium halobium membranes .... See Entry 103813

Estimating kinetic constants from single channel data .... See Entry 103819

Single voltage-dependent chloride-selective channels of large conductance in cultured rat muscle .... See Entry 103821

Transit time conception for ion diffusion through membrane channels (biomembranes) .... See Entry 103822

Rate theoretical analysis of ion transport in membrane channels with elastically bound ligands (biomembranes) .... See Entry 103823

Effect of discreteness of charge on the potential distribution in bilayer lipid membranes .... See Entry 103827

Mechanism of action of ultrasound of low intensity on mitochondria .... See Entry 103945

Blue light effect on proton pumping by bacteriorhodopsin .... See Entry 103949

Phospholipid bilayers made from monolayers on patch-clamp pipettes .... See Entry 104134

Analysis of cardiac transmembrane action potentials with parallel microprocessors .... See Entry 104155

87.25 CELLULAR BIOPHYSICS

103805 The biomedium. Adsorbed water as a model for the aqueous medium supporting life functions. G.F.Cerofolini (Istituto di Chimica Fisica, Politecnico di Milano, Milano, Italy).
Adv. Colloid & Interface Sci. (Netherlands), vol.19, no.1-2, p.103-36 (July 1983).
A proposed new model for water in biosystems assumes that most of the intercellular water is adsorbed on macromolecules. This model is useful to describe several phenomena characteristic of the cellular level: Na^+/K^+ ratio, metabolism, growth, reproduction and morphology. (45 refs.)

103806 On the slow component of P-515 and the flash-induced reduction of cytochrome *b*-563 in chloroplast membranes. O.van Kooten, A.G.M.Gloudemans, W.J.Vredenberg (Lab. of Plant Physiological Res., Agricultural Univ., Wageningen, Netherlands).
Photobiochem. & Photobiophys. (Netherlands), vol.6, no.1, p.9-14 (July 1983).
Absorbance changes of P-515 and of cytochrome *b*-563 induced by double flashes (spaced by a dark time of 125 ms) have been studied in intact spinach leaves. The slow component (reaction II) of the P-515 response is only observed in a first flash, whereas cytochrome *b*-563 oxido-reduction occurs in both flashes. This leads to the conclusion that the slow phase of P-515 cannot be taken as a measure of an all-or-none electrogenic electron transfer in a Q-cycle. (29 refs.)

103807 Study of charge separation at the reaction centres of photosystem II of higher plants by magnetic modulation of fluorescence. L.I.Kolesnikova, M.M.Triebel, Ye.L.Frankevich (Inst. of Phys. Chem., Acad. of Sci., Moscow, USSR).
Biophysics (GB), vol.27, no.4, p.581-9 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.4, p.565-71 (1982).
The modulation of the fluorescence of the leaves of higher plants by an external magnetic field has been studied. It was found that the intensity of fluorescence increases on exposure to a magnetic field by values of up to 0.3 per cent on induction $B\simeq10$-20 mT. The magnetic effect is linked with spin phenomena on charge separation in photosystem II. The characteristic of the magnetic effect for fluorescence in different portions of the induction curve have been studied and it is shown that two types of magnetic effect exist corresponding to the open and closed reaction centres. In the first the field of semi-saturation of the effect $B_{1/2}=20$ mT, in the second $B_{1/2}=1.6$ mT. The lifetimes of the charge pairs at the open and closed centres have been determined (250 psec and >6 nsec). (17 refs.)

103808 Effect of dispersion of electric parameters of bacterial cells on their orientation in an alternating electric field. V.M.Fomchenkov, A.L.Mazanov, V.N.Brezgunov (All Union Appl. Microbiology Res. Inst., Serpukhov, USSR).
Biophysics (GB), vol.27, no.4, p.692-7 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.4, p.665-9 (1982).
On the basis of an electrophysical model of the bacterial cell the authors calculate the frequency dependence of the orientating moment of forces acting on it in an alternating electric field. The dependence of the relative value of the moment on the electric and geometric parameters of the model is studied. It is shown that allowance for the frequency dispersion of the electric parameters leads to a change in the course of the frequency dependence of the orienting moment in the region of low and medium frequencies. The results correspond to those of electrooptical measurements made on E. coli cells. (15 refs.)

103809 Analysis of the cable structure of blue-green algae. S.A.Levin, T.V.Potapova, V.P.Skulachev, L.M.Chailakhyan.
Biophysics (GB), vol.27, no.4, p.714-19 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.4, p.684-8 (1982).
Using extracellular electrodes the authors have studied special aspects of the electrical responses on local illumination of filamentous cyanobacteria (blue-green algae) Phormidium uncinatum. Recording the electrical responses at different distances from the site of illumination, and comparison of these data with results obtained on a physical model of Ph. uncinatum, made it possible to evaluate the parameters of the cable which may serve as a model of the object: $RC=440$ sec/cm^2 and $\lambda_{min}>0.07$ cm. From these values, and assuming that the membrane capacitance $C=10^{-6}$ F/cm^2, the authors evaluate the intercellular resistance $R_M=10^7\ \Omega$ and conductivity of the surface membrane $G_{Sp}\leq10^{-6}\ \Omega^{-1}\ cm^{-2}$. (5 refs.)

103810 Model of mechanical auto-oscillations in Myxomycetes plasmodium. Yu.M.Romanovskii, N.P.Khors (Phys. Faculty, Lomonosov State Univ., Moscow, USSR).
Biophysics (GB), vol.27, no.4, p.740-5 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.4, p.707-10 (1982).
A mathematical model of the push-pull movements of the protoplasma is proposed. The model is intended for a two-chamber system the auto-oscillations of which are caused by the action of the active force on contractions of the filaments of the membrane of the strand. The evaluations of the speed of flow of the protoplasma, the decay time in a passive system and also the general course of the time relations of speed and the changes in radius also agree with the experimental data. (12 refs.)

103811 Symmetry of the process of electron transfer on the donor and acceptor sides of the photosynthetic reaction centre. V.P.Shinkrev, A.B.Rubin (Biology Faculty, Lomonosov State Univ., Moscow, USSR).
Biophysics (GB), vol.27, no.4, p.756-9 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.4, p.722-4 (1982).
The scheme of electron transfer in photosynthetic reaction centres (PRCs) is considered. If this scheme is inverted by 180° for holes then the scheme obtained is entirely analogous to the original scheme. From comparison of these schemes it follows that the kinetic behaviour of the oxidised forms of the carriers denoted $A_s...A_1$ corresponds to that of the reduced forms of the carriers denoted $D_1...D_n$. On replacing electron by hole transfer there is a change in the sign of the potentials of semi-reduction of the electron carriers to the opposite. The kinetic duality of electron and hole transfer in the donor and acceptor parts otf the PRC makes it possible, is analysing electron transfer, to confine the analysis merely to the donor or merely to the acceptor side of the PRC. (6 refs.)

103812 Effect of plant 'hardening' on the crystallization of intracellular water in the tissues. N.G.Bakradze, K.M.Moistrapishvili, L.V.Keshelashvili (Inst. of Phys., Acad. of Sci., Tbilisi, Georgian SSR).
Biophysics (GB), vol.27, no.4, p.774-6 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.4, p.736-8 (1982).
The process of preparing a plant for exposure to low-temperature is called 'hardening'. It has been shown that a result of 'hardening' in a certain cooling regime the branches of many species of woody plants withstand the temperature of liquid nitrogen (I. Tumanov and O. Krasavtsev, 1959). This means that with stepped fall in the temperature of the ambient medium definite rearrangements occur in plants leading to a change in the state of the system giving it the ability to survive after exposure to such low temperatures. In this paper the authors try to describe the process of 'hardening' in terms of crystallization of the intracellular water in the tissues of the grapevine. Results for core, xylem, pholem and primary cortex tissues are reported. The results show that the process of plant 'hardening' substantially changes the physical properties of the system and more prolonged investigations of this process may give answers to many questions connected with the front hardiness of perennial plants. (3 refs.)

103813 Spectroscopic discrimination of the three rhodopsinlike pigments in Halobacterium halobium membranes. J.L.Spudich (Dept. of Anatomy, Albert Einstein Coll. of Medicine, New York, NY, USA), R.A.Bogomolni.
Biophys. J. (USA), vol.43, no.2, p.234-6 (Aug. 1983).
Membranes of Halobacterium halobium contain two photochemically retinal pigments in addition to the proton pump bacteriorhodopsin. One, halorhodopsin, is also an electrogenic ion pump with a fast (on a scale of milliseconds) photoreaction cycle. The other, s-rhodopsin, is active in the same spectral region, but has a much slower photoreaction cycle (on a scale of seconds). s-rhodopsin is not an electrogenic ion pump and its properties suggest it functions as the receptor pigment for phototaxis. All three pigments have very similar absorption spectra. The recent isolation of mutants deficient in both bacteriorhodopsin and halorhodopsin and in retinal synthesis has allowed the authors to resolve the absorption spectra of s-rhodopsin and halorhodopsin. At neutral pH s-rhodopsin has an absorption maximum at 587 ± 2 nm and halorhodopsin at 578 ± 2 nm. At pH 10.8, λ_{max} for s-rhodopsin is shifted to 552 nm and extinction decreases slightly (15%) while halorhodopsin loses all extinction above 500 nm. Both effects are fully reversible and allow determination of the amounts of s-rhodopsin and halorhodopsin in membrane preparations containing both pigments. Both pigments were present in earlier studies of *H.* halobium membranes, and in view of these findings, several observations must be reinterpreted. (19 refs.)

103814 Movement of polymorphonuclear leukocytes: an elastimetry analysis. A.T.W.Cheung, M.E.Miller, E.J.Kawaoka (Dept. of Pediatrics, Univ. of California, Davis, CA, USA).
Biomater. Med. Devices & Artif. Organs (USA), vol.11, no.1, p.53-61 (1983).
By utilizing the technique of cell elastimetry, which measures the negative pressure required to aspirate human polymorphonuclear leukocytes (PMNs) into a micropipette, a correlation between PMN deformability and cellular movement is confirmed. The effects of the synthetic chemotactic peptide, N-formyl-methionyl-leucyl-phenylalanine (f-met-leu-phe) on the deformability and chemotaxis of PMNs have been investigated, and a relationship between peptide concentrations and PMN deformability, which parallels the effects of the peptide on filter (chemotactic) studies, has been established. Experimental evidence indicates that alterations in PMN deformability occur as a natural consequence of stimulation of PMNs with a chemoattractant and that cellular deformation is a prerequisite to PMN movement. (14 refs.)

103815 Elastooptic photon signal modulation in collagenic fiber optics of tendon. K.E.Simanonok (Dept. of Animal Physiology, Univ. of California, Davis, CA, USA).
Biomater. Med. Devices & Artif. Organs (USA), vol.11, no.1, p.83-92 (1983).
In a test of a hypothesis of cell-to-cell communication via their endogenous photon emissions, the nearly pure collagen fibers in tendon were found to exhibit the fiber optic property of axially conducting light, providing a mechanism for photon exchange between nonadjacent cells. Further, it was found that light penetrates farther along the tendon fibers when tension is applied to an end-illuminated tendon, establishing that an elastooptic mechan-

ism exists for the modulation of photon signals in transit between cells, in the hypothesized system of cell-to-cell photon communication. (10 refs.)

103816 The effect of hyperthermia on hemopoietic progenitor cells of the mouse. G.Van Zant, D.Flentje, M.Flentje (Mallinckrodt Inst. of Radiology, Washington Univ. School of Medicine, St. Louis, MO, USA).
Radiat. Res. (USA), vol.95, no.1, p.142-9 (July 1983).
The effect of heat on four lineage-specific clonogenic cells from mouse bone marrow has been studied. The thermal sensitivities of two red cell precursors, one primitive (BFU-E) and one more differentiated (CFU-E), a granulocyte-macrophage precursor (CFU-GM), and a megakaryocyte precursor (CFU-M) were determined after exposure to 42, 43, and 44°C. It was found that the erythroid precursors were much more heat sensitive than either the CFU-GM or CFU-M. At 42°C the CFU-E and BFU-E had a D_0 of about 30 min, while the CFU-GM and CFU-M had D_0 values of about 60 min. Thus the four progenitors could be divided into two distinct classes with respect to their sensitivity to hyperthermia. These results suggest that erythropoiesis is more likely to be suppressed than either thrombopoiesis or leukocyte production when hyperthermia is applied in a clinical setting. (24 refs.)

Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206) .... See Entry 98659

Temperature dependence of the 735 nm fluorescence kinetics from spinach measured by picosecond laser-stream camera system .... See Entry 103785

Evidence against the stage of electron localization on monomeric bacteriochlorophyll (*P*-800) under charge separation in reaction centers ... See Entry 103786

Temperature dependence of spin-label intensity in solutions and its implication in spin-labeled erythrocyte membrane studies .... See Entry 103794

Effect of hyperthermia on isolated DNA polymerase-β .... See Entry 103797

Transverse deformation of bilayer lipid membranes on electrostriction .... See Entry 103800

Participation of photosystem II in regulation of photosynthetic electron transport in the green alga Chlamydobotrys stellata .... See Entry 103817

Dependence of cellular potential on ionic concentrations. Data supporting a modification of the constant field equation .... See Entry 103829

Regenerative impulses in taste cells .... See Entry 103906

Response of human lymphocyte chromosomes to fractionated neutron irradiation in vitro .... See Entry 103936

Influence of alternating magnetic field on the bactericidal effect of ionizing radiation .... See Entry 103938

Micronucleus induction in Vicia faba roots. II. Biological effects of neutrons below 1 cGy .... See Entry 103939

V79 survival following simultaneous or sequential irradiation by 15-MeV neutrons and ^{60}Co photons .... See Entry 103940

Ultrasound does not affect human lymphocyte transformation in vitro .... See Entry 103944

Mechanism of action of ultrasound of low intensity on mitochondria .... See Entry 103945

Study of ultrasonic haemolysis of erythrocytes in normal and pathological conditions .... See Entry 103946

Pulsing electromagnetic fields induce cellular transcription .... See Entry 103950

A cytophotometric study of protein in tumours after irradiation and the use of dihydromonocalcium phosphate .... See Entry 103953

Theoretical analysis of the effect of photoreactivation of γ-irradiated E. coli cells .... See Entry 103956

Effect of adrenalectomy and irradiation on some indices of protein metabolism in rat erythrocytes .... See Entry 103960

The results of cytogenetic analysis of human peripheral blood lymphocytes performed at various times after radiotherapy .... See Entry 103961

'Pseudonormal' thymocytes: a peculiar response of lymphoid elements of the thymus cortex to high doses of ionizing radiation .... See Entry 103963

Postirradiation recovery of yeast Pichia pinus .... See Entry 103965

Chromosome damage in peripheral lymphocytes from American thorium workers .... See Entry 103968

Relative effectiveness of ^{241}Am vs. ^{226}Ra approached by haemopoietic stem cell studies in various bone marrow sites of contaminated mice ... See Entry 103970

UDS and SCE in lymphocytes of persons occupationally exposed to low levels of ionizing radiation .... See Entry 103972

Radiation-induced DNA strand breaks and cell pycnosis in the developing rat cerebellum .... See Entry 103975

Micronucleus induction in Vicia faba roots. I. Absence of dose-rate, fractionation, and oxygen effect at low doses of low LET radiations .. See Entry 103978

Natural cell-mediated cytotoxicity among A-bomb survivors residing in the United States .... See Entry 103980

RBE of SPLEEN CFU-S to low dose rate Cf-252 or photon radiation in vivo .... See Entry 103982

1982 Resident's Essay Award: the immunologic effects of lymphoid irradiation in human and non-human primates: cellular changes and the potential for renal transplantation .... See Entry 103983

Inactivation of Ehrlich ascites tumor cells by heavy ions .... See Entry 103985

Evidence that repair and expression of potentially lethal damage cause the variations in cell survival after X-irradiation observed through the cell cycle in Ehrlich ascites tumor cells .... See Entry 103987

Colorimetric and cytophotometric investigation of an improved Papanicolaou staining procedure in cervical cells .... See Entry 104020

Stepwise-control concept for the ray therapy of tumors .... See Entry 104025

Iso-effect tables and therapeutic ratios for epidermoid cancer and normal tissue stroma .... See Entry 104033

Estimation of the genetically significant dose from diagnostic X-ray procedures in the Islamic Republic of Iran .... See Entry 104057

A method to record the circadian rhythm in a unicellular green algae under extraterrestrial conditions .... See Entry 104079

Effects of space environmental factors on cell proliferation .. See Entry 104081

Growth and differentiation of Bacillus subtilis at microgravity .... See Entry 104082

Effects of low gravity on mammalian cell polarization at the ultrastructural level .... See Entry 104083

The problem of long-term function of neutrophils in studies on the effects of gravity on motility, shape and structure of locomotor cells ... See Entry 104084

Graviperception, mitotic activity and cell differentiation in lentil seedling roots .... See Entry 104085

Physarum polycephalum: contraction behavior, direction and velocity of protoplasmic streaming in near weightlessness .... See Entry 104086

Experiment A08/32/CH: 'effect of spaceflight on lymphocyte activation' .... See Entry 104087

A micro-computer system for cell electrophoresis measurements .... See Entry 104104

A high-resolution staining method for examination of mammalian cell surfaces in the light microscope .... See Entry 104145

87.25D Biological transport; cellular and subcellular transmembrane physics

103817 Participation of photosystem II in regulation of photosynthetic electron transport in the green alga Chlamydobotrys stellata. D.Mende, W.Wiessner (Univ. Gottingen, Gottingen, Germany).
Photobiochem. & Photobiophys. (Netherlands), vol.6, no.1, p.1-7 (July 1983).
Reports on 559 nm absorption changes induced by single flash illumination and on delayed light emission after single and double flash excitation. (1) In autotrophic cells an absorption change at 559 nm can be seen only after DCMU treatment. Its reduction and oxidation half-times are 150 and 350 μs, respectively. After adaptation to photoheterotrophy, the 559 nm signal is present already without any treatment. The reduction proceeds within <5 μs and its oxidation within 60 μs. (2) Delayed light emission by autotrophic cells shows a <5 μs component after single flash excitation and a 35 μs component after double flash excitation. Adaptation to photoheterotrophic growth conditions leads to a disappearance of the <5 μs and 35 μs components and brings about a 60 μs component after single as well as after double flash excitation. The results are discussed with respect to the function of cytochrome b_{559} in a cyclic Photosystem II which disconnects the photosynthetic electron transport between Photosystems II and I. (28 refs.)

103818 Transepithelial transport in cell culture. A theoretical and experimental analysis of the biophysical properties of domes. C.Tanner, D.A.Frambach, D.S.Misfeldt (Palo Alto Veterans Administration Medical Center, Palo Alto, CA, USA).
Biophys. J. (USA), vol.43, no.2, p.183-90 (Aug. 1983).
Dissociated cells of transporting epithelia, when cultured on an impermeant substratum, form polarized monolayers frequently characterized by the presence of domes. If the assumption is made that the monolayer exhibits a uniform stretch modulus of elasticity and tension of cell-dish adhesion, *Ta*, then biophysical properties of the epithelium can be predicted. The authors have shown that for such epithelia, domes should (a) have circular bases, (*b*) be sections of spheres with a constant height to radius, h/r, ratio, (*c*) have a dome-wall tension, T_w, that is constant, and (*d*) have a dome volume that is a function of radius alone. Additionally, a Laplace equation derived for this geometry predicted the hydrostatic pressure from within to outside domes as a decreasing function of radius alone. By microscopy, domes had predominantly circular bases and were found to be sections of spheres with a constant height, *h*, to radius, *r*, ratio of 0.684. Using the Laplace equation derived for this geometry and measurements of ΔP and *r*, the tension of cell-dish adhesion, T_a, and dome-wall tension, T_w, were found to be constants of 6.60 and 7.08 torr, respectively. Combining the constants for T_a and h/r ratio, and the fact that domes are sections of spheres, ΔP and dome volume were shown to be known functions of radius alone. In addition, the modulus of elasticity of the epithelium was calculated to be 4.82×10^3 dyn/cm^3. (13 refs.)

103819 Estimating kinetic constants from single channel data. R.Horn, K.Lange (Dept. of Physiology & Biomath., Univ. of California at Los Angeles School of Medicine, Los Angeles, CA, USA).
Biophys. J. (USA), vol.43, no.2, p.207-23 (Aug. 1983).
The process underlying the opening and closing of ionic channels in biological or artificial lipid membranes can be modeled kinetically as a time-homogeneous Markov chain. The elements of the chain are kinetic states that can be either open or closed. A maximum likelihood procedure is described for estimating the transition rates between these states from single channel data. The method has been implemented for linear kinetic schemes of fewer than six states, and is suitable for nonstationary data in which one or more independent channels are functioning simultaneously. It also provides standard errors for all estimates of rate constants and permits testing of smoothly parameterized subhypotheses of a general model. The authors illustrate their approach by analysis of single channel data simulated on a computer and describe a procedure for analysis of experimental data. (46 refs.)

103820 Diffusion profiles of Na$^+$-fluorescein in frog ventricular muscle. G.Salama, M.Morad (Dept. of Physiology, Univ. of Pennsylvania School of Medicine, Philadelphia, PA, USA).
Biophys. J. (USA), vol.43, no.2, p.225-9 (Aug. 1983).
Frog ventricular muscle strips were placed on a single sucrose-gap chamber to measure the interdiffusion of solutes across the sucrose-Ringer's solution partition. Steady-state diffusion profiles of fluorescein sodium developed along the axis of the muscle in the physiological node by continuously perfusing the sucrose pool with 210-mM sucrose plus fluorescein (5-10 mM). Fluorescein was found to diffuse freely through the extracellular space of the ventricular muscle without binding to the tissue. The fluorescence of Na$^+$-fluorescein in the muscle (measured at 530 ± 30 nm) varied linearly with the dye concentration in the sucrose perfusate. The diffusion profiles of dye in the test node depended on the tightness or snaring of the muscle strip by the latex diaphragms, the diameter of the muscle strip, and changes in hydrostatic pressure between the sucrose and Ringer's solution pools. Fluorescein concentration in the cross section of test node closest to the latex partition (sucrose-Ringer's solution interface) ranged between 4-13% of the dye concentration in the sucrose pool. These values are more than five times smaller than those estimated theoretically, assuming free diffusion. The experimental findings indicate that the presence of a physical barrier, such as a rubber diaphragm, limits free interdiffusion of solutes across the sucrose gap. The presence of such a barrier thus prevents large concentration gradients from occurring in the extracellular spaces along the physiological node. (12 refs.)

103821 Single voltage-dependent chloride-selective channels of large conductance in cultured rat muscle. A.L.Blatz, K.L.Magleby (Dept. of Physiology & Biophys., Univ. of Miami School of Medicine, Miami, FL, USA).
Biophys. J. (USA), vol.43, no.2, p.237-41 (Aug. 1983).
Single-channel currents of an anion-selective channel in the plasma membrane of cultured rat muscle cells (myotubes) were recorded with the patch-clamp technique (O.P. Hamill et al., Pfluegers Arch. Eur. J. Physiol., 391, p.85-100, 1981). The channel is selective for Cl$^-$ over cations, and has an unusually large single-channel conductance of $\sim$430 pS in symmetrical 143 mM KCl. The channel is often active at 0 mV, opening and closing spontaneously. When active, steps from 0 mV to either negative or positive membrane poten-

tials close the channel to an apparent inactivated state. The mean effective time that a channel is open before it inactivates is ~1.19 s for steps to −30 mV and 0.48 s for steps to +30 mV. Returning the membrane potential to 0 mV results in recovery from inactivation. Calcium ions are not required for channel activity. (25 refs.)

103822 Transit time conception for ion diffusion through membrane channels (biomembranes). H.Schroder (Fakultat fur Phys., Univ. Konstanz, Konstanz, Germany).
J. Chem. Phys. (USA), vol.79, no.4, p.1991-6 (15 Aug. 1983).
The diffusion path of an ion is considered as a one-dimensional random walk between binding sites along the channel, where the potential energy profile may consist of an arbitrary sequence of different barriers and binding sites. It is shown that the conception of discrete transit times leads to a very simple calculation of transport quantities such as diffusion constant and stationary transmembrane current. The diffusion constant obtained is the discrete counterpart of the diffusion constant obtained from the exact solution of the Smoluchowski equation. The resulting current-voltage characteristics indicate that the assumption of a discrete random walk represents a fairly good approximation. Furthermore, the first passage time problem for the present model is discussed and solved for the homogeneous case with the aid of a difference equation for successive first passage times. (14 refs.)

103823 Rate theoretical analysis of ion transport in membrane channels with elastically bound ligands (biomembranes). H.Schroder (Tech. Hochschule Darmstadt, Darmstadt, Germany).
J. Chem. Phys. (USA), vol.79, no.4, p.1997-2005 (15 Aug. 1983).
The presentation consists of two parts. In the first one, a model Hamiltonian for a channel with elastically bound ligands is constructed. In the second one, escape rates are derived from the Hamiltonian and transport properties of the channel are discussed considering diffusion of ions as a random walk between binding sites. Rate theory as traditionally applied considers a potential energy profile as a sequence of rigid barriers. A realistic molecular channel, however, consists of elastically bound atomic groups (ligands) which are subject to temperature induced motion, and which can respond more or less to the presence of an ion. The elastic deformation of the channel gives rise to a correction of the interaction energy between the ion and the channel as a whole. The result is an effective potential for fixed position of the ion. Moreover, due to the finite masses of the ligands and their coupling to the ion in motion, the latter will experience inertia effects, which lead to an effective ion mass. It is shown that the introduction of an effective potential requires a canonical transformation of the generalized momenta. The corresponding Hamiltonian is directly used to calculate the jumping rates over a barrier, with the effective ion mass depending on all ligand masses and the geometry of the channel. In the present case, a model Hamiltonian for a helical arrangement of dipoles as hindered rotators is discussed, followed by an investigation of the diffusion constant for this system. (22 refs.)

103824 In situ electrophoresis of cancer cell membrane components. Y.-S.Nie, Y.-B.Feng, M.-Q.Tan (Inst. of Biophys., Acad. Sinica, Beijing, China), N.-M.Chao, D.-P.Zhao.
Mol. Cryst. & Liq. Cryst. (GB), vol.97, no.1-4, p.317-24 (1983). (Proceedings of the Ninth International Liquid Crystal Conference, Bangalore, India, 6-10 Dec. 1982).
Biomembranes show some properties of a liquid crystal. The molecules of the membrane can diffuse along the membrane plane. ISE (in situ electrophoresis) is one of the new techniques to measure the lateral diffusion of the molecules. By this technique, the authors studied the membrane fluidity of Ehrlich ascitic cancer cell of a mouse, and obtained the diffusion coefficient $D=3.2\times10^{-10}$ cm^2/sec and the electrophoretic mobility $m=1.3\times10^{-4}$ (μ/sec)/(v/cm) of the Con A receptors of the membrane at 22°C. A larger dispersion of the diffusion coefficient was noticed. (10 refs.)

103825 Diffusion and the physics of chemoreception. F.W.Wiegel (Dept. of Appl. Phys., Twente Univ. of Technol., Enschede, Netherlands).
Phys. Rep. (Netherlands), vol.95, no.5, p.283-319 (May 1983).
This review provides a manual which enables the reader to perform calculations on the rate with which a biological cell can capture certain chemical compounds (ligands) which are essential to its survival and which diffuse in its environment. After a discussion of spatial diffusion and the capture of ligands by a single receptor in the cell membrane, the theory of one-stage chemoreception is developed for the general case in which the cell is spherical and arbitrary forces act between the ligand and the cell. The method can also be applied to cells with other shapes. Next the author discusses membrane diffusion and develops a theory of two-stage chemoreception. Some hydrodynamic effects are also discussed. (73 refs.)

103826 Cell polarity: endogenous ion currents precede and predict branching in the water mold Achyla. D.L.Kropf (Nat. Jewish Hospital & Res. Center, Denver, CO, USA), M.D.A.Lupa, J.H.Caldwell, F.M.Harold.
Science (USA), vol.220, no.4604, p.1385-7 (24 June 1983).
The hyphae of the water mold Achyla bisexualis generate electrical currents that enter the growing tips and leave farther back. An inward-moving current also precedes branching and predicts the site of branch emergence; during the branching process, the current at the original tip declines or even reverses transiently without any change in growth rate. The inward current probably acts as an early signal during branch differentiation. The flow of specific ions rather than the flow of electrical charge probably serves to localize growth. (13 refs.)

Translocation pathway in the catalysis of active transport .... See Entry 103802

Structure-function relationships for a voltage-dependent ion channel: properties of COOH-terminal fragments of colicin E1 .... See Entry 103803

Symmetry of the process of electron transfer on the donor and acceptor sides of the photosynthetic reaction centre .... See Entry 103811

Two components of the calcium current of mollusc neurones .... See Entry 103828

Peristaltic transport of a solid bolus .... See Entry 103924

Mechanism of action of ultrasound of low intensity on mitochondria .... See Entry 103945

Changes in water-electrolyte exchange in the rat brain after γ-irradiation of the head .... See Entry 103959

Modifying effect of radiation on sodium and water transport in rabbit small intestine in different irradiation conditions .... See Entry 103962

A localized pattern photobleaching method for the concurrent analysis of rapid and slow diffusion processes .... See Entry 104133

87.30 BIOPHYSICS OF NEUROPHYSIOLOGICAL PROCESSES

(exc. perception processes and speech)

103827 Effect of discreteness of charge on the potential distribution in bilayer lipid membranes. M.M.Kozlov, V.S.Markin (Inst. of Electrochem., Acad. of Sci., Moscow, USSR).
Biophysics (GB), vol.27, no.4, p.652-8 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.4, p.629-34 (1982).
The potential of discrete charges located in the plane at a certain depth within the membrane is considered. In the approximation of the constant dielectric permeability of the membrane an expression has been found for the micropotential distribution. The case of charges on the membrane surface is separately considered. A refined variant of the method of the cutout disk is developed making it possible with good accuracy to find the potentials from discrete lattices. (10 refs.)

103828 Two components of the calcium current of mollusc neurones. N.K.Chemeris, M.A.Poskonova, B.Yu.Kafengauz (Inst. of Biological Phys., Acad. of Sci., Pushchino, USSR).
Biophysics (GB), vol.27, no.4, p.763-5 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.4, p.727-9 (1982).
Reports voltage clamp experiments on dialysed neurones of the mollusc Limnaea stagnalis. From the result it is concluded that, at a minimum, there are 2 pharmacologically distinguishable Ca^{2+} conducting channels having rapid and slow inactivation. (6 refs.)

103829 Dependence of cellular potential on ionic concentrations. Data supporting a modification of the constant field equation. D.C.Chang (Dept. of Physiology, Baylor Coll. of Medicine, Houston, TX, USA).
Biophys. J. (USA), vol.43, no.2, p.149-57 (Aug. 1983).
The resting potential in the squid axon has been measured at various concentrations of Cl, K, Na, and Ca ions. The results of these measurements are compared with the Goldman-Hodgkin-Katz (GHK) equation and a modified constant field equation. This modified equation was derived by including currents carried by divalent ions and the effects of the unstirred layer and the periaxonal space. It is shown that, although the GHK equation can fit the V vs. $[K]_0$ data well, it has difficulty explaining the observed dependence of V on $[Na]_0$ when the axon is bathed in K-free artificial sea water. The use of the modified constant field equation removes this difficulty. (21 refs.)

103830 EMG levels in the occipitofrontalis muscles under an experimental stress condition. D.W.Pritchard, M.M.Wood (Flinders Univ. of South Australia, Bedford Park, Australia).
Biofeedback & Self-Regul. (USA), vol.8, no.1, p.165-75 (March 1983).
In view of the importance attached to the frontalis muscles by researchers into the etiology of head pain and its treatment by biofeedback techniques, it is surprising that no data have yet been reported on the functioning of the occipitalis muscles, which have a close physiological relationship to the frontales. This study explores the response of the frontalis and occipitalis muscles under a condition of experimental stress. Migraine and tension-headache sufferers were separately compared with a headache-free control group under four conditions: baseline, while listening to instructions, while carrying out an auditory vigilance task, and for a further resting period equivalent to baseline. Results showed that tension levels in the frontalis muscles were not elevated at rest in any of the experimental groups, nor were they significantly responsive to the experimental task. The occipitales however proved to have significantly higher levels in both the tension-headache and migraine groups during the task and recovery periods. The results for the tension group reached significance because of a drop in control group values. These results may have significance in determining the best site for electrode placement in biofeedback. (50 refs.)

103831 Cerebellar stimulation for spasticity. J.R.Bloedel, T.J.Ebner (Univ. of Minnesota Medical School, Minneapolis, MN, USA).
IEEE Eng. Med. & Biol. Mag. (USA), vol.2, no.3, p.36-43 (Sept. 1983).
This review focuses on the research underlying the development of cerebellar stimulation for treating spasticity. The authors consider: the pathophysiological characteristics of spasticity; the role of the cerebellum in motor behaviour; stimulation of the cerebellum to treat spasticity; the effects of cerebellar stimulation in nonprimates; studies in spastic primates. (6 refs.)

103832 Stationarity, randomness, and serial dependence in neuronal spike trains. C.J.Sherry, W.R.Klemm (Dept. of Biology, Texas A&M Univ., College Station, TX, USA).
J. Electrophysiol. Tech. (GB), vol.10, no.2, p.59-73 (1983).
Spike trains without obvious serial dependencies are commonly described as reflecting a renewal process, in which the intervals are randomly and independently generated. The authors present a simple, straightforward but statistically rigorous way to test for randomness and stationarity in neuronal spike trains. This method is based on quantile analysis of cumulative probability distributions. The method can be used to test null hypotheses about any two interval distributions. Application of the method for spike trains from rat cerebellar cortex revealed that randomness and independence can be separate phenomena that require separate evaluation. (19 refs.)

103833 Relationships between characteristics of electrical stimulation muscle pain and blink responses in man. R.Duranti, R.Galletti, T.Pantaleo (Univ. Degli Studi, Florence, Italy).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.6, p.637-44 (June 1983).
Reports research on 11 healthy volunteers with the aim of investigating the relationship between blink response, a feature of the startle reaction, and muscular pain evoked by muscle electrical stimulation (train of stimuli). At a repetition rate of 0.1 Hz, a close relationship was found between the threshold for muscle pain and that for the blink response, without apparent habituation. At the same rate and with stimulation intensity maintained at pain threshold, the subject could voluntarily inhibit the blink response, but not pain. Under the same conditions both pain and blink response were inhibited during a mental task. By increasing the current intensity pain became more intense and the blink response tended to increase in amplitude and to decrease in latency. Similar effects were achieved by increasing the repetition rate with the current intensity maintained at pain threshold. Habituation of the blink response, but not of pain, was found at repetition rates of 1 Hz or more. Present results indicate that nociceptive inputs from muscle have a facilitatory effect on central mechanisms subserving the blink response. It is suggested that the comparative analysis of pain sensation and the blink response may be a useful tool for pain research in man. (36 refs.)

103834 Modelling compound action potentials of peripheral nerves in situ. III. Nerve propagation in the refractory period. D.F.Stegeman (Lab. of Medical Phys. & Biophys,, Univ. of Nijmegen, Nijmegen, Netherlands), J.P.C.De Weerd, S.L.H.Notermans.
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.6, p.668-79 (June 1983).
For pt.II see ibid., vol.54, p.516-29, 1982. Compound nerve action potentials (CAPs) of sural nerves of health persons were measured in the relative refractory period of the fibres. Double stimuli were used with interstimulus intervals ranging from 0.7 and 4.0 msec. The CAP latency increase, its amplitude decrease and its wave shape alterations with decreasing interstimulus interval are discussed, using a model description. Recovery functions for the single fibre action potential in the relative refractory period are defined. These recovery functions, however, cannot sufficiently explain the CAP amplitude diminutions actually measured. Apparently in the relative refractory period increasing number of fibres ceases to propagate an action potential when the stimulus interval is shortened. This effect, which is caused by subthreshold stimulation, predominantly involves the slower fibres. The usual derivation of refractory period parameters in clinical practice is reviewed. (32 refs.)

103835 Stretch reflex modulation during a cyclic elbow movement. W.A.MacKay, H.C.Kwan, J.T.Murphy, Y.C.Wong (Dept. of Physiology, Univ. of Toronto, Toronto, Ontario, Canada).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.6, p.687-98 (June 1983).
Small torque pulses were pulses were delivered to the forearm in order to test the stretch reflex of the brachialis and triceps arm muscles in 11 normal subjects performing a cyclic movement about the elbow in the horizontal plane. The flexion-extension movement was paced by a metronome and performed under various loading conditions. Reflexes for each muscle were tested either in each 50 msec segment of the 2 sec cycle period, or in a smaller number of selected phases. A late reflex, appearing at a latency of about 60 msec, was modulated extensively during the movement cycle. The amplitude of the late reflex increased markedly at the onset of a muscle contraction. In many of the subjects reflex responsiveness began to increase as early as 200 msec prior to the onset of voluntary muscle activity. Peak reflex responses were elicited by stimuli delivered 100-150 msec prior to the peak rate of increase of dynamic load. The increase in responsiveness was followed by a drop which was generally coincident in time with the peak rate of increase of the load opposing muscle contraction. The modulation of the late reflex is appropriately timed for reflex-generated tension to help counteract dynamic loads, intrinsic to the movement. (31 refs.)

103836 Spectral analysis of neocortical and hippocampal EEG in the protein malnourished rat. J.D.Bronzino, K.Austin, C.J.Siok, C.Cordova, P.J.Morane (Trinity Coll., Hartford, CT, USA).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.6, p.699-709 (June 1983).
Power spectral analysis techniques were utilized to quantify changes in the cortical and hippocampal EEG obtained from rats reared on either an 8% or 25% casein diet as they mature from 14 to 22 days of age. Analyses of the power spectral data obtained from the frontal cortex of rats reared on the 25% casein diet during this preweaning period (14-22 days) indicated increases in the power in the 0.5-3.5 c/sec frequency band primarily during slow-wave sleep. Prenatal protein malnutrition (8% casein diet) significantly reduced the low frequency power content in the cortical EEG obtained during slow-wave sleep at 18 and 22 days of age. Analyses of power spectral data obtained from the hippocampal EEG during REM sleep also revealed developmental and diet-related differences. The frequency at which the peak power occurs in the theta band (4-11 c/sec) was found to increase normally in a linear fashion from 14 to 22 days of age (from 4.4 to 5.5 c/sec) in rats reared on the 25% casein diet. In addition, power in the 4-7 c/sec band significantly increased during this preweaning period. Prenatal protein malnutrition significantly slowed the development of theta frequency and produced higher values of power in the component of theta rhythm. (25 refs.)

103837 Simulation of macro EMG motor unit potentials. S.Nandedkar, E.Stalberg (Dept. of Clinical Neurophysiology, Univ. Hospital, Uppsala, Sweden).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.1, p.52-62 (July 1983).
Macro EMG motor unit potentials (MUPs) have been simulated. The effects on MUP parameters of number of fibres, fibre diameter, end-plate scatter, nerve branch delay, motor unit territory and electrode position have been studied. The MUP shape is sensitive to electrode position in the vicinity of the end-plates. It is mainly reflecting the end-plate scatter and the nerve delays. Away from the end-plates the wave shape is principally determined by the fibre diameter distribution. Total number of muscle fibres and their mean diameter act as gain factors at all recording positions. In the simulations the area of the signal appears to be a better measure of the strength of the motor unit than the amplitude. Macro EMG offers a much less selective recording than conventional EMG and single fibre EMG and therefore new aspects of the motor unit can be quantified. Preliminary results from simulations of neuromuscular disorders are consistent with actual findings. (22 refs.)

103838 The dielectric properties of the cerebellum, cerebrum and brain stem of mouse brain at radiowave and microwave frequencies. N.R.V.Nightingale (Dept. of Phys., Queen Elizabeth Coll., London, England), V.D.Goodridge, R.J.Sheppard, J.L.Christie.
Phys. Med. & Biol. (GB), vol.28, no.8, p.897-903 (Aug. 1983).
The relative permittivity and conductivity of the cerebellum, cerebrum and rain stem of mouse brain were measured at a temperature of 37°C over a frequency range of 72 MHz to over 5 GHz using time-domain spectroscopy. An analysis of the data suggests that the water exists in various forms of binding with an average relaxation frequency less than free water. (10 refs.)

103839 Potassium currents in the frog node of Ranvier. J.M.Dubois (Lab. de Neurobiologie, Ecole Normale Superieure, Paris, France).
Prog. Biophys. & Mol. Biol. (GB), vol.42, no.1, p.1-20 (1983).
This review summarises the different results in the literature concerning the potassium currents of frog node and Ranvier, and compares the properties of the nodal K channels to those of K channels in other preparations. (95 refs.)

103840 Inhibitory conductance changes at synapses in the lamprey brainstem. M.R.Gold, A.R.Martin (Dept. of Physiology, Univ. of Colorado School of Medicine, Denver, CO, USA).
Science (USA), vol.221, no.4605, p.85-7 (1 July 1983).
Although the conductance and kinetic behavior of inhibitory synaptic channels have been studied in a number of nerve and muscle cells, there has been little if any detailed study of such channels at synapses in the vertebrate central nervous system or of the relation of such channels to natural synaptic events. In the experiments reported here, current noise measurements were used to obtain such information at synapses on Muller cells in the lamprey brainstem. Application of glycine to the cells activated synaptic channels with large conductances and relaxation time constants (70 picosiemens and 33 milliseconds, respectively, at 3° to 10°C). Spontaneous inhibitory synaptic currents had a mean conductance of 107 nanosiemens and decayed with the same time constant. In addition, the glycine responses and the spontaneous currents had the same reversal potential and both were abolished by strychnine. These results support the idea that glycine is the natural inhibitory transmitter at these synapses and suggest that one quantum of transmitter activates about 1500 elementary conductance channels. (8 refs.)

103841 Ventricular fibrillation and fluctuations in the magnitude of the repolarization vector. D.R.Adam, A.O.Powell, H.Gordon, R.J.Cohen (Div. of Health Sci. & Technol., Harvard-MIT, Cambridge, MA, USA).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.241-4
Susceptibility to ventricular fibrillation, as estimated by the measurement of the Ventricular Fibrillation Threshold (VFT), has been related to the degree of both the spatial inhomogeneity of the ventricular repolarization process and also the temporal, beat-to-beat variation in the pattern of ventricular repolarization. Specifically, as the VFT is reduced, the repolarization process is found to develop a periodic behavior, reflected in an alternans pattern of variation in T-wave morphology. The authors investigate whether this increase in temporal fluctuations is due solely to mechanical or electrical angular changes of the repolarization wavefront propagation or due to a more fundamental alteration in electrical conduction processes. The hypothesis was tested by investigating the effects of reducing the Ventricular Fibrillation Threshold (VFT), on both single lead surface electrocardiogram (ECG) and the magnitude of the instantaneous cardiac dipole as measured by vectorcardiography. Canine studies are performed. (6 refs.)

103842 The apparent repetition frequency of ventricular fibrillation. J.N.Herbschleb, I.van der Tweel, F.L.Meijler (Dept. of Cardiology, Univ. Hospital Utrecht, Utrecht, Netherlands).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.249-52
The auto power spectra of the recorded electrical activity of the heart during ventricular fibrillation (VF) strongly suggests that during VF action potentials occur at very regular time intervals. These intervals, however, are approximately twice as short as the shortest RR-intervals encountered in, e.g. sinus-rhythm during heavy exercise or ventricular tachycardia. A mathematical model of 1000 interconnected 'cells' showed a persistent repetitive activity, with the rate of the model as a whole two times higher than the individual components. An analysis of the individual states of all 1000 'cells' indicated that approximately 30% of the 'cells' were activated synchronously and regularly, another 30% behaved in the same way, but with a shift of half a period compared to the first group, thus causing the two times higher frequency of the whole. Data from literature and the authors' own observations disclose that fibrillation as a sequel to tachycardia may indeed contain a repetition frequency approximately twice the frequency of the tachycardia. (16 refs.)

Generation of a potential on the bilayer lipid membrane in the reaction of proton attachment—separation in the near membrane layers .... See Entry 103798

Transverse deformation of bilayer lipid membranes on electrostriction .... See Entry 103800

Structure-function relationships for a voltage-dependent ion channel: properties of COOH-terminal fragments of colicin E1 .... See Entry 103803

Linearisation by optimal control .... See Entry 103804

Study of charge separation at the reaction centres of photosystem II of higher plants by magnetic modulation of fluorescence .... See Entry 103807

Effect of dispersion of electric parameters of bacterial cells on their orientation in an alternating electric field .... See Entry 103808

Analysis of the cable structure of blue-green algae .... See Entry 103809

Symmetry of the process of electron transfer on the donor and acceptor sides of the photosynthetic reaction centre .... See Entry 103811

Participation of photosystem II in regulation of photosynthetic electron transport in the green alga Chlamydobotrys stellata .... See Entry 103817

Single voltage-dependent chloride-selective channels of large conductance in cultured rat muscle .... See Entry 103821

In situ electrophoresis of cancer cell membrane components ..See Entry 103824

Cell polarity: endogenous ion currents precede and predict branching in the water mold Achyla .... See Entry 103826

The transmission of signals by auditory-nerve fiber discharge patterns .... See Entry 103875

Representation of stop consonants in the discharge patterns of auditory-nerve fibers .... See Entry 103876

Demonstration of useful differences between magnetoencephalogram and electroencephalogram .... See Entry 103909

Interactive control of isolated heart experiments .... See Entry 103935

Changes in water-electrolyte exchange in the rat brain after γ-irradiation of the head .... See Entry 103959

Monitoring variations of biological impedances using microwave Doppler radar .... See Entry 104023

Quantification of regional ventricular function with vector Fourier analysis of gated images .... See Entry 104048

Removal of eye movement and ECG artifacts from the non-cephalic reference EEG .... See Entry 104089

Spike detection based on a pattern recognition approach using a microcomputer .... See Entry 104090

Elimination of EMG interference during recording of somatosensory evoked potentials elicited by posterior tibial nerve stimulation in patients with cervical spinal cord injury .... See Entry 104091

A dedicated microcomputer-based instrument for interval analysis of multicomponent wave forms in single fibre EMG .... See Entry 104092

Quantification of spindles in comatose patients .... See Entry 104093

Analysis on diagnostic criteria of pediatric ECG .... See Entry 104096

On-line monitoring of multiple precordial leads in high risk patients with coronary artery disease .... See Entry 104097

Beat-to-beat analysis of waveshape and rhythm in XECG using inner vector product hardware .... See Entry 104098

The design and evaluation of a real-time arrhythmia monitoring algorithm .... See Entry 104099

Differentiation of epileptiform abnormalities from normal transients and artifacts on ambulatory cassette EEG .... See Entry 104102

Frequency difference and amplitude difference pattern analysis of the electroencephalogram .... See Entry 104103

A micro-computer system for cell electrophoresis measurements .... See Entry 104104

A solution of the ECG inverse problem based on the solid angle model .... See Entry 104105

ECG criteria for left ventricular hypertrophy: use of ECG and echo computerized databases .... See Entry 104107

Manual vs. computerized electrocardiographic measurements of the P-wave: the diagnosis of left atrial enlargement .... See Entry 104108

Automated vectorcardiographic analysis by an inexpensive microprocessor .... See Entry 104109

Thermal characterization of electrosurgery .... See Entry 104111

Restoration of upper extremity function .... See Entry 104112

The treatment of scoliosis using electrical stimulation of muscle .... See Entry 104113

Recognition of ventricular fibrillation, other rhythms and noise in patients developing the sudden cardiac death syndrome .... See Entry 104116

Control of movements by functional neuromuscular stimulation .... See Entry 104123

Teflon insulation for metal microelectrode shafts .... See Entry 104135

BAK instruments DIS-1 window spike discriminator .... See Entry 104137

Analysis of cardiac transmembrane action potentials with parallel microprocessors .... See Entry 104155

87.32 PHYSIOLOGICAL OPTICS, VISION

103843 **Objective measurement of sensory functions.** N.Sugie.
J. Soc. Instrum. & Control Eng. (Japan), vol.22, no.3, p.274-81 (March 1983). In Japanese.
For visual-acuity measurements there are three objective instrumentation methods: (1) the preferential looking (PL) method, which can be carried out with a simple apparatus; (2) the visually evoked potential (VEP) method, which requires a complicated apparatus for generating and controlling a stimulus pattern; and (3) the optokinetic nystagmus (OKN) method, which allows measurements to be made in a short time. Measuring the binocular stereopsis provides an effective method for finding strabismus in human infants. For this there is a method based on VEP. In addition, VEP can be used to measure opponent-colours response. Auditory function can be revealed by measuring brain stem potentials. (27 refs.) *K.B.*

A model of the eye for use in medical education .... See Entry 98691

Iris pigmentation and AC thresholds .... See Entry 103882

Spectral irradiances of and maximal permissible exposures to two indirect ophthalmoscopes .... See Entry 104013

A confrontation test of visual fields in the low-vision patient .... See Entry 104014

Cause of the drift of the zero point of the visual polarimeter .... See Entry 104132

87.32C Anatomy and optics of the eye

103844 **On the relation between aniseikonia and axial anisometropia.** J.Rabin, A.Bradley, R.D.Freeman (School of Optometry, Univ. of California, Berkeley, CA, USA).
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.7, p.553-8 (July 1983).
A dichoptic, size-matching technique was used to evaluate aniseikonia in a sample of axial anisometropes. During testing, the subjects were optically corrected to minimize differences in retinal image size. A clinically significant degree of aniseikonia was measured which varied in proportion to the magnitude of anisometropia. These results may reflect interocular differences in the spatial density of the retinal elements secondary to anisometropic ocular growth. (11 refs.)

Laboratory evaluation of commercial aspheric aphakic lenses .... See Entry 104117

87.32E Physiology of the eye; nerve structure and function

103845 **Zone of zero-associated phoria in patients with convergence insufficiency.** R.P.Rutstein (School of Optometry, Univ. of Alabama, Birmingham, AL, USA), L.B.Godio.
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.7, p.582-5 (July 1983).
The zone of zero-associated phoria (ZZAP) was determined for patients with convergence insufficiency. The ZZAP for these patients differs from that of asymptomatic patients. It is concluded that the ZZAP may be used as a supplemental test to help the clinician detect convergence insufficiency and possibly other binocular deficiencies. (30 refs.)

103846 **New measures of fixation disparity in the diagnosis of binocular oculomotor deficiencies.** A.L.Duwaer (Dept. of Biological & Medical Phys., Erasmus Univ., Rotterdam, Netherlands).
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.7, p.586-97 (July 1983).
Two new measures of fixation disparity have been successfully used to evaluate the occurrence of binocular oculomotor deficiencies under (normal) viewing conditions with no interposed prisms. They are the threshold for the perception of misalignment between briefly presented dichoptic nonius lines and the SD of this threshold. The effectiveness of these new measures of fixation disparity for diagnosing binocular oculomotor deficiencies, which are symptomatically manifested as asthenopia, was found to surpass the diagnostic effectiveness of two measures of fixation disparity in current use: the mean amount of fixation disparity at the point where there are no prisms before the eyes and the slope of the fixation disparity curve near this point. The high diagnostic effectiveness of the new measures of fixation disparity, which are related to the spread of the fixation disparity, suggests that the binocular oculomotor deficiency underlying asthenopia is in essence an inaccurate and unstable alignment of the two eyes. (18 refs.)

103847 **Two-dimensional structure of the receptive fields of the cat visual cortex.** V.D.Glezer, V.Ye.Gauzel'man, T.A.Schcherbach, V.M.Bondarko (Pavlov Inst. of Physiology, Acad. of Sci., Leningrad, USSR).
Biophysics (GB), vol.27, no.4, p.749-54 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.4, p.715-19 (1982).
Study of the responses of the neurones of the receptive fields of the cat visual cortex to sinusoidal gratings of different spatial frequency and orientation gave the two-dimensional space frequency characteristics. It is shown that the frequency optimal for the field does not change with orientation. Theoretical analysis of the role of the factor of the limited size of the field showed that tuning both in spatial frequency and orientation must be sufficiently wide. The results indicate that the receptive fields are grating filters of spatial frequencies. (16 refs.)

103848 **Developmental changes in the human visual system as reflected by the latency of the pattern reversal VEP.** A.Moskowitz, S.Sokol (Dept. of Ophthalmology, Tufts Univ. School of Medicine, Boston, MA, USA).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.1, p.1-15 (July 1983).
Pattern reversal visually evoked potentials (VEPs) were recorded from 439 infants and young children ranging in age from 1 month to 5 years in response to large and small checks. Qualitative analysis of the VEP wave form showed that the first major positive component, P_1, is consistently present at all ages, while the frequency of occurrence of later positive components is more variable. The proportion of infants showing late positive components increases with age; by 1 year, the frequency of occurrence of late components for large checks is more adult-like than for small checks. The latency of P_1 was analyzed quantitatively. Results showed that P_1 latency decreases rapidly during the first year of life for both large and small checks and that the time course of the latency change differs as a function of check size. VEPs to large checks attain adult-like P_1 latency values by about 1 year of age, while the P_1 latency of VEPs to small checks has still not reached adult levels by 5 years of age. (58 refs.)

103849 **Perimetry, visual evoked potentials and visual evoked spectrum array in homonymous hemianopsia.** G.G.Celesia, J.T.Meredith, K.Pluff (Dept. of Neurology, Williams S. Middleton Memorial Veterans Hospital, Madison, WI, USA).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.1, p.16-30 (July 1983).
Confrontation field examination, perimetry, visual evoked potentials (VEPs) to pattern hemi-field stimulation and visual evoked spectrum array to flash stimulation were compared in 50 patients with homonymous hemianopsia. The visual field could be examined by confrontation in all patients and the field defect was demonstrated in 96% of cases. Goldmann perimetry could only be performed in 60% of patients, but always quantitatively defined the margins of the defect. VEPs could only be tested in 77% of patients and demonstrated an abnormality in 79% of cases. VEPs were absent to stimulation of the affected hemifield in every case of homonymous field defects with macular splitting. Visual evoked spectrum array could be tested in 95% of patients and revealed abnormalities in 67% of cases. The relative value of each test is discussed. (39 refs.)

103850 **Visual evoked-response correlates of speechreading performance in normal-hearing adults: a replication and factor analytic extension.** V.J.Samar, D.G.Sims (Nat. Tech. Inst. for the Deaf, Rochester Inst. of Technol., Rochester, NY, USA).
J. Speech & Hear. Res. (USA), vol.26, no.1, p.2-9 (March 1983).
The relationship between the latency of the negative peak occurring at approximately 130 msec in the visual evoked-response (VER) and speechreading scores was investigated. A significant product-moment correlation of −.58 was obtained between the two measures, which confirmed the fundamental effect but was significantly weaker than that previously reported in the literature (−.90). Principal compenents analysis of the visual evoked-response waveforms revealed a previously undiscovered early VER component, statistically independent of the latency measure, which in combination with two other components predicted speechreading with a multiple correlation coefficient of .84. The potential significance of this new component for the study of individual differences in speechreading ability is discussed. (12 refs.)

103851 **Mutual coupling between the ocular circadian pacemakers of Bulla gouldiana.** M.H.Roberts, G.D.Block (Dept. of Biology, Univ. of Virginia, Charlottesville, VA, USA).
Science (USA), vol.221, no.4605, p.87-9 (1 July 1983).
The ocular circadian pacemakers of Bulla gouldiana were found to be mutually coupled, and their interaction could be observed in an isolated nervous system maintained in vitro. Experimentally induced phase separations between the two ocular pacemakers were reduced when the eyes were allowed to interact for 48 hours. The reduction in phase separation did not occur however when the cerebral commissure was severed, indicating that this neural tract is a critical pathway coupling these two circadian clocks. (18 refs.)

Relationships between characteristics of electrical stimulation muscle pain and blink responses in man .... See Entry 103833

Wavelength-dependent rod-cone transition of the electroretinographic response .... See Entry 103852

Brain stem auditory, pattern-reversal visual, and short-latency somatosensory evoked potentials: latencies in relation to age, sex, and brain and body size .... See Entry 103863

Quantification of spindles in comatose patients .... See Entry 104093

SELAVCO: a method to deal with trial-to-trial variability of evoked potentials .... See Entry 104138

87.32N Colour detection; adaptation and discrimination

103852 **Wavelength-dependent rod-cone transition of the electroretinographic response.** W.J.Donovan, W.S.Baron (SRI Internat., Menlo Park, CA, USA).
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.7, p.559-66 (July 1983).
Signal-averaging and vector voltmeter techniques have been used to measure the rod-cone response transition of the primate corneal electroretinogram (ERG). Lights of 580 nm or shorter wavelength, flickering sinusoidally at 5 Hz, produced nearly sinusoidal ERGs with a rod-type spectral sensitivity. For stimuli of 600 nm or longer wavelength, the ERG exhibited cone as well as rod response components; the ERG response became increasingly nonlinear and measurements of sensitivity and phase grew more variable. The results show how phase information may reveal changes in response nonlinearities. Response shape and vector voltmeter phase readings are more accurate indicators of the boundary between rod-only vs. rod-cone mixed responses than are vector voltmeter magnitude readings. Shifts in the rod-cone response boundary could perhaps be exploited clinically to test for some anomalous visual processes. (23 refs.)

103853 **Color of visual display terminals and the eye: green VDTs provide the optimal stimulus to accommodation.** J.G.Sivak, G.C.Woo (School of Optometry, Univ. of Waterloo, Waterloo, Ontario, Canada).
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.7, p.640-2 (July 1983).
The longitudinal chromatic aberration of the human eye is substantial and therefore the color of the phosphor chosen for a visual display terminal

(VDT) will affect refractive state and accommodative demand. For most working distances, green stimuli (λ max 520nm) are optimal. (17 refs.)

103854 Chromatic valence and hue sensation. Y.Ejima (Dept. of Electrical Engng., Kyoto Inst. of Technol., Kyoto, Japan), S.Takahashi.
J. Opt. Soc. Am. (USA), vol.73, no.8, p.1048-54 (Aug. 1983).
Red-green and yellow-blue chromaticnesses were scaled for various monochromatic lights by a just-noticeable-difference method. The just-noticeable difference of each chromaticness, i.e. redness, greenness, yellowness, or blueness, was defined by the change of the cancelling light intensity that was required to produce a just-noticeable difference in the amount of the opponent-hue attribute of each monochromatic light. The results showed that an approximately logarithmic transformation took place at the two opponent-colour coding systems and that there existed an interaction between red-green and yellow-blue opponent colour coding systems in such a manner that the effective contribution of one opponent-colour response to the perceived opponent-hue attribute was reduced by increasing the magnitude of the other opponent-colour response. This interaction is considered to be responsible for the well-known veiling effect. (15 refs.)

103855 Linearity law reexamined for flicker photometry by the summation-index method. M.Ikeda (Dept. of Information Processing, Tokyo Inst. of Technol. Graduate School, Yokohama, Japan).
J. Opt. Soc. Am. (USA), vol.73, no.8, p.1055-61 (Aug. 1983).
The summation-index technique was applied to flicker photometry to investigate the linearity law. Two test stimuli of different wavelengths were mixed, and the luminous efficiency of the mixture was measured under three different adapting conditions: no adaptation, 507-nm adaptation, and 650-nm adaptation. Most of the wavelength combinations and adapting conditions gave a summation index of 0.30, which is the linearity in the visual system that is responsible for the flicker perception, namely, the achromatic channel. An exception was the red and green combination under the no-adaptation condition, which gave a slightly smaller summation index than 0.30, indicating that these two stimuli do not add linearly. The subsummation was interpreted as cancellation of red and green responses in the red-versus-green opponent channel. The subsummation disappeared when the flicker frequency was increased from 5 to 12 Hz, confirming the interpretation. (21 refs.)

87.32S Psychophysics of vision, visual perception, binocular vision

103856 Border enhancement as a function of binocular fixation performance. A.Remole (School of Optometry, Univ. of Waterloo, Waterloo, Ontario, Canada).
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.7, p.567-77 (July 1983).
Traditionally, fixation disparity is measured by interocular vertical alignment of unfusable monocular targets. The disparity generally increases with forced ocular vergences, producing characteristic individual functions. This study explores a new method of monitoring binocular fixation performance; the method is based on the effect of the distance of the border stimulus from the foveal center on the lateral spread of border enhancement. That is, as this distance increases, the enhancement spread increases. It is found that, as increasing ocular vergence is applied, the enhancement also increases, in a manner resembling conventional fixation disparity measurements. However, some dissimilarities between the border enhancement functions and the conventional functions suggest that the directional values used as a basis for the latter undergo modifications. (21 refs.)

103857 Application of two-dimensional Fourier transforms to problems of visual perception. F.L.Royer (Cleveland Veterans Administration Medical Center, Cleveland, OH, USA), M.S.Rzeszotarski, G.C.Gilmore.
Behav. Res. Methods & Instrum. (USA), vol.15, no.2, p.319-26 (April 1983). (12th National Conference on the Use of On-Line Computers in Psychology, Minneapolis, MN, USA, 1982).
Neurophysiological and psychophysical evidence indicates that the visual system performs a sort of Fourier analysis of retinal variations in brightness through multiple spatial frequency-tuned channels. Two types of applications of techniques of two-dimensional Fourier analysis are discussed: (1) modelling and simulation of visual functions, and (2) generation of stimuli in which the spatial frequency information is controlled. Examples of both these applications are presented. (22 refs.)

103858 Visual motion and cortical velocity. A.Johnston, M.J.Wright (Dept. of Psychology, Brunel Univ., Uxbridge, England).
Nature (GB), vol.304, no.5925, p.436-8 (4 Aug. 1983).
Visual acuity decreases with distance from the fovea in proportion to the estimated cortical magnification factor, M (the extend of striate cortex in millimetres corresponding to a degree of arc in visual space). The authors have used M-scaling to investigate motion perception as a visual field variable. They report that both the lower threshold of motion and adaption to motion are uniform for M-scaled stimuli, and are related to the velocity of the 'cortical image.'. (19 refs.)

103859 Statistical differences of reaction time in Schizophrenic and normal person groups to four modes of light stimulation. H.Miike, Y.Ebina (Faculty of Engng., Yamaguchi Univ., Ube, Japan), M.Momota.
Trans. Inst. Electron. & Commun. Eng. Jpn. Part C (Japan), vol.J66C, no.5, p.377-84 (May 1983). In Japanese.
The reaction time to four light stimulus modes is statistically examined in normal and schizophrenic person groups. Two modes are presented at constant and random time intervals at a constant position. The other presentation methods are to use spatially constant (SC) and random (SR) positions at random time intervals. The difference in the two person groups is evaluated by the degree of overlap and level of significance of four statistics; average (AV), standard deviation (SD), median (ME) and shape factor of histogram (SF). Maximum differences are found in the SR mode and the discriminant functions ME and SF are most effective in discriminating between the two groups. (18 refs.)

On-line computer demonstrations in a visual perception class . See Entry 98708

New measures of fixation disparity in the diagnosis of binocular oculomotor deficiencies ....See Entry 103846

Chromatic valence and hue sensation ....See Entry 103854

Problems associated with atmospheric visibility measurement techniques ....See Entry 104560

87.34 AUDITION

103860 Perceptual prominence of harmonic components in vowel-like sounds. O.Kakusho, H.Nakashima, M.Yanagida, R.Mizoguchi (Inst. of Sci. & Industrial Res., Osaka Univ., Osaka, Japan), T.Kobayashi.
Acustica (Germany), vol.53, no.3, p.132-42 (July 1983).
The perceptual sensitivity of the human auditory system to the harmonic components in vowel-like sounds is investigated in order to identify dominant components in both natural and synthetic vowels. A new concept of the removal-detectable components (RDCs) in the spectrum of vowel-like sounds is introduced as a component whose removal is perceptually detectable in either phonological or tonal quality. The properties of RDCs are discussed on the $\Delta F_i - A_i$ plane, where ΔF_i and A_i denote the frequency difference between two adjacent local peaks and the area surrounded by the line connecting the peaks and the spectral envelope, respectively. In the preliminary investigation for the present research, it was confirmed that the mutual phase relation among the components plays little role in the removal-detectability experiment. The RDCs in synthetic vowels are identified through paired comparison test by two male subjects. The distribution diagram of RDCs on a modified $\Delta F_i - A_i'$ plane enables one to distinguish the formant peaks from spurious ones on irregular short-time frequency spectra of natural vowels. The correct identification rate of peak components due to formants for five Japanese vowels was found to be more than 98% for over 1000 frames of short-time frequency spectra of natural vowels uttered by seven male adults and was found to be perfect for time-averaged frequency spectra of the same vowels. (7 refs.)

103861 Vowel identification and dichotic fusion of time-varying synthetic speech sounds. H.Kuwabara (NHK Broadcasting Sci. Res. Labs., Tokyo, Japan).
Acustica (Germany), vol.53, no.3, p.143-51 (July 1983).
Two kinds of perceptual experiments were performed for synthetic unsteady vowels. The synthetic stimuli were symmetric three-vowel sequences of the forms [uVu] and [eVe]. The first experiment was conducted to investigate the perceptual phoneme-boundary for the middle vowels of [uVu] stimuli, and a large amount of boundary shift in comparison with the boundary of the steady-state counterparts was found to occur. The second experiment was designed to find out the possible location within the auditory nerve system of the inner mechanism that gives the boundary-shift, making use of a dichotic fusion paradigm. The result shows that the mechanism is not located in the peripheral system, but is more likely a process of the central brain function. (13 refs.)

103862 Note on a non-linear model of the basilar membrane. C.H.Loh (Dept. of Theoretical & Appl. Mech., Univ. of Auckland, Auckland, New Zealand).
Acustica (Germany), vol.53, no.3, p.159-62 (July 1983).
The present analysis yields a simple procedure for finding the non-linear response of the basilar membrane. The required calculations are minimal and are more economical than direct numerical techniques. The chief disadvantage is the fact that the approximations used are asymptotic and thus not fully exact. Although the analysis has been restricted to a pure-tone stimulus, the perturbation method can be extended to include multi-tonal stimuli. The various primaries would then interact to produce harmonics and intermodulation components. (13 refs.)

103863 Brain stem auditory, pattern-reversal visual, and short-latency somatosensory evoked potentials: latencies in relation to age, sex, and brain and body size. T.Allison, C.C.Wood, W.R.Goff (Neuropsychology Lab., Veterans Administration Medical Center, West Haven, CT, USA).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.6, p.619-36 (June 1983).
To determine standards of normality for auditory, somatosensory and visual evoked potentials commonly used in the assessment of neurological disease, 8 auditory evoked potential, 1 visual evoked potential (VEP) and 12 somatosensory evoked potential components were recorded to stimulation of left and right ears, eyes, and median nerves in 286 normal subjects ranging in age from 4 to 95 years. Peak and interpeak latencies, and left-right differences in latency, were analyzed as function of age, sex, and estimates of brain and body size. Major features of the results were: (1) Peak latencies of all components showed statistically significant increases in latency with age except for VEP P100. (2) In adults the peak latencies of all components were significantly later in males than in females. (3) Most interpeak latencies showed significant differences in relation to age or sex. (4) Age and sex are useful predictors of latency for nearly all peak and interpeak latencies. (5) Left-right latency differences showed little age-related, and no sex-related change. (42 refs.)

103864 Variations in early and late event-related components of the auditory evoked potential with task difficulty. D.S.Goodin, K.C.Squires, A.Starr (Dept. of Neurology, Univ. of California, Irvine, CA, USA).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.6, p.680-6 (June 1983).
A variation in the difficulty of an auditory discrimination was used to investigate the relationship between the event-related P_{165}, N_2 and P_3 components of the auditory evoked potential. Equivalent increases in the latencies of all 3 components were found with increased task difficulty. The P_{165} component, however, could be differentiated from the two later components since it increased in amplitude with increased task demands while the N_2 and P_3 amplitudes remained constant. It is suggested that the P_{165}, N_2 and P_3 components comprise a functional sequence in the processing of rare events and possibly involved in a subject's preparations for the future. (24 refs.)

103865 Effect of contralateral and ipsilateral masking of acoustic stimulation on the latencies of auditory evoked potentials from cochlea and brain stem. E.H.J.F.Boezeman (Dept. of Clinical Neurophysiology, Valeriuskliniek & Academic Hospital, Free University, Amsterdam, Netherlands), T.S.Kapteyn, S.L.Visser, A.M.Snel.
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.6, p.710-13 (June 1983).
Masking techniques were applied to a group of 10 subjects with normal hearing to investigate the influence of masking on the latencies of brain stem auditory evoked potentials. The levels of sufficient masking and overmasking were determined. Central masking, as established in a psychophysiological manner, cannot be clearly demonstrated by auditory brain stem evoked potentials. When masking the untested ear, the alterations in the response are small and this can be ignored in clinical practice if masking of the untested ear is necessary. (20 refs.)

103866 Auditory nerve-brain stem evoked potentials and EEG during severe hypoglycemia. E.Deutsch (Dept. of Ear, Nose & Throat, Bikur Cholim Hospital, Jerusalem, Israel), H.Sohmer, J.Weidenfeld, S.Zelig, I.Chowers.
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.6, p.714-16 (June 1983).
To investigate the effects of severe hypoglycemia on the ability of the brain to generate electrical activity, the EEG and auditory nerve-brain stem evoked potentials (ABP) were recorded before and during the development of insulin-induced hypoglycemia in rats (ABP only) and cats (ABP and EEG). No significant ABP changes were seen in rats in which the average blood glucose levels had reached 0.38 mmol/l (=7 mg%). In cats, even though the EEG was depressed, no ABP latency changes and only slightly significant amplitude changes were seen in animals in which the average blood glucose level was 0.8 mmol/l. In both animals blood glucose levels were below 1.66 mmol/l for an average duration of 90 min. Therefore, even though it has been shown that the brain structures involved in generation of the ABP have higher metabolic rates, they seem to be resistant to deviations from homeostasis such as hypoglycemia. (9 refs.)

103867 Wave I of early auditory evoked potentials in multiple sclerosis. H.C.Hopf, K.Maurer (Dept. of Clinical Neurology, Johannes Gutenberg Univ., Mainz, Germany).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.1, p.31-7 (July 1983).
Early auditory evoked potentials (EAEPs) were recorded in a series of 71 consecutively examined patients suffering from clinical definite or probable multiple sclerosis (MS). Wave I abnormalities, i.e. delayed latency, with or without reduced amplitude, were observed in 15 such patients and were interpreted as due to MS in 8 of them. As EAEP wave I is identical with the potential N1 in electrocochleography and corresponds to activity of the most distal part of the acoustic nerve or the spiral ganglion, it is concluded that the peripheral part of the acoustic nerve is involved in about 10% of MS patients. In two cases normalization of initially delayed wave I latencies were demonstrated during follow-up recording. The pattern of a late wave I but normal hearing in 3 patients is interpreted in terms of a desynchronized compound nerve activity with fully preserved conductivity, segmental demyelination of a considerable number of acoustic nerve fibres being the most likely cause. (45 refs.)

103868 Far-field cochlear microphonics in man and their relation to cochlear integrity. M.Euler, J.Kiessling (Phys. Technol., Univ. Duisburg, Duisburg, Germany).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.1, p.86-9 (July 1983).
Far-field cochlear microphonics (CM) in man have been measured as a function of frequency by phase-sensitive detection. CM amplitude, dispersion and input-output functions vary periodically with frequency and exhibit certain frequency windows, where responses are approximately frequency specific, in contrast to the commonly accepted model of basal turn CM generators as main sources. Pathological cochleae show abnormal amplitude and phase functions. The results offer new diagnostic possibilities, because hair cell function can be evaluated by a routine non-invasive procedure down to the low frequency speech range. (11 refs.)

103869 Discrimination of speech processed by low-pass filtering and pitch-invariant frequency lowering. C.M.Reed, B.L.Hicks, L.D.Braida, N.I.Durlach (MIT, Cambridge, MA, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.409-19 (Aug. 1983).
Consonant discriminability by normal-hearing listeners was studied for monosyllables processed using frequency lowering with either uniform (linear) or nonuniform (warped) compression of the frequency axis. The bandwidth of the compressed signal was either 2500 or 1250 Hz and five compression characteristics were studied, in addition to low-pass filtering, for each of the two bandwidths. Stimuli were 24 consonant-vowel syllables made up of 24 consonants and three vowels, recorded three times by each of two male and female speakers. A 'roving-speaker, roving-vowel, roving-utterance', two-interval, forced-choiced procedure with feedback was employed. As expected, performance for the 2500-Hz bandwidth was superior to that for the 1250-Hz bandwidth. For each bandwidth, compression schemes which accomplished greater lowering of the high frequencies relative to the low frequencies resulted in the highest performance. Overall performance for the best frquency-lowering system studied, however, was roughly comparable to that obtained for low-pass filtering. Patterns of performance over articulatory features were different for frequency lowering and filtering. In general, lowering was superior to filtering for contrasts for fricative sounds but inferior for contrasts of nasals and semivowels. (23 refs.)

103870 Coarticulation in sequences of two nonhomorganic stop consonants: perceptual and acoustic evidence. B.H.Repp (Haskins Labs., New Haven, CT, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.420-7 (Aug. 1983).
This study investigated whether any perceptually useful coarticulatory information is carried by the release burst of the first of two successive, nonhomorganic stop consonants. The CV portions of natural VCCV utterances were replaced with matched synthetic stimuli from a continuum spanning the three places of stop articulation. There was a sizable effect of coarticulatory cues in the natural-speech portion on the perception of the second stop consonant. Moreover, when the natural VC portions including the final release burst were presented in isolation, listeners were significantly better than chance at guessing the identity of the following, 'missing' syllable-initial stop. The hypothesis that the release burst of a syllable-final stop contains significant coarticulatory information about the place of articulation of a following, nonhomorganic stop was further confirmed in acoustic analyses which revealed significant effects of CV context on the spectral properties of the release bursts. The relationship between acoustic stimulus properties and listeners' perceptual responses was not straightforward, however. (12 refs.)

103871 Intense sounds may alter the mechanical properties of the cochlear partition. D.McFadden (Dept. of Psychology, Univ. of Texas, Austin, TX, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.447-55 (Aug. 1983).
Morphological and structural changes have been observed in various cochlear elements following exposure to intense sounds. Whether these changes are sufficient to locally alter the mechanical properties of the cochlear partition is unknown. Here a psychophysical test for mechanical changes in the partition is developed and applied. Monaural exposures to an intense 1700-Hz tone were preceded and followed by a binaural task in which the subject adjusted the interaural time difference of a 250-Hz tone in order to perceive it as centered inside his head. If the local gradients of mass, stiffness, and/or coupling were altered by the exposure, then the post-exposure settings should contain a time lead toward one ear or the other, depending upon the direction of the mechanical changes. Following exposure to an intense tone, the maximum temporary threshold shift (TTS) is often displaced upward in frequency from the exposure stimulus—an effect widely known as the half-octave shift in TTS. Time leads toward the nonexposed ear in the post-exposure centering task would be in accord with a mechanical-change explanation of the half-octave shift. Settings in this direction were observed with the most intense and longest durations of exposure used, but with less intense or shorter exposures, the post-exposure settings were initially toward the exposed ear. Thus, the psychophysical evidence reported here supports the idea that exposure to intense sounds does produce temporary, local changes in cochlear mechanics, but if fails to provide a simple confirmation of the possibility that these mechanical changes underlie the half-octave shift in TTS. (39 refs.)

103872 Effects of auditory fatigue on speech intelligibility and lexical decision in noise. C.Sorin, C.Thouin-Daniel (CNET, Lannion, France).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.456-66 (Aug. 1983).
The influence of weak auditory fatigue on speech identification and lexical decision (word/nonword) was studied. It appears that, at a low listening level and in presence of a strong masking noise, auditory fatigue gives rise to: (1) a decrease in identification scores, (2) more frequent confusions for fricatives, (3) a reduction in correct lexical decision scores, (4) an increase in the tendency to respond 'word' more often than 'nonword', (5) a slight increase in reaction times for incorrectly repeated items. The intelligibility impairment can be attributed to a combination of masking and fatigue effects. Errors in lexical decisions and changes in response times are explained by an adaptation of the lexical decision processes to the degraded perceptual representation of the stimuli. There is no clear evidence in this experiment that a very central component of auditory fatigue influences lexical decisions. (40 refs.)

103873 Gap detection as a function of frequency, bandwidth, and level. M.J.Shailer, B.C.J.Moore (Dept. of Experimental Psychology, Univ. of Cambridge, Cambridge, England).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.467-73 (Aug. 1983).
The threshold for detection of a temporal gap in a noiseband was measured. A notched noise masker was used to restrict listening to a limited spectral region. Threshold was measured as a function of center frequency, bandwidth, and level. For a signal bandwidth of one-half the center frequency, the gap threshold decreased from 22.5 ms for a center frequency of 0.2 kHz to 3.2 ms at 8.0 kHz: a wideband condition provided an estimate of 2.3 ms, a value in agreement with previously published estimates. Bandwidth manipulation showed that the variation with frequency was not due to changes in absolute bandwidth alone. The effect of changes in level was determined at three frequencies, 0.4, 1.0, and 6.5 kHz, using a signal bandwidth of half the center frequency. At all frequencies gap threshold decreased as the signal spectrum level was raised from 10 to 25 dB, but a further increase to 40 dB showed no additional improvement. At frequencies up to about 1.0 kHz, the variation of gap threshold with frequency matches well the reciprocal of the bandwidth of the auditory filter, as determined from masking experiments using a notched-noise masker. This suggests that the temporal response of the auditory filter may limit gap detection at low frequencies. (26 refs.)

103874 Effects of perilymph viscosity on low-frequency intracochlear pressures and the cochlear input impedance of the cat. S.Koshigoe, Wai-Kwong Kwok, A.Tubis (Dept. of Phys., Purdue Univ., West Lafayette, IN, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.486-92 (Aug. 1983).
Cochlear model calculations are shown to be in reasonable agreement with recent low-frequency measurements of intracochlear pressures and the cochlear input impedance of the cat [V. Nedzelnitsky, ibid., vol.68, p.1676-1689 (1980); T.J. Lynch, III, V. Nedzelnitsky, and W.T. Peake, ibid., vol.72, p.108-130 (1982)]. Included in the cochlear model are perilymph viscosity, the measured variation of the area of the scala vestibuli with distance from the stapes [P. Dallos, ibid., vol.48, p.489-499 (1970)], and finite impedance of the round window membrane. The WKB approximation and its extension to the low-frequency region is used in order to exhibit explicitly the dependence of the model results on the cochlear parameters. (35 refs.)

103875 The transmission of signals by auditory-nerve fiber discharge patterns. D.H.Johnson, Ananthram Swami (Dept. of Electrical Engng., Rice Univ., Houston, TX, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.493-501 (Aug. 1983).
Recent developments in the theory of point processes are used to analyze the accuracy by which signals are conveyed by the discharges of single auditory-nerve fibers. It is shown that the only spike trains which can convey a signal without distortion are those well-described by a Poisson process model. Theoretical predictions are made of the distortion present in the transmission of signals by auditory-nerve fiber discharge patterns. Absolute refractory effects are shown to result in more distortion than relative refractory ones. Procedures are developed to compensate for these distortions. The procedures designed to compensate for absolute refractory effects operate on the PST histogram. Computer simulations are used to confirm the theoretical predictions and to assess the accuracy of the compensation techniques. (23 refs.)

103876 Representation of stop consonants in the discharge patterns of auditory-nerve fibers. M.I.Miller, M.B.Sachs (Dept. of Biomedical Engng., Johns Hopkins Univ. School of Medicine, Baltimore, MD, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.504-17 (Aug. 1983).
The representation of the speech syllables /da/ and /ba/ in populations of auditory-nerve fibers was studied. Post-stimulus-time histograms were computed from 20-ms segments of fiber spike trains occurring in response to the stimulus. Discrete Fourier transforms with a resolution of 50 Hz were computed from each histogram. As a measure of the response of the population of fibers to each harmonic of the 50-Hz resolution frequency of the transform, the magnitude of the response to that frequency was averaged across all fibers whose characteristic frequencies were within one-fourth octave of that harmonic. The authors have previously called this measure the average localized synchronized rate (ALSR). Response profiles for the 20-ms segments of the stimulus was generated by plotting the ALSR versus frequency. Time-varying spectral features of the /da/ and /ba/ stimuli are well preserved by such profiles. For example, the onset spectrum and formant transition of the consonant-vowel syllable are well represented. Furthermore, the fine structure in the speech spectrum related to the pitch of the excitation source is maintained in these ALSR plots. Average discharge rate profiles were generated in a manner similar to that for the ALSR; in this case average rate replaces Fourier transform components as response measure. Such average rate profiles can represent the transitions of at least formants two and three. However, such average rate profiles do not represent the steady-state formants or the voice pitch. (43 refs.)

103877 Dichotic listening performance, language impairment, and lesion location in aphasic listeners. N.Niccum, A.B.Rubens, O.A.Selnes (Hennepin County Medical Center, Minneapolis, MN, USA).
J. Speech & Hear. Res. (USA), vol.26, no.1, p.42-9 (March 1983).
This investigation sought to identify relations between dichotic listening performance and both specific language functions and CT scan evidence of lesion location in order to determine whether the nature of these relations would support either 'dominance effect' or 'lesion effect' interpretations of the dichotic scores. Twenty-five aphasic patients completed the authors' digit dichotic listening test, the Boston Diagnostic Aphasia Examination (BDAE),

an experimental sentence comprehension test, and a digit immediate memory span test. Right ear scores (and the ear advantage) accurately reflected the integrity of the central auditory structures for all but one of the patients, and thus were interpreted as 'lesion effects.' These same right ear scores also were related more strongly to performance on phrase repetition subtests of the BDAE and to scores obtained on the authors' sentence comprehension test than to the other language measures analyzed. These relations were maintained even when general measures of auditory comprehension and immediate memory were held constant through the use of partial correlations. Both 'dominance' and 'lesion' effect interpretations were discussed, but the 'lesion effect' interpretation more adequately characterized the data. That is, the integrity of the posterior, superior temporal area seemed to be essential for perception of right ear stimuli on the digit dichotic test and for accurate performance on specific language tests. (20 refs.)

103878 Threshold inaccuracies in an elderly clinical population: ear canal collapse as a possible cause. L.J.Randolph, R.L.Schow (Idaho State Univ., Pocatello, ID, USA).
J. Speech & Hear. Res. (USA), vol.26, no.1, p.54-8 (March 1983).
In a sample of 80 persons in the 60-79-year age range, threshold shifts suggestive of collapsible ear canals were found in over one third of the subjects. A very conservative interpretation of the data suggests that at least 10-16% of these 60-79-year old elderly subjects have collapsible ear canals. Neither sex nor age was related significantly to prevalence. Results of this study indicate that in testing elderly persons there are threshold inaccuracies, relating possibly to collapsible ear canals, which, if not taken into account, may cause unacceptably large errors in both clinical and research applications. (21 refs.)

103879 The determination of tinnitus loudness considering the effects of recruitment. R.S.Tyler (Univ. of Iowa, Iowa City, IA, USA), D.Conrad-Armes.
J. Speech & Hear. Res. (USA), vol.26, no.1, p.59-72 (March 1983).
Reports an attempt to determine a meaningful measure of tinnitus loudness that considers loudness recruitment. Sixteen subjects with sensorineural tinnitus adjusted the level of a pure tone so that it was (a) at threshold, (b) equal in loudness to the tinnitus, and (c) uncomfortably loud. The pure-tone frequency was (a) at the frequency of the tinnitus pitch, and (b) at the octave frequency between 500 and 4000 Hz having the pure-tone threshold closest to 0 dB HL. In addition, the subjects adjusted the level of a broadband noise so that it (a) was at threshold, (b) just masked the tinnitus, and (c) was uncomfortably loud. These measurements were performed both in the ear ipsilateral and in the ear contralateral to the tinnitus. Formulae based on abnormal loudness functions and uncomfortable loudness levels are presented that convert equal-loudness matches in dB sensation level (SL) into loudness in sones. The level of broadband noise (in dB SL) required to mask tinnitus was about the same in the ipsilateral and in the contralateral ear for most of the subjects, regardless of the ear in which the tinnitus was localized. This noise level (in dB SL) required to mask the tinnitus correlated well with the level (in dB SL) of a tone at the most normal frequency judged equal in loudness to the tinnitus. (55 refs.)

103880 The annoyance of tinnitus and the noise required to mask it. M.J.Penner (Univ. of Maryland, College Park, MD, USA).
J. Speech & Hear. Res. (USA), vol.26, no.1, p.73-6 (March 1983).
For 11 patients with tinnitus and sensorineural hearing loss, the intensity of bilateral broad-band noise required to mask the tinnitus increased by as much as 41 dB over a 30-minute period. A significant correlation was obtained between the rate of change in the noise over time and reported annoyance of the tinnitus as measured on a 5-point rating scale. The total change in the noise level and the initial noise level required to mask the tinnitus were not significantly correlated with the annoyance of the tinnitus. (13 refs.)

103881 Audiologic correlates of hearing handicap in the elderly. B.E.Weinstein, I.M.Ventry (Teachers Coll., Columbia Univ., New York, NY, USA).
J. Speech & Hear. Res. (USA), vol.26, no.1, p.148-51 (March 1983).
This investigation was conducted to determine the relationship between self-assessed hearing handicap and audiometric measures in a large sample of noninstitutionalized elderly individuals. Eighty subjects underwent a complete audiological evaluation and responded to the Hearing Measurement Scale (HMS). Each of the correlations between measures of sensitivity and the HMS score was statistically significant. The speech discrimination scores showed a somewhat lower correlation with the HMS score than did pure-tone measures. The implications of these findings are discussed. (9 refs.)

103882 Iris pigmentation and AC thresholds. A.F.Roche, D.Mukherjee, Wm.C.Chumlea, R.M.Siervogel (Fels Res. Inst., Wright State Univ., Yellow Springs, OH, USA).
J. Speech & Hear. Res. (USA), vol.26, no.1, p.151-4 (March 1983).
Data from 160 white children were used to analyze possible associations between iris pigmentation and AC pure-tone thresholds. Iris pigmentation was graded from iris color using glass models of eyes, and AC thresholds were obtained under carefully controlled conditions. Analyses of variance using two groupings of iris color grades showed no evidence of an association between iris color grade and AC thresholds. Furthermore, inspection of arrays of the actual glass eye models, in conjunction with the order of mean thresholds at each test frequency, did not indicate the presence of an association between iris color grades and thresholds. It was conducted that while iris pigmentation may be related to some aspects of hearing ability, it does not appear to be related to AC thresholds in children. (23 refs.)

103883 Three models of temporal summation evaluated using normal-hearing and hearing-impaired subjects. G.M.Gerken, A.D.Gunnarson, C.M.Allen (Callier Center for Communication Disorders, Univ. of Texas, Dallas, TX, USA).
J. Speech & Hear. Res. (USA), vol.26, no.2, p.256-62 (June 1983).
Temporal summation effects were measured in normal-hearing and hearing-impaired subjects using stimuli of different durations and temporal patterns. Threshold decreased with increasing stimulus duration for either single- or multiple-burst stimuli, but the hearing-impaired group showed smaller threshold shifts, which differed from those obtained with the normal-hearing group at the .0001 level of significance. Three models of temporal summation were evaluated: One model employed a time constant in an exponential function, one used a power function characterized by an exponent, and the last combined the properties of the exponential and power functions and was also characterized by an exponent. Estimates of the parameters that best described the data were obtained for each model. Data from the hearing-impaired subjects provided the most critical test of the models. The power function model and the combined model were both satisfactory with the range of stimulus durations used, but the exponential model failed to describe the data from the hearing-impaired subjects. It is suggested that there may not be a decrease in the time constant for temporal summation for subjects with sensorineural hearing-loss, but that a factor related to the utilization of sensory input is altered. (24 refs.)

103884 Variability in matches to subjective tinnitus. M.J.Penner (Univ. of Maryland, College Park, MD, USA).
J. Speech & Hear. Res. (USA), vol.26, no.2, p.263-7 (June 1983).
For patients with noise-induced sensorineural hearing loss the results of matching a binaurally presented comparison tone to subjective tinnitus during a 20-day test period are reported. As a control, results of matching an external comparison tone to a standard tone are also presented. The variability for tinnitus measurements was extremely large relative to comparable measures for objective stimuli. The relevance of this finding to the nature of tinnitus and to the construction of tinnitus maskers is discussed. (20 refs.)

Stress and vowel duration effects on syllable recognition ....See Entry 100980

Contextual effects in the measurement of hearing-impaired speakers' intelligibility ....See Entry 103888

Perception of intonational contrasts in alaryngeal speech ...... See Entry 103892

Airflow characteristics of fricative consonants produced by normally hearing and hearing-impaired speakers ....See Entry 103894

Perceptual organization of speech sounds by infants .... See Entry 103900

Phonological correlates of middle-ear involvement in speech-delayed children: a methodological note ....See Entry 103901

Assessment of electromagnetic characteristics of the Willeford Central Auditory Processing Test Battery ....See Entry 103997

The cortical hearing aid ....See Entry 104118

Performance characteristics for hearing aid microphone versus telephone and telephone/telecoil reception modes ....See Entry 104124

SELAVCO: a method to deal with trial-to-trial variability of evoked potentials ....See Entry 104138

87.36 SPEECH

(see also 43.70 Speech communication)

103885 Physiological evidence for central modulation of voice tremor. G.F.Inbar, G.Eden (Dept. of Electrical Engng., Technion-Israel Inst. of Technol., Haifa, Israel).
Biol. Cybern. (Germany), vol.47, no.1, p.1-12 (1983).
This paper presents an attempt to define the physiological parameter used to describe 'voice tremor' in psychological stress evaluating machines, and to find its sources. This parameter was found to be a low frequency (5-20 Hz) random process which frequency modulates the vocal cord waveform and (independently) affects the frequency range of the third speech formant. The frequency variations in unstressed speakers were found to be the result of forced muscular undulations driven by central nervous signals and not of a passive resonant phenomenon. In this paper various physiological and clinical experiments which lead to the above conclusions are discussed. (17 refs.)

103886 Formant frequencies, bandwidths, and Qs in helium speech. E.O.Belcher (Appl. Phys. Lab., Univ. of Washington, Seattle, WA, USA), S.Hatlestad.
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.428-32 (Aug. 1983).
Uses linear prediction analysis to estimate a diver's vocal tract response for isolated vowels spoken in air at 1 atm and in heliox at simulated depths of 54-, 120-, 300-, and 500-m seawater. The authors specifically measured formant frequency, bandwidth, and Q changes as a function of environment. The formant frequencies shifted upward nonlinearity in helium speech. The formant bandwidths in helium speech increased as much as 14 times their corresponding bandwidths in normal speech. The ratios of formant Qs (helium speech to normal speech) ranges from 0.3 (low formants) to 2 (high formants). (12 refs.)

103887 Effects of physiological aging on selected acoustic characteristics of voice. L.A.Ramig (Univ. of Colorado, Boulder, CO, USA), R.L.Ringel.
J. Speech & Hear. Res. (USA), vol.26, no.1, p.22-30 (March 1983).
The relationship between age-related changes in body physiology and certain acoustic characteristics of voice was studied in a sample of 48 men representing three chronological age groupings (25-35, 45-55, and 65-75) and two levels of physical condition (good and poor). A fundamental frequency analysis program (SEARP) was used to measure mean fundamental frequency, jitter, shimmer, and phonation range from samples of connected speech and sustained vowel production. Subjects in good physical condition produced maximum duration vowel phonation with significantly less jitter and shimmer and had larger phonation ranges than did subjects of similar chronological ages who were in poor physical condition. These differences were most apparent in the productions of the elderly subjects. While chronological aging is undoubtedly a contributor to such changes in the acoustic characteristics of voice, these results suggest that age-related changes in body physiology, or physiological aging, also must be considered. (47 refs.)

103888 Contextual effects in the measurement of hearing-impaired speakers' intelligibility. R.W.Sitler, N.Schiavetti (State Univ. of New York, Geneseo, NY, USA), D.E.Metz.
J. Speech & Hear. Res. (USA), vol.26, no.1, p.30-5 (March 1983).
Previous research has indicated that hearing-impaired speakers' intelligibility scores are better when sentences are used than when word lists are used as speech materials in word indentification tests. The speech intelligibility of 20 hearing-impaired speakers was measured with word indentification tests using isolated words (W-22 monosyllables) and words in sentence context (CID sentences). Analysis of individual speakers' intelligibility data revealed that sentence intelligibility scores were higher than word intelligibility scores only for the better speakers and that no differences were apparent between sentence and single-word intelligibility for the poorer speakers. These findings agree with the results of research with normal speech degraded in intelligibility by noise or filtering and indicate that an interaction may exist between context and overall intelligibility in which only speech that has a certain degree of overall intelligibility may show further intelligibility improvement with increased contextual clues. (23 refs.)

103889 A cinefluorographic investigation of repeated fluent productations of stutterers in an adaption procedure. G.N.Zimmerman (Univ. of Iowa, Iowa City, IA, USA).
J. Speech & Hear. Res. (USA), vol.26, no.1, p.35-42 (March 1983).
Cinefluorography was used to study three stutterers and two nonstutterers repeating a passage made up of monosyllables. CVC target words of the form /caet/ were embedded in the passage and were analyzed to determine the effects of repeating the passage on velocities, displacements, and durations of movements of the tongue, jaw, and lower lip. Coordination among the articulators was also assessed. The investigation was undertaken to test the hypothesis that decreases in velocities and displacements, increased movement durations, and decreased latency between the onsets of jaw movements and of tongue tip movements would be associated with the repeated readings. The hypothesis was not supported by the results. A post hoc analysis showed that a decrease in the variability of instantaneous velocities (and by inference a

decrease in variation in muscle stiffness) was associated with practice for the three stutterers but not for the nonstutterers. Inferences about the adaptation effect are made related (a) to the stabilization of tonic muscle activity which may be associated with a decrease in arousal, and (b) to the effects of practice. (26 refs.)

103890 The influence of stress, position, and utterance length on the pressure characteristics of English /p/ and /b/. J.E.Flege (Univ. of Florida, Gainesville, FL, USA).
J. Speech & Hear. Res. (USA), vol.26, no.1, p.111-18 (March 1983).
This study examines pressure characteristics of /p/ and/b/ as a function of position with regard to stress and position within the utterance. Eight female talkers produced utterances which varied in length from one to five disyllables ([pape] or [babe]). Results demonstrate the importance of utterance position for the magnitude of supraglottal pressure in stops. Except in voiceless stops found in the first words of utterances, pressure was greater in the prestressed than in the poststressed position. The pressure difference distinguishing /p/ and /b/ was reduced considerably when these stops occurred in absolute utterance-initial position. A post hoc analysis revealed that pressured increased much more slowly in initial than in noninitial stops and that /p/ and /b/ were not distinguished by the rate at which supraglottal pressure increased when these stops occurred in utterance-initial position. Finally, it was found that the pressure of stops in the first words of utterances increased as a function of utterance length, suggesting preplanning for sentence production at the respiratory level. (34 refs.)

103891 A 3-year longitudinal study of school-aged children's fundamental frequencies. S.Bennett (Univ. of Maryland, College Park, MD, USA).
J. Speech & Hear. Res. (USA), vol.26, no.1, p.137-42 (March 1983).
Describes the longitudinal changes that took place in the average fundamental frequencies (f_0) of 25 boys and girls over a 3-year period ($\bar{x}$ age range=8:2-11:2). Results showed that developmental changes in the central tendency of f_0 can be detected over a 1-year period. For the group, the amount of decrease per 12-month interval averaged about 12 Hz, with a standard deviation of about 8 Hz. Cross-sectional observations of 7-11-year-old children's fundamental frequency characteristics do not reflect accurately the development course of f_0, in large part because the between-subject standard deviations are larger than the age-related changes that occur in children's voices at this stage of development. (22 refs.)

103892 Perception of intonational contrasts in alaryngeal speech. J.Gandour, B.Weinberg (Purdue Univ., West Lafayette, IN, USA).
J. Speech & Hear. Res. (USA), vol.26, no.1, p.142-8 (March 1983).
The achievement of intonational contrasts by 4 normal and 16 laryngectomized speakers was assessed. The laryngectomized subjects represented four clinical subgroups of alaryngeal speech: esophageal, tracheoesophageal, Western Electric #5 electrolarynx, and Servox electrolarynx. High-quality tape recordings of each subject's productions of two pairs of sentences (Bev loves Bob) spoken in statement and question form were presented to 40 listeners for evaluation using a two-interval-alternative-forced-choice procedure. Intonational contrasts were achieved in a highly effective manner by the normal, esophageal, and tracheoesophageal speakers. In contrast, users of electronic artificial larynges were generally unable to achieve these intonational distinctions except for one user of the Western Electric #5 electrolarynx Western Electric no.5 electrolarynx;. (21 refs.)

103893 Linguistic processing and reaction time differences in stutterers and nonstutterers. C.R.Hand, W.O.Haynes (Auburn Univ., Auburn, AL, USA).
J. Speech & Hear. Res. (USA), vol.26, no.2, p.181-5 (June 1983).
Linguistic processing by the left and right cerebral hemispheres was investigated in 10 adult male stutterers and 10 matched nonstutterers. Subjects performed a lexical decision task in which nonword and real-word stimuli were presented tachistoscopically to the right and left visual hemifields. Vocal and manual reaction times to real words were measured to assess hemispheric participation in processing linguistic information and to determine differences between response modes. The stuttering group exhibited a left visual field efficiency or right hemisphere preference for this task and were slower in both vocal and manual reaction times. Ramifications for hemispheric processing theories and laryngeal dysfunction hypotheses are discussed. (30 refs.)

103894 Airflow characteristics of fricative consonants produced by normally hearing and hearing-impaired speakers. R.L.Whitehead, S.M.Barefoot (Nat. Tech. Inst. for the Deaf, Rochester Inst. of Technol., Rochester, NY, USA).
J. Speech & Hear. Res. (USA), vol.26, no.2, p.185-94 (June 1983).
The rates of airflow were investigated for fricative consonants produced by normally hearing speakers and by hearing-impaired speakers who varied in degree of hearing loss and speech intelligibility. Subjects consisted of 20 normally hearing adults (10 men and 10 women), 20 moderately-to-severely hearing-impaired adults with intelligible speech (10 men and 10 women), and 20 profoundly hearing-impaired adults with semi-intelligible speech (10 men and 10 women). Average airflow rates were obtained for the fricatives /s/, /z/, /f/, and /v/ in CV and VCV syllables. In general, it was found that normally hearing, intelligible hearing-impaired, and some semi-intelligible hearing-impaired speakers produced voiceless fricatives with substantially greater airflow rates than they produced voiced cognates. The data also revealed that both male and female semi-intelligible hearing-impaired speakers produced fricatives in the CV context with greater amounts of airflow and fricatives in the VCV environment with less airflow than did the normally hearing and intelligible hearing-impaired speakers. Further, the male and female semi-intelligible hearing-impaired speakers failed to demonstrate the trend, as exhibited by the other speakers, for lingua-alveolar fricatives to be produced with greater air flow than the labiodental fricatives. The data from this investigation provide additional evidence to support the assumption that some hearing-impaired speakers fail to control and coordinate the biomechanical aspects of speech properly. (31 refs.)

103895 Airflow characteristics of stop-plosive consonant productions of normal-speaking children. R.W.Trullinger (VA Medical Center, Augusta, GA, USA), F.W.Emanuel.
J. Speech & Hear. Res. (USA), vol.26, no.2, p.202-8 (June 1983).
This study of children's speech was designed to investigate peak oral-nasal airflow during the production of stop-plosive consonants in isolated syllable contexts. The subjects were 30 normal-speaking children: five girls and five boys at each of three age levels (8, 9, and 10 years). Each subject produced each of six stop-plosive consonants (/p/, /b/, /t/, /d/, /k/, and /g/) in each of three syllable contexts (CV, VCV, and VC) with each of two vowels (/i/ and /a/). A pneumotachometer and an oscillographic recorder were used to obtain permanent airflow records of the test syllables. It was found that the peak flows varied according to the age of subjects, consonant voicing, place of consonant production, consonant position within the test syllable, and the vowel in combination with the test consonant. Results were compared to related findings previously obtained for children and adults. (19 refs.)

103896 The effects of varying lower-lip displacement on upper-lip movements: implications for the coordination of speech movements. J.W.Folkins, R.N.Linville (Univ. of Iowa, Iowa City, IA, USA).
J. Speech & Hear. Res. (USA), vol.26, no.2, p.209-17 (June 1983).
Upper-lip and lower-lip movements were transduced in the inferior-superior dimension in five normal-speaking subjects during four tasks. In task 1 visual feedback was used to manipulate the maximum displacement of the lower lip during speech. The upper lip elevated significantly less for the opening gesture when the amount of opening from the lower lip was increased. The upper lip moved to significantly lower positions for bilabial closure when the distance to be moved by the lower lip was increased. In task 2 the same procedures were followed with a bite block between the teeth. The bite block did not significantly change the interactions between lips for the opening gesture. The interactions were larger for bilabial closure with the bite block. In task 3 different vowels instead of visual feedback were used to manipulate lower-lip displacement. The relations between lips were similar to those found in task 1. In task 4 it was shown that these relations between lips are not found in nonspeech lower-lip movements. The interactions between lips are discussed in relation to models of speech motor control, including spatial targets, mass-spring systems, and planned trajectories. (33 refs.)

103897 'Compensatory articulation' under conditions of reduced afferent information: a dynamic formulation. J.A.S.Kelso (Haskins Labs., New Haven, CT, USA), B.Tuller.
J. Speech & Hear. Res. (USA), vol.26, no.2, p.217-24 (June 1983).
A well-established feature of speech production is that talkers, faced with either anticipated or unanticipated perturbations, can spontaneously adjust the movement patterns of articulators such that the acoustic output remains relatively undistorted. Less clear is the nature of the underlying processes involved. The authors examined five subjects' productions of the point vowels /i, a, u/ in isolation and of the same vowels embedded in a dynamic speech context under normal conditions and under a combined condition, in which (a) the mandible was fixed by means of a bite block; (b) proprioceptive information was reduced through bilateral anesthetization of the temporomandibular joint; (c) tactile information from the oral mucosa was reduced by application of a topical anesthetic; and (d) auditory information was masked by white noise. Minimal distortion of the formant patterns was found in the combined condition. These findings are unfavourable for central (e.g. predictive simulation) or peripheral closed-loop models, both of which require reliable peripheral information; they are more in line with recent work suggesting that movement goals may be achieved by muscle collectives that behave in a way that is qualitatively similar to a nonlinear vibratory system. (45 refs.)

103898 Spectrographic analysis of vowel and word duration in apraxia of speech. M.Collins, J.C.Rosenbek (Wm. S. Middleton Memorial VA Hospital, Madison, WI, USA), R.T.Wertz.
J. Speech & Hear. Res. (USA), vol.26, no.2, p.224-40 (June 1983).
Most normal speakers of English reduce the duration of the stem word vowel as words increase in length. Theoretically, this durational reduction reflects low-level linguistic knowledge. The authors posed two questions in this study: First, do speakers with apraxia of speech progressively reduce vowel durations as words increase in length, and, second, do these vowel and word durations differ significantly from normal productions? The authors asked 11 apraxia of speech patients and 11 normal speakers to repeat three sets of three words which progressively increased in length, and they analyzed these productions spectrographically. The results revealed that both groups reduced vowel duration as words increased in length. Word and vowel duration for apraxia of speech patients, however, were often significantly longer than those for normal speakers. The results suggest that vowel reduction is a robust phenomenon which resists impairment in apraxia of speech, despite often significant disturbances in motor programming. (22 refs.)

103899 Acoustic patterns of apraxia of speech. R.D.Kent (Boys Town Inst., Omaha, NE, USA), J.C.Rosenbek.
J. Speech & Hear. Res. (USA), vol.26, no.2, p.231-48 (June 1983).
Apraxia of speech (or verbal apraxia) is a controversial disorder, considered by some to be an impairment of the motor programming of speech. Because the disorder is characterized by 'higher order' errors such as metathesis and segment addition as well as by errors of apparent dyscoordination of articulation, it seems to reflect a relatively high level of damage to the nervous system. This report presents acoustic descriptions of the speech of seven persons diagnosed as having apraxia of speech but without severe aphasic impairment, especially agrammatism. The acoustic results indicate a variety of segmental and prosodic abnormalities, including slow speaking rate with prolongations of transitions, steady states, and intersyllable pauses; reduced intensity variation across syllables; slow and inaccurate movements of the articulators; incoordination of voicing with other articulations; initiation difficulties; and errors of selection or sequencing of segments. These error patterns are discussed with respect to a theory of motor control based on spatial-temporal schemata. In addition, consideration is given to the controversy about phonologic versus motor programming impairment in apraxia of speech. (53 refs.)

103900 Perceptual organization of speech sounds by infants. J.Hillenbrand (Northwestern Univ., Evanston, IL, USA).
J. Speech & Hear. Res. (USA), vol.26, no.2, p.268-81 (June 1983).
An operant head-turn procedure was used to test whether 6-month-old infants recognize the auditory similarity of speech sounds sharing a value on a phonetic-feature dimension. One group of infants was reinforced for head turns when a change occurred from a series of repeating background stimuli containing nasal consonants ([m, n, η]) to repetitions from a category of syllables containing voiced stop consonants ([b, d, g]), or to a change from stops to nasals. The stimuli were naturally produced by both male and female talkers. The performance of infants in this 'phonetic' group was compared to that of infants in a 'nonphonetic' control group. Using the same procedures, these infants were reinforced for head turns to a group of phonetically unrelated speech sounds. Results indicated that the performance of infants in the group trained on phonetically related speech sounds was far superior to that of infants in the nonphonetic control group. These findings suggest that prelinguistic infants can perceptually organize speech sounds on the basis of auditory properties related to feature similarity. (36 refs.)

103901 Phonological correlates of middle-ear involvement in speech-delayed children: a methodological note. L.D.Shriberg, A.J.Smith (Univ. of Wisconsin-Madison, Madison, WI, USA).
J. Speech & Hear. Res. (USA), vol.26, no.2, p.293-7 (June 1983).
The purpose of this note is to illustrate the potential contribution of phonological analysis to the study of the origins of developmental phonological disorders (delayed speech). Speech samples from two clinical populations of children with delayed speech were inspected. Within each group, children were subdivided on the basis of case records data on their histories of middle-ear involvement. In both clinical samples, children with positive histories of middle-ear involvement had statistically higher frequencies of occurrence of two sound change categories. Several analyses of one of the sound change cate-

gories were undertaken to determine whether these errors could be related to current deficits in underlying forms, to phonetic output constraints, or to perceptual-acoustic characteristics of the sounds involved. (18 refs.)

103902 Formant frequency fluctuation as an index of motor steadiness in the vocal tract. B.R.Gerratt (VA Medical Center, West Los Angeles, CA, USA).
J. Speech & Hear. Res. (USA), vol.26, no.2, p.297-304 (June 1983).
Involuntary movement of the articulatory structures can interfere with the accurate placement of the articulators during consonant production and may also result in distortion of vowel quality. An acoustic method was used to assess motor steadiness in the vocal tract musculature superior to the glottis during vowel production by five subjects with abnormal involuntary orofacial movements associated with tardive dyskinesia and 10 normal subjects. A linear predictive coding technique of spectral analysis yielded formant frequencies from the sustained productions of /a/. Based on the premise that changes in vocal tract configuration can be measured as changes in formant frequency, the sequential segment-to-segment fluctuations of the second formant frequency of these vowel samples were computed and used as an index of motor steadiness. Results showed that formant frequency fluctuation measures for four of the five tardive dyskinetic patients were substantially larger than those of the normal subjects, indicating a reduction of motor steadiness in these four subjects. Factors influencing the validity of this procedure and implications for its use are discussed. (16 refs.)

The relationship between the RMS level and the average absolute magnitude of long-time continuous speech .... See Entry 100981

Acoustical effects of vertical vibrations of the vocal folds .... See Entry 100982

Visual evoked-response correlates of speechreading performance in normal-hearing adults: a replication and factor analytic extension .... See Entry 103850

Perceptual prominence of harmonic components in vowel-like sounds .... See Entry 103860

Vowel identification and dichotic fusion of time-varying synthetic speech sounds .... See Entry 103861

Dichotic listening performance, language impairment, and lesion location in aphasic listeners .... See Entry 103877

Assessment of electromagnetic characteristics of the Willeford Central Auditory Processing Test Battery .... See Entry 103997

A noninvasive acoustic method using frequency perturbations and computer-generated vocal-tract shapes .... See Entry 103998

A new head-mounted lip-jaw movement transduction system for the study of motor speech disorders .... See Entry 104094

Analysis and synthesis of bird vocalizations: an FFT-based software system .... See Entry 104131

The accuracy of formant frequency measurements: a comparison of spectrographic analysis and linear prediction .... See Entry 104140

Effects of practice and instructional set on the measurement of lingual vibrotactile thresholds .... See Entry 104141

87.38 MECHANO- AND CHEMIO-CEPTIONS

(inc. biosonic generation, detection and guidance)

103903 Behavior of a single neuron in a recurrent excitatory loop. O.Diez Martinez, J.P.Segundo (Dept. of Anatomy & Brain Res. Inst., Univ. of California, Los Angeles, CA, USA).
Biol. Cybern. (Germany), vol.47, no.1, p.33-41 (1983).
This paper examines the practical possibility and the consequences of recurrent excitation, or positive feedback, on the impulse discharge of a single nerve cell. The latter was the neuron in the slowly-adapting crustacean stretch-receptor organ: each of its action potentials triggered an excitatory sensory stimulus via an external artificial electronic circuit. (27 refs.)

103904 Origins of short latency somatosensory evoked potentials to median nerve stimulation. T.Nakanishi, M.Tamaki, Y.Ozaki, K.Arasaki (Dept. of Neurology, Univ. of Tsukuba, Ibaraki-Ken, Japan).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.1, p.74-85 (July 1983).
Short latency SEPs recorded in hand-scalp, ear-scalp and upper neck-scalp leads with stimulation of the median nerve were examined in 27 normal subjects and in 11 selected patients with unilateral complete loss of position sense in order to provide information concerning the generator sources of these potentials. Evidences obtained from both normal subjects and patients suggest the following origins for these short latency SEPs. In hand reference recording, P_1 may arise in the brachial plexus just beneath the clavicle, P_2 in the cervical dorsal column, P_3 mainly in the caudal brain stem, and P_4 primarily in the brain stem lemniscal pathways and partly in the thalamus. The initial negative potential recorded in upper neck-scalp leads may originate largely in the cervical dorsal columns. The early positive potential recorded in ear-scalp leads may reflect activity mainly in the brain stem lemniscal pathways and partly in the thalamus. The initial negative component of the cortical SEPs (N1) may arise in the thalamus, and the subsequent positive component (P1) may reflect activity in the primary somatosensory cortex. (26 refs.)

103905 Vibrotactile forward masking: evidence for channel independence. G.A.Gescheider, M.J.O'Malley (Dept. of Psychology, Hamilton Coll., Clinton, NY, USA), R.T.Verrillo.
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.474-85 (Aug. 1983).
Threshold shifts for the decision of vibrotactile test stimuli were determined as a function of the intensity of a masker. A 50-ms sinusoidal test stimulus was applied to the thenar eminence of the hand 25 ms after the termination of a 700-ms sinusoidal masker applied to the same site. The intensity of the masker was varied over a range of 0-44 dB SL. The frequency of the masker was either 15 or 250 Hz and the frequency of the test stimulus was either 15, 25, 100 or 250 Hz. The results support the hypothesis that the detection of vibrotactile stimuli is mediated by at least two receptor systems which do not mask each other. (33 refs.)

103906 Regenerative impulses in taste cells. S.Roper (Dept. of Anatomy & Physiology, Univ. of Colorado Medical School, Denver, CO, USA).
Science (USA), vol.220, no.4603, p.1311-12 (17 June 1983).
Taste cells and nongustatory epithelial cells in the isolated lingual mucosa from the mud puppy Necturus maculosus were impaled with microelectrodes. The taste cells, but not surrounding epithelial cells, were electrically excitable when directly stimulated with current passed through the recording electrode. Action potentials produced by taste cells had both a sodium and a calcium component. (17 refs.)

103907 Reversible loss of gravitropic sensitivity in maize roots after tip application of calcium chelators. J.S.Lee, T.J.Mulkey, M.L.Evans (Dept. of Botany, Ohio State Univ., Columbus, OH, USA).
Science (USA), vol.220, no.4604, p.1375-6 (24 June 1983).
The application of calcium chelating agents (EDTA or EGTA) to the tips of maize roots caused a loss of gravitropic sensitivity. When the chelator was replaced with calcium chloride, gravitropic sensitivity was restored. Asymmetric application of calcium chloride near the tip of a vertical root caused curvature toward the calcium source. When the calcium was applied to the upper surface of the tip of a root oriented horizontally, the root curved upward even though control roots exhibited strong downward curvature. Application of calcium chloride to the tips of decapped roots, which are known to be gravitropically insensitive, did not restore gravitropic sensitivity. However, asymmetric application of calcium chloride near the tips of decapped roots caused curvature toward the calcium source. Calcium may play a key role in linking gravity detection to gravitropic curvature in roots. (14 refs.)

Diffusion and the physics of chemoreception .... See Entry 103825

Brain stem auditory, pattern-reversal visual, and short-latency somatosensory evoked potentials: latencies in relation to age, sex, and brain and body size .... See Entry 103863

Discrimination of systolic blood pressure .... See Entry 103914

Graviperception, mitotic activity and cell differentiation in lentil seedling roots .... See Entry 104085

Elimination of EMG interference during recording of somatosensory evoked potentials elicited by posterior tibial nerve stimulation in patients with cervical spinal cord injury .... See Entry 104091

Recent developments in aids for profoundly deaf children .... See Entry 104126

Peripheral nerve fiber group separation in evoked potential research using cooling and polarization .... See Entry 104136

Effects of practice and instructional set on the measurement of lingual vibrotactile thresholds .... See Entry 104141

87.40 BIOMAGNETISM

(inc. magnetocardiography)

103908 Possible adaptation to strong magnetic fields. Z.N.Nakhilnitskaya, L.D.Klimovskaya, Z.F.Kuzmina, V.N.Mastryukova, N.P.Smirnova, A.D.Strzhizhovsky, G.V.Cherkasov (Inst. of Biomedical Problems, Min. of Health, Moscow, USSR).
Acta Astronaut. (GB), vol.10, no.3, p.159-61 (March 1983).
Animal adaptation to a strong magnetic field was investigated. Mice were exposed to 30-day total-body continuous effects of a constant magnetic field (CMF) of 1.6 T, and their physiological responses were assessed. Analysis of the data obtained showed that different parameters varied in a dissimilar manner. Red blood changes returned to normal in the course of the experiment. Leucocytosis and increased content of catecholamines and corticosterone of blood and adrenals persisted throughout the exposure. Changes in the spermatogenic epithelium were most distinct after the exposure. The recovery of certain parameters during the CMF exposures is indicative of adaptation of some physiological systems. The adaptation is, however, incomplete as suggested by the long persisting stress manifestation. Reticulocytopenia and spermatogenetic abnormalities found after the exposure are of particular importance. (5 refs.)

103909 Demonstration of useful differences between magnetoencephalogram and electroencephalogram. D.Cohen, B.N.Cuffin (Francis Bitter Nat. Magnet Lab., MIT, Cambridge, MA, USA).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.1, p.38-51 (July 1983).
An experimental comparison is made between MEG and EEG maps due to a neural source which appears to behave as a dipole (N20 of the somatic evoked response). The same three differences as predicted theoretically are seen, therefore the predicted differences are confirmed experimentally. The first two differences, due only to the tangential component of the dipole, are that the MEG pattern is rotated by 90° from the EEG pattern and is one-third tighter. The first allows the MEG to localize a tangential dipole better in a preferred direction, across the dipole (while the EEG does so along the dipole); the second allows the MEG to localize somewhat better in its preferred direction than the EEG does in its preferred direction. The third difference is due only to the radial component of the dipole; while the MEG receives no contribution from this component, the EEG pattern is asymmetrical and is heavily weighted by it. This allows the MEG to reveal tangential sources which are obscured by the radial sources in the EEG. (20 refs.)

Study of charge separation at the reaction centres of photosystem II of higher plants by magnetic modulation of fluorescence .... See Entry 103807

Influence of alternating magnetic field on the bactericidal effect of ionizing radiation .... See Entry 103938

Paramagnetic centers in tissues of γ-irradiated rats treated with hormones .... See Entry 103957

SQUID biomagnetic measurements .... See Entry 104010

Reconstructing NMR images from projections under inhomogeneous magnetic field and nonlinear field gradients .... See Entry 104022

In vivo one-dimensional imaging of phosphorus metabolites by phosphorus-31 nuclear magnetic resonance .... See Entry 104149

87.45 BIOMECHANICS, BIORHEOLOGY, BIOLOGICAL FLUID DYNAMICS

103910 Effect of the time of the day on left ventricular systole and diastole dynamics. K.Markiewicz, M.Cholewa, J.Bechler (First Dept. of Internal Diseases, Inst. of Internal Medicine, Military School of Medicine, Lodz, Poland).
Acta Physiol. Pol. (Poland), vol.33, no.5-6, p.551-8 (Sept.-Dec. 1982).
Synchronous recording of ECG from the second lead, phonocardiograph from the Erb's point and right carotid sphygmogram was performed in 20 healthy men aged 20 to 25 years four times during a 24-hour period: at 9 am, at 4 pm, at 2 am after awakening, and at 2 am during all-night activity. The polycardiograms obtained were analysed by the method of Weissler calculating the measured and corrected left ventricular contraction periods. An increase was observed in the dependence of the diastole time (D), total electromechanical contraction time (QS_2) and the left ventricular ejection time (LVET) on the heart rate in the night hours. Moreover, the functional reserve of the heart increased during the night as demonstrated by prolongation of the D time and decrease of QS_2 in the heart cycle (R-R). It was found also

that during the night hours the LVET and QS_2 values and the pre-ejection period were significantly greater independently of the degree of activity than in the morning and afternoon ($p<0.05$). (20 refs.)

103911 Elasticity of the foot on modelling human movements. A.V.Zinkovskii, V.A.Chistyakov (Lenigrad Polytech. Inst., Leningrad, USSR).
Biophysics (GB), vol.27, no.4, p.745-9 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.4, p.711-14 (1982).
An anthropomorphic model is designed taking into account the elasticity of the foot in human movements. The foot in the model is represented in the form of an elastic rod. The computer-synthesized movements of the model are in good imitation of human movements in performing a jump. (9 refs.)

103912 Regulation of human balance on a small bearing surface. Ye.T.Petrenko (Kazakh Inst. of Phys. Culture, Alma Ata, USSR).
Biophysics (GB), vol.27, no.4, p.772-4 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.4, p.734-5 (1982).
The investigation reported was on 15 gymnasts, Masters of Sport. The subjects maintained their balance by standing on one leg of the full foot (bearing surface 170-190 cm^2) and on tiptoes (bearing surface 28-32 cm^2). During exercises the author recorded stabilograms, micro-displacements of the centre of gravity (CG) of the body, electrogoniograms of the angular displacements in the ankle and knee joints and electromyograms (EMG) of the muscles of the shin of the support leg. The results indicate intensification of the processes of regulation of balance in extremal conditions. It may be assumed that the agreement of the peaks of the maximum of the frequency spectra of the fluctuations in CG, the goniograms and the EMGs reflects the processes of co-tuning of the system of execution to the optimal frequency of regulation. The maintenance of balance on tiptoe is possible only as a result of previous prolonged training. This indicates the prime importance of the central mechanisms of the control system in maintaining stability on small bearing surfaces. (4 refs.)

103913 Determination of femoral head containment during gait. G.T.Rab (Dept. of Orthopaedic Surgery, University of California, Davis, CA, USA).
Biomater. Med. Devices & Artif. Organs (USA), vol.11, no.1, p.31-8 (1983).
Using three-dimensional gait data, a mathematical model of the proximal femur was developed that will predict the loading conditions in the child's hip joint during walking. The model is based on knowledge of rim coordinates of the acetabulum, and consists of rotating unit vectors eminating from the center of the epiphysis. The results will be used in a variety of three-dimensional stress analyses of the femoral head in Legg-Perthes disease (a disorder of femoral head collapse). (4 refs.)

103914 Discrimination of systolic blood pressure. L.J.Vidergar (Wayne State Univ., Detroit, MI, USA), R.M.Lee, M.S.Goldman.
Biofeedback & Self-Regul. (USA), vol.8, no.1, p.45-61 (March 1983).
The ability of humans to discriminate systolic blood pressure (BP) was investigated in two experiments. In Experiment 1, 14 normal subjects were asked to make estimates of their systolic BP while performing both BP-elevating and BP-lowering tasks. They were given intermittent feedback throughout all 10 45-min sessions. Results indicated significant correlations and small absolute differences between estimated and measured BP for all subjects in almost all sessions. Experiment 2, undertaken 6 months after Experiment 1, assessed whether estimation accuracy by subjects who had available both external and interoceptive cues surpassed that of subjects which access to external cues only. Three subjects from the original group who showed consistently high motivation, and who improved in accuracy across the 10 sessions in the previous experiment, made estimates of BP while performing novel tasks with no feedback. Correlations between estimated and measured BP remained high for 2 of the 3. (15 refs.)

103915 Reduction of blood pressure by indirect biofeedback. J.R.Erbeck, L.F.Elfner, D.F.Driggs (Florida State Univ., Tallahasse, FL, USA).
Biofeedback & Self-Regul. (USA), vol.8, no.1, p.63-72 (March 1983).
Forty-five randomly assigned subjects served in either a relaxation control, an EMG plus thermal, or a thermal biofeedback group. All groups received the same relaxation manipulation. Experimental results demonstrated a significant drop in both diastolic and systolic blood pressure for the feedback treatment. Diastolic measures showed a somewhat greater decrease for the EMG plus thermal treatment condition. A learning effect was demonstrated both within and across the three experimental sessions. Given that the sample was normotensive, the 20% reduction in blood pressure was notable. The results support the idea that blood pressure biofeedback is not a necessary condition for reduction of arterial blood pressure. (12 refs.)

103916 Mechanical properties of banana fibres (Musa sepientum). A.G.Kulkarni, K.G.Satyanarayana, P.K.Rohatgi (Regional Res. Lab., CSIR, Kerala, India), K.Vijayan.
J. Mater. Sci. (GB), vol.18, no.8, p.2290-6 (Aug. 1983).
The stress-strain curve for banana fibre is determined. Properties such as the initial modulus (YM), ultimate tensile strength (UTS) and percentage elongation are evaluated as a function of fibre diameter, test length and speed of testing. It is found that YM, UTS and % elongation show little variation in their values for fibres of diameter ranging from 50 to 250 μm. The UTS and breaking strain are found to decrease with an increase in the test length while both breaking strength and breaking strain remain constant with the increase of speed of testing from 0.5 to 100×10^{-3} m and thereafter they both decrease. These observed properties are explained on the basis of the internal structure of the fibre, namely, the number of cells, spiral angle and the number of defects. Scanning electron microscopic (SEM) studies of the frcatured surfaces of these fibres indiacte that the failure is due to pull-out of microfibrils accompanied by tearing of cell walls; the tendency for fibre pull-out seems to decrease with increasing speed of testing. (15 refs.)

103917 The dynamic mechanical properties of human skin in vivo. R.O.Potts, D.A.Chrisman,Jr., E.M.Buras,Jr. (Gillette Res. Inst., Rockville, MD, USA).
J. Biomech. (GB), vol.16, no.6, p.365-72 (1983).
The propagation and attenuation of shear waves in human skin is investigated over a frequency range of near zero to 1000 Hz. The results show that at frequencies below a few hundred Hz, shear waves propagate along the skin surface and thus provide information on the dynamic mechanical properties of the stratum corneum. The surface waves, however, are rapidly attenuated with increasing frequency so that at frequencies above about 500 Hz the energy is propagated only as bulk shear waves. Thus, at high frequencies the properties measured are those of the dermis. (10 refs.)

103918 In vitro contact stress distributions in the natural human hip. T.D.Brown, D.T.Shaw (Dept. of Orthopaedic Surgery, Univ. of Pittsburgh, Pittsburgh, PA, USA).
J. Biomech. (GB), vol.16, no.6, p.373-84 (1983).
Time variant distributions of intra-articular contact stress were assembled from direct measurement in seventeen grossly normal fresh cadaveric hips. Local stresses were sensed by arrays of 24 compliant miniature transducers inset superficially in the femoral head cartilage. Local contact stress magnitude was usually found to rise nearly linearly with applied joint loads in excess of about 1000 N. The sites of maximum local stress were found to underlie the general region of the acetabular dome. For a resultant joint load of 2700 N, the spatial mean contact stress and peak local contact stress averaged 2.92 MN m^{-2} and 8.80 MN m^{-2}, respectively, for the 68 loading cycles analysed. The full contact stress patterns were irregular and complex, but most commonly the general feature was a central band or 'ridge' of pressure elevation, oriented in an approximately anterior-to-posterior direction. (32 refs.)

103919 A survey of finite element analysis in orthopedic biomechanics: the first decade. R.Huiskes (Lab. for Experimental Orthopedics, Univ. of Nijmegen, Nijmegen, Netherlands), E.Y.S.Chao.
J. Biomech. (GB), vol.16, no.6, p.385-409 (1983).
The finite element method (FEM), an advanced computer technique of structural stress analysis developed in engineering mechanics, was introduced to orthopedic biomechanics in 1972 to evaluate stresses in human bones. Since then, this method has been applied with increasing frequency for stress analyses of bones and bone-prosthesis structures, fracture fixation devices and various kinds of tissues other than bone. The aims of these investigations were to asses relationships between load carrying functions and morphology of the tissues, and to optimize designs and fixation techniques of implants. Although the amounts of significant findings and useful concepts generated by the FEM during the first decade of its application in this field were limited, many publications have served to illustrate its capabilities and limitations. The method is now well established as a tool for basic research and for design analysis in orthopedic biomechanics, and the number of publications in which it is used is increasing rapidly. In the meantime, following developments in engineering mechanics, the capabilities of the method are augmented which, together with an increasing sophistication of computers, guarantees exciting possibilities for the future. (12 refs.)

103920 Quantification of intersegmental reactions during rapid swing motion. S.J.Phillips (Dept. of Phys. Education, Univ. of Maryland, College Park, MD, USA), E.M.Roberts, T.C.Huang.
J. Biomech. (GB), vol.16, no.6, p.411-17 (1983).
A simple mathematical model was developed to quantify the nonmuscular reactions between two adjacent segments undergoing rapid free-segment motion. Newtonian equations of motion were used to simulate the trajectories of the two segments using the input parameters of linear acceleration and muscular moment acting only about the proximal end of the proximal link. The intersegmental muscular force and moment were mathematically considered to be zero, and no constraints were placed on the motion of the two segments. The motion of the thigh and shank during the swing phase of running was simulated by the model and compared to the real motion obtained from cinematographic records. The simulation demonstrated that proximal thigh motion has a significant effect on the distal shank motion. Depending on the initial conditions, intersegmental reactions alone can produce large increases in distal segment speed. The role of the knee musculature in preventing these reactions during the swing phase of running was inferred. (12 refs.)

103921 Tendon excursion and moment arm of index finger muscles. K.N.An, Y.Ueba, E.Y.Chao, W.P.Cooney, R.L.Linscheid (Dept. of Orthopedics, Mayo Clinic/Mayo Foundation, Rochester, MN, USA).
J. Biomech. (GB), vol.16, no.6, p.419-25 (1983).
Tendon excursions during rotation of individual index finger joints were recorded continuously throughout the joints' ranges of motion. Both intrinsic and extrinsic muscles were studied during flexion-extension and abduction-adduction functions. Excursions and joint-displacement relationships were observed to not always be linear. Moment arms of tendons with respect to joint centers were further derived from excursion data. The significance of this information to tendon transfer techniques is discussed. These data are also important for theoretical modeling in muscle force determination. (12 refs.)

103922 Mechanical analysis of the human pelvis and its application to the artificial hip joint—by means of the three dimensional finite element method. H.Oonishi (Dept. of Orthopedic Surgery & Artificial Joint Section, Osaka-Minami Nat. Hospital, Osaka, Japan), H.Isha, T.Hasegawa.
J. Biomech. (GB), vol.16, no.6, p.427-44 (1983).
Mechanical analysis of the human pelvis and the hip joint was performed by means of a three-dimensional finite element method by the ASKA program. Two models each standing on one leg were made, one was the pelvis with the physiological hip joint, in the other pelvis part of the cartilage and subchondral bone was replaced with Al_2O_3 ceramic materials. In this study, the authors obtained; (1) the various deformations and displacements of the whole pelvis, the pelvic ring and the acetabulum and (2) the principal stress, the maximum shear stress and the Von Mises stress on the surface of the whole pelvis and in various horizontal sections of the whole pelvis. (7 refs.)

103923 Mathematical modeling of the stress strain-strain rate behavior of bone using the Ramberg-Osgood equation. T.K.Hight (Dept. of Mech. Engng. & Materials Sci., Duke Univ., Durham, NC, USA), J.F.Brandeau.
J. Biomech. (GB), vol.16, no.6, p.445-50 (1983).
The Ramberg-Osgood equation is used to model the viscoplastic properties of compact bone. Because of the exponential nature of this equation a special optimization technique is used for curve fitting. Results are presented for the application of this equation to three sets of strain rate dependent stress-strain curves from the literature. Good to very good curve fits are achieved. This technique holds promise both as a relatively simple means of quantifying the viscoplastic nature of compact bone response and also as a mechanism for mathematically modeling that behavior. (11 refs.)

103924 Peristaltic transport of a solid bolus. A.Bertuzzi (Istituto di Analisi dei Sistemi ed Informatica, CNR, Roma, Italy), S.Salinari, R.Mancinelli, M.Pescatori.
J. Biomech. (GB), vol.16, no.7, p.459-64 (1983).
An analysis of the peristaltic propulsion of a solid spherical bolus enclosed in a contractile membrane is presented. The model is based on in vitro preparations of intestinal segments, and utilizes a simplified representation of the mechanical properties of the muscular coats of the wall. The sequence of deformed configurations of the membrane and the displacement of the bolus are obtained by numerical solution of the model equations. The analysis presented in this paper could be useful for other studies in biomechanics (e.g. uterine contraction and motion of red blood cells in narrow capillaries). (18 refs.)

103925 The influence of superficial tissue on response of the primate knee to traumatic posterior tibial drawer. R.C.Haut (Biomedical Sci. Dept., General Motors Res. Labs., Warren, MI, USA).
J. Biomech. (GB), vol.16, no.7, p.465-72 (1983).
The posterior cruciate ligament is the primary restraint against large posterior displacement of the tibia in the isolated knee joint. However, muscle tone and superificial tissue may contribute to stability of the knee at traumatic levels of posterior tibial drawer. The influence of these parameters on joint resis-

tance was studied for the knee flexed at 90°. Experiments were conducted on an anesthetized primate with resting and tensed extensor muscles. Experiments were also conducted on postmortem and isolated knee joints. The experiments show that anteriorly-oriented superficial tissue contributes significantly to the stiffness and strength of the knee. Contraction of extensor muscles can increase the strength of the flexed knee by more than 50%. In posterior drawer, data from the isolated knee joint provides a lower bound on the actual strength of the living knee. (8 refs.)

103926 Effect of pressurization on methylmethacrylate-bone interdigitation: an in vitro study of canine femora. M.M.Panjabi, V.K.Goel, H.Drinker, J.Wong, G.Kamire, S.D.Walter (Section of Orthopaedic Surgery, Yale Medical School, New Haven, CT, USA).
J. Biomech. (GB), vol.16, no.7, p.473-80 (1983).
Aseptic mechanical loosening of the femoral and acetabular components is a major long term complication of total hip arthroplasty. Pressurized injection of bone cement (polymethylmethacrylate) has been advocated for increasing cement-bone interlock. To determine the relationship between cement intrusion pressure and its penetration into cancellous bone, an in-vitro study of paired, fresh frozen canine femora was conducted. Methacrylate cement was injected at predefined constant pressures from 0.11 to 1.23 MPa (16-175 psi). The penetration was quantified for each injection pressure. The results showed a positive logarithmic relationship between the relative penetration and the intrusion pressure, the former reaching a near asymptotic value at approximately 0.70 MPa (100 psi). Unequal radial distribution of cement within the metaphysis was demonstrated. Greater penetration was observed into the proximal postero-lateral cancellous bone bed as compared to other regions. The relationship between cement penetration and bone size was explored at a single constant pressure of 0.35 MPa (50 psi). Although absolute cement penetration was found to be linearly related to the bone size, the relative penetration remained nearly constant with bone size. (19 refs.)

103927 Stress wave propagation in bone. R.R.Pelker (Section of Orthopaedic Surgery, Yale Univ. School of Medicine, New Haven, CT, USA), S.Saha.
J. Biomech. (GB), vol.16, no.7, p.481-9 (1983).
The traveling wave characteristics for a single compressive pulse were studied in fresh and embalmed human long bones. The stress wave was generated by the longitudinal impact of a steel ball on one end of a bone and was monitored by bonded strain gages. The dynamic properties, namely velocity, attenuation coefficient and dispersion were correlated with the mineral density, porosity, and cross-sectional area of the specimens. Statistically significant relationships were found between several of these parameters. These stress wave propagation characteristics are important for one's understanding of the dynamic loading of bone and they may also provide a basis for the development of noninvasive techniques for studies of diseased or fractured bone. (49 refs.)

103928 Strain measurement in the medial collateral ligament of the human knee: an autopsy study. S.Arms, J.Boyle, R.Johnson, M.Pope (Dept. of Orthopaedics & Rehabilitation, Univ. of Vermont, Burlington, VT, USA).
J. Biomech. (GB), vol.16, no.7, p.491-6 (1983).
A strain transducer was developed which employs a magnetic field sensing device to detect linear displacement. The transducer was attached to the medial collateral ligament (MCL) of human autopsy specimens, minimally influencing their physiologic behavior. A strain 'map' of the MCL as a function of knee flexion (full extension to 120°) both with and without abduction force was obtained. The investigation revealed consistent differences in the strain patterns between proximal, middle and distal segments of the anterior and posterior borders of the MCL. Anatomic variations in the pattern of collagen fibers within the MCL, interactions between posterior oblique capsular fibers and the MCL, and the skeletal configuration may account for these varied strain patterns. (13 refs.)

103929 Balancing a force on the fingertip of a two-dimensional finger model without intrinsic muscles. C.W.Spoor (Dept. of Anatomy & Embryology, Univ. of Leiden, Leiden, Netherlands).
J. Biomech. (GB), vol.16, no.7, p.497-504 (1983).
A slightly flexed human middle finger can balance an external force on the fingertip. Internal stabilization is also possible, which means that the externally unloaded finger can be kept stiff. The authors analyse whether in these situations the intrinsic hand muscles are needed. Distances from tendons to flexion axes, taken from the literature, are substituted in the moment equilibrium equations of a two-dimensional finger model. Diagrams illustrate the statically indeterminate problem of solving tendon forces. The possibilites for equilibrium without intrinsics appear to depend mainly on four tendon-to-joint distances. These distances determine to which of two groups a finger belongs: (1) one in which intrinsics are not necessary for internal stabilization nor for balancing a force on the fingertip in any direction in the sagittal plane; (2) one in which, without intrinsics, internal stabilization is impossible and only dorso-distally directed forces on the fingertip can be balanced. (11 refs.)

103930 Velocity measurements in steady flow through axisymmetric stenoses at moderate Reynolds number. S.A.Ahmed, D.P.Giddens (School of Aerospace Engng., Georgia Inst. of Technol., Atlanta, GA, USA).
J. Biomech. (GB), vol.16, no.7, p.505-16 (1983).
The velocity field in the neighborhood of axisymmetric constrictions in rigid tubes was investigated using laser Doppler anemometry and flow visualization. Upstream flow conditions were steady; and Reynolds number were in the range 500-2000, values which are representative of the larger arteries in humans. Stenoses of 25, 50 and 75% area reduction were studied. Velocity profiles are presented in sufficient detail to allow comparison with computational biofluid dynamics models. Wall shear stresses were estimated from the near wall velocity gradient, and the nature of observed poststenotic flow disturbances is discussed. Results indicate that flow disturbances of discrete oscillation frequency may be more valuable than turbulence as an indicator of early stages of stenosis development. Additionally, despite the fact that poststenotic turbulence exists for the higher degrees of stenosis and Reynolds numbers, the resulting wall shear stresses are only three to four times greater than the Poiseuille value and are considerably less than the wall shear stress within the stenosis itself. (24 refs.)

103931 Changes in knee function associated with treadmill ambulation. G.M.Strathy, E.Y.Chao, R.K.Laughman (Dept. of Orthopedics, Mayo Clinic/Mayo Found., Rochester, MN, USA).
J. Biomech. (GB), vol.16, no.7, p.517-22 (1983).
A comparison of level walking, on a walkway and on a treadmill, was performed using ten normal subjects. Motion about the knee was measured using a triaxial electrogoniometer, and foot-floor contact patterns were recorded by means of four foot switches attached to the sole of each shoe. On the walkway, the data were collected with the subject moving at a comfortable walking speed. The treadmill was then set at the average velocity obtained on the walkway. Knee joint rotation in the coronal and transverse planes did not change significantly between the walkway and the treadmill. In the sagittal plane, significant differences were found for total motion ($p<0.01$), swing phase motion ($p<0.01$), knee position at heel strike ($p<0.05$), and maximum swing phase extension ($p<0.01$). A comparison of the foot-floor contact patterns between walkway and treadmill ambulation revealed reduced heel contact time, with an increase in toe contact while on the treadmill. It was concluded that sagittal plane knee kinematics during level treadmill walking differ significantly from level overground walking. (12 refs.)

103932 Calf muscle moment, work and efficiency in level walking; role of series elasticity. A.L.Hof, B.A.Geelen, J.Van den Berg (Lab. of Medical Phys., Univ. of Groningen, Bloemsingel, Netherlands).
J. Biomech. (GB), vol.16, no.7, p.523-37 (1983).
Moment and work of the human calf muscles in level walking were determined by means of an EMG to force processor, based on a muscle analogue (see Hof and Van den Berg, ibid., vol.14, p.7470-92, 1981). Nine subjects (four women, five men) walked on a level treadmill at speeds between 0.5 and 2.5 m s^{-1}, at their self-chosen pace and at a forced pace with steplengths between 0.3 and 1.1 m. The interaction between the contractile and the series elastic component in the muscle could be studied by means of the analogue. A great part of the work done on the muscle and of the positive work done by the contractile component are stored in the series elastic component. The stored energy is released at a high rate in push-off. This mechanism ideally requires a concerted contraction, i.e. a contraction in which the activation is matched to the load to the effect that the length of the contractile component remains constant. The muscle then behaves like a spring. Consequences are (a) only little of the negative work gets lost, (b) the length of the contractile component remains close to the optimum of the force-length relation, (c) the shortening speed of the contractile component is now in the range where the muscle works at a high efficiency, and (d) high power peaks can be delivered due to the 'catapult action'. (48 refs.)

103933 Stresses in the closed mitral valve: a model study. T.Arts, S.Meerbaum (Dept. of Medicine, Cedars Sinai Medical Center, Los Angeles, CA, USA), R.Reneman, E.Corday.
J. Biomech. (GB), vol.16, no.7, p.539-47 (1983).
The tensile force in the chordae tendineae was related to transvalvular pressure using a mathematical model of mechanics of the closed mitral valve. Circumferential stress as well as bending stress in the valve leaflets were neglected. Without precisely knowing the mechanical properties of the leaflet material, the geometry of the leaflets was estimated by applying Laplace's law, which relates leaflet stress to leaflet curvature. Independent of the shape of the mitral valve orifice, under all circumstances the tensile force in the chordae tendineae was calculated to be equal or greater than half the force exerted on the mitral valve orifice by the transvalvular pressure. (13 refs.)

103934 On the mechanical resonances of a human tibia in vitro. G.Van der Perre, P.Cornelissen (Biomech. & Biomaterials Section, Katholieke Univ. Leuven, Heverlee, Belgium).
J. Biomech. (GB), vol.16, no.7, p.549-52 (1983).
Some comments concerning basic vibration theory, experimental techniques and mathematical modelling are given in connection with a paper by R.J. Collier et al. (ibid., vol.15, p.545-53, 1982) in which the mechanical resonances of an in vitro human tibia were analyzed experimentally. (6 refs.)

103935 Interactive control of isolated heart experiments. J.A.van Alste, A.L.Schoute, S.R.Vaartjes, H.B.K.Boom (Twente Univ. of Technol., Enschede, Netherlands).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.255-8
Presents a study of the pressure generating properties of working isolated left ventricles of rabbit hearts including the dependence on time, ventricular volume and flow at any chosen moment. An experimental set-up is built of which the central part consists of a servomotor driven piston pump. This volume actuator is connected to the left ventricle via a cannula tied in the mitral orifice and is controlled by a small computer. This computer also controls the electrical stimulator, artificial valves, a pressure calibration circuit and the end diastolic pressure or end diastolic volume. The experimental protocol requires many repetitive functions, with adjustable interval times and magnitudes. A special language syntax has been developed for (i) experiment definition, (ii) experiment composition in advance, (iii) real-time control during the actual experiment and (iv) registration of the actual protocol parameters. The interactive control was realized using the special language and an interpreter as one of the parallel processes for the experimental control. (4 refs.)

Model of mechanical auto-oscillations in Myxomycetes plasmodium .... See Entry 103810

Movement of polymorphonuclear leukocytes: an elastimetry analysis .... See Entry 103814

Transepithelial transport in cell culture. A theoretical and experimental analysis of the biophysical properties of domes .... See Entry 103818

Stretch reflex modulation during a cyclic elbow movement ... See Entry 103835

Intense sounds may alter the mechanical properties of the cochlear partition .... See Entry 103871

Effects of perilymph viscosity on low-frequency intracochlear pressures and the cochlear input impedance of the cat .... See Entry 103874

A cinefluorographic investigation of repeated fluent productations of stutterers in an adaption procedure .... See Entry 103889

The influence of stress, position, and utterance length on the pressure characteristics of English /p/ and /b/ .... See Entry 103890

Airflow characteristics of fricative consonants produced by normally hearing and hearing-impaired speakers .... See Entry 103894

Airflow characteristics of stop-plosive consonant productions of normal-speaking children .... See Entry 103895

The effects of varying lower-lip displacement on upper-lip movements: implications for the coordination of speech movements .... See Entry 103896

Theoretical sensitivity of perivascular electromagnetic flowmeters deduced from the distribution of an applied inter-electrode potential .... See Entry 104011

Mean transit time image—a new method of analyzing brain perfusion studies .... See Entry 104030

The ramp injection of radiotracers for blood flow measurement by emission tomography .... See Entry 104038

A digital X-ray image processing system for measurement of phasic blood flow in coronary arteries .... See Entry 104045

Using a gamma camera to follow left ventricular function during transient ischaemic attacks .... See Entry 104047

A new method for the temporal evaluation of ventricular wall motion from digitized contrast ventriculography .... See Entry 104051

Muscle function test device for measuring forces in the region of the angle joint See Entry 104088

A new head-mounted lip-jaw movement transduction system for the study of motor speech disorders See Entry 104094

The assessment of the post-thrombotic limb by foot volumetry and pedal venous pressure See Entry 104095

Three dimensional graphic display of cardiac motion abnormalities in myocardial infarction See Entry 104100

On the analysis of ambulatory long-term blood pressure recordings See Entry 104101

A new femoral component design based on the trabecular systems of the proximal femur See Entry 104121

Stress analysis of a simplified compression plate fixation system for fractured bones See Entry 104122

Biomechanics of the through-knee prosthesis See Entry 104125

An improved microindentation technique to measure changes in properties of arterial intima during atherogenesis See Entry 104139

A pulsed-wire spirometer using sing-around method See Entry 104150

87.50 BIOLOGICAL EFFECTS OF RADIATIONS

(inc. effects of fields)

103936 Response of human lymphocyte chromosomes to fractionated neutron irradiation in vitro. A.V.Sevan'kaev, V.A.Nasonova, G.I.Golovinova (Sci. Res. Inst. of Medical Radiology, USSR Acad. of Medical Sci., Obninsk, USSR).
Radiobiologiya (USSR), vol.23, no.3, p.332-6 (1983). In Russian.
A comparative study was made of the yield of chromosome aberrations in a human lymphocyte culture after a single and fractionated exposure to neutron radiation at the beginning of the G_1 phase and during the S phase of the mitotic cycle. It was shown that the degree of the chromosome affection in both phases does not depend upon the irradiation schedules. (19 refs.)

103937 Relative biological effectiveness of neutrons in conditions of mixed γ- and neutron-irradiation. L.N.Postnikov, A.G.Sverdlov, G.A.Lavrova, N.G.Nikanorova (B.P. Konstantinov Leningrad Inst. of Nuclear Phys., USSR Acad. of Sci., Gatchina, USSR).
Radiobiologiya (USSR), vol.23, no.3, p.337-43 (1983). In Russian.
Experimental animals (mice and rats) were exposed to mixed γ/neutron radiation. Relative biological effectiveness of a neutron component ($RBE_n/_x$) was shown to decrease with decreasing share of neutrons in the combination. This is considered as a manifestation of nonadditivity of the effects of neutrons and sparsely ionizing radiation. (19 refs.)

103938 Influence of alternating magnetic field on the bactericidal effect of ionizing radiation. M.A.Tumanyan, I.I.Samoilenko (N.F. Gamaleya Sci. Res. Inst. of Epidemiology & Microbiology, USSR Acad. of Medical Sci., Moscow, USSR).
Radiobiologiya (USSR), vol.23, no.3, p.415-19 (1983). In Russian.
A study was made of the effect of an alternating magnetic field (AMF) and ionizing radiation delivered separately or in a combination on microorganisms differing in radioresistance. The AMF (240 and 750 E) had no pronounced bactericidal action. A synergistic increase in the sterilizing effect of ionizing radiation was demonstrated after incubation of irradiated bacteria in the AMF. A radiation-magnetic technique is proposed for sterilization of preparations and articles made of nonthermoresistant materials which enables one to decrease by 1.5 times the bactericidal dose of ionizing radiation. (11 refs.)

103939 Micronucleus induction in Vicia faba roots. II. Biological effects of neutrons below 1 cGy. I.Marshall (Kernforschungszentrum Karlsruhe, Inst. fur Kernphys., Karlsruhe, Germany), M.Bianchi.
Int. J. Radiat. Biol. (GB), vol.44, no.2, p.163-73 (Aug. 1983).
For pt.I see ibid., vol.44, no.2, p.151-62, 1983. A dose-effect relationship has been established for high-energy neutrons (maximum energy 600 MeV) within a dose range of 0.2 to 80 cGy and for low-energy neutrons produced by a ^{252}Cf source (mean energy 2.35 MeV) for doses between 0.2 and 5 cGy. The frequency of micronuclei was found to increase linearly with dose. The relative biological effectiveness values calculated using ^{60}Co radiation as a reference were, in the high-dose region, 4.7 ± 0.4 and 11.8 ± 1.3 for the high- and low-energy neutrons, respectively. At doses below 1 cGy constant values of 25.4 ± 4.4 and 63.7 ± 12 were reached for the respective neutron energies. (28 refs.)

103940 V79 survival following simultaneous or sequential irradiation by 15-MeV neutrons and ^{60}Co photons. P.D.Higgins, P.M.DeLuca,Jr., D.W.Pearson (Dept. of Medical Phys., Univ. of Wisconsin, Madison, WI, USA), M.N.Gould.
Radiat. Res. (USA), vol.95, no.1, p.45-56 (July 1983).
A unique tandem source irradiation facility, composed of an intense d-T neutron source and a ^{60}Co teletherapy unit, was used to investigate biological responses for different neutron/photon configurations. V79 Chinese hamster cells, attached as monolayers in log-phase growth, were irradiated at 37°C by either 14.8-MeV neutrons, ^{60}Co, or a mixture of 40% neutrons and 60% photons in simultaneous or sequential application. Measurements of cell survival indicate an increased effectiveness in cell killing for simultaneously administered neutrons and photons compared to that measured or predicted for sequentially applied beam modalities. An understanding of the magnitude of these interactive effects is important both for calculating accurate effective doses for neutron radiotherapy of deep-seated tumors, for which the photon component is appreciable, and for determination of environmental hazards to people occupationally exposed to mixtures of photons and neutrons. (16 refs.)

103941 The RBE for mouse skin irradiated with 3-MeV neutrons: single and fractionated doses. M.C.Joiner, R.L.Maughan, J.F.Fowler, J.Denekamp (Gray Lab. of the Cancer Res. Campaign, Mount Vernon Hospital, Northwood, England).
Radiat. Res. (USA), vol.95, no.1, p.130-41 (July 1983).
Early skin reactions on the feet of mice were measured after irradiation with 240-kVp X-rays or with neutrons from a 4-MV Van de Graaff accelerator. The results are compared with previous experiments using cyclotron-produced neutrons (Field and Hornsey 1971, 1979). Single doses, or 2, 5, or 9 equal fractions, were given to measure the RBE and repair capacity for neutrons and X-rays over the neutron dose per fraction range from 1.0 to 13.0 Gy. The RBE increased with decreasing dose per fraction, and these data could be fitted with a straight line on a log-log plot. The RBE was 4.6 at 1.0 Gy and fell to 2.1 at 13.0 Gy. These RBE values are significantly higher than those from cyclotron-produced 7.5-MeV neutrons, especially at low doses per fraction. The repair capacity was calculated from a comparison of the single-dose and fractionated data over a skin reaction range from 0.6 to 2.4. The D_2-D_1 value was 5-10 Gy for X-ray doses up to 18 Gy and <1.5 Gy for 7 Gy of neutrons. This reduced repair capacity after neutrons was even more apparent with further fractionation, becoming close to zero for neutron doses below 3 Gy. These data were used to construct quasi-survival curves for epidermal cells. (25 refs.)

Effect of dispersion of electric parameters of bacterial cells on their orientation in an alternating electric field See Entry 103808

Possible adaptation to strong magnetic fields See Entry 103908

RBE of SPLEEN CFU-S to low dose rate Cf-252 or photon radiation in vivo See Entry 103982

Fast neutron beam formed at the isochronous cyclotron U-240, and study of its dosimetric characteristics See Entry 104130

87.50B Interactions of biosystems with radiations

103942 Normalization of ultrasonic scattering measurements to obtain average differential scattering cross sections for tissues. J.A.Campbell, R.C.Waag (Dept. of Electrical Engng., Univ. of Rochester, Rochester, NY, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.393-9 (Aug. 1983).
An integral expression is derived for the normalization of ultrasonic scattering data to obtain an average differential scattering cross section per unit volume for tissue which is modeled as a random, fluidlike medium. The expression assumes narrowband signals and involves the incident beam, receiver beam pattern, and time gates. The beams and gates combine to form a window which limits the scattering volume. The derivation of the expression requires that the dimensions of the window be large compared to the correlation length of the scattering medium. Numerical values of the normalizing integral are given for cylindrical and beamlimited scattering volumes as a function of incident frequency and scattering angle under the assumptions of Gaussian beams and rectangular time gates. A set of curves is presented to relate the percent difference between the result of backscatter from a cylindrical scattering volume and from a beamlimited scattering volume which does not include the truncation effect of the cylinder boundary. Although similar in form to normalizations used by others, the integral in this paper is obtained from a derivation which treats physical parameters rigorously and provides a precise statement of conditions which are sufficient to obtain system-independent scattering data. (16 refs.)

103943 Refractometry of fungi. S.Joseph (Dept. of Cell Biology & Anatomy, Univ. of Sheffield, Sheffield, England).
J. Microsc. (GB), vol.131, pt.2, p.163-72 (Aug. 1983).
Immersion refractometry is based on matching the refractive index of the medium to that of the cytoplasm of the cell, in which case the latter will have minimum contrast in the phase contrast microscope and will practically disappear. The cytoplasm is then said to be at the match point with the medium. Since the refractive index of a solution is related to its concentration by the formula $n - n_0 = \alpha C$, the values for the refractive indices can be expressed in terms of the concentration of solids (g/100 ml) which in fact has been done throughout this work. The properties of a suitable immersion medium, its preparation and interpretation of numerical results are discussed. Refractometric measurements were carried out on fungal hyphae and spores. The solid concentration in hyphae varies according to their age, physiological state and function. The solid concentration of mature, resting spores was found to be in the range of 45-54%, with the exception of powdery mildew spores in which the concentration of solids was 30-32%. The germination of spores is preceded by a fall in the concentration of solids, and subsequent swelling before the emergence of the germ tube. When the solid concentrating in pregermination spore has fallen to about 20-30%, metabolic activity can take place and germination can occur. (21 refs.)

The dielectric properties of the cerebellum, cerebrum and brain stem of mouse brain at radiowave and microwave frequencies See Entry 103838

87.50C Bioacoustics (sonic and ultrasonic effects on living matter)

103944 Ultrasound does not affect human lymphocyte transformation in vitro. A.K.Katoh, S.Charoensiri (Dept. of Pathology, Mercy Hospital, Pittsburgh, PA, USA).
J. Clin. Ultrasound (USA), vol.11, no.6, p.305-7 (Aug. 1983).
The lymphocyte transformation test has been used in testing the effect of ultrasound on human lymphocytes. The test utilizes the mitogenic lectins, phytohemagglutinin, concanavalin A, and pokeweed mitogen to stimulate the incorporation of ^{3}H-thymidine into resting lymphocytes after several days in culture. Ultrasound, which is increasingly used in diagnostic radiology, has been reported as an immunosuppressive agent in mice (Anderson and Barrett, 1979). Lymphocyte transformation has been used clinically as a test measuring the effectiveness of immunoenhancing and immunosuppressive therapies. The experiments reported here do not demonstrate an immunosuppressive role for ultrasound on human lymphocytes. (5 refs.)

103945 Mechanism of action of ultrasound of low intensity on mitochondria. V.A.Selivanov, V.P.Zinchenko, A.P.Sarvazyan (Inst. of Biological Phys., Acad. of Sci., Pushchino, USSR).
Biophysics (GB), vol.27, no.4, p.679-83 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.4, p.653-6 (1982).
Ultrasound with an intensity of 0.2 W/cm^2 acts on the transport of ions across the mitochondrial membrane. In the presence of 1 mM EGTA in the incubation medium ultrasound delays the release of K^+ into the external medium after addition of uncoupler (2,4-DNP). After addition to the initial medium of 100-400 mM Ca^{2+} exposure to ultrasound reduces the amount of Ca^{2+} adsorbed by the mitochondria and increases the rate of electroneutral $Ca^{2+}/2H^+$ exchange. When no Ca^{2+} ions are added to the incubation medium ultrasound does not influence the rate of respiration coupled and uncoupled by 2,4-dinitrophenol or the process of oxidative phosphorylation. (12 refs.)

103946 Study of ultrasonic haemolysis of erythrocytes in normal and pathological conditions. F.I.Braginskaya, G.G.Sultanova, V.B.Akopyan, D.B.Korman, K.Ye.Kruglyakova (Inst. of Chem. Phys., Acad. of Sci., Moscow, USSR).
Biophysics (GB), vol.27, no.4, p.709-14 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.4, p.679-83 (1982).
A method of automatic recording of the kinetics of ultrasonic (US) haemolysis has been devised. The quantitative parametrs characterizing the mechanical stability of the erythrocytes (time and rate of haemolysis, time of semidestruction, percentage distribution of erythrocytes by haemolytic stabity) have been studied. The results fundamentally differ for the erythrocytes in normal conditions and in the tumours studied. It is shown that the mechanical stability of the erythrocytes increases in the presence of tumour in the body as compared with normal. Analysis of the curves of differential distribution of

the erythrocytes by their resistance to US reveals accumulation of red blood cells, the membranes of which possess enhanced resistance. The effective rate constants of haemolysis of the erythrocytes in a suspension on exposure to ultrasound are calculated. (8 refs.)

103947 The induction of hyperthermia by ultrasound: its value and associated problems. I. Single, static, plane transducer. G.ter Haar (Phys. Div., Inst. of Cancer Res., Sutton, England), J.W.Hopewell.
Phys. Med. & Biol. (GB), vol.28, no.8, p.889-96 (Aug. 1983).
The temperature distributions that may be achieved in mammalian tissues by ultrasonic heating have been studied. Thigh muscle of Large White pigs has been irradiated with 0.75 and 3.0 MHz ultrasound at spatial average intensities in the range 1.5-3.0 W cm^{-2} in both pulsed and continuous modes of delivery. Resultant temperature profiles are described and some of the problems arising are discussed. (11 refs.)

Intense sounds may alter the mechanical properties of the cochlear partition ... .See Entry 103871

Changes in the immunobiological reactivity under the combined effect of microwave-, infrasonic- and γ-radiations ....See Entry 103948

87.50E Bio-optics (effects of microwaves, light, laser and other electromagnetic waves)

103948 Changes in the immunobiological reactivity under the combined effect of microwave-, infrasonic- and γ-radiations. Yu.G.Grigor'ev, G.V.Batanov, V.S.Stepanov (Inst. of Biophys., USSR Ministry of Health, Moscow, USSR).
Radiobiologiya (USSR), vol.23, no.3, p.406-9 (1983). In Russian.
In experiments on rats and rabbits a study was made of the combined effect of 9.3 GHz and 0.1 GHz microwaves (200 and 1530 $\mu W/cm^2$, respectively), infrasound (8 Hz, 115 db), and γ-radiation (cumulative dose 5.5 Gy) on cell and humoral immunity, and on autoimmune processes. It was shown that preirradiation with microwaves increased the resistance of the organism to γ-radiation, and microwaves combined with infrasound enhanced the biological effect of γ-radiation. (13 refs.)

103949 Blue light effect on proton pumping by bacteriorhodopsin. K.Ohno, R.Govindjee, T.G.Ebrey (Dept. of Physiology & Biophys., Univ. of Illinois, Urbana, IL, USA).
Biophys. J. (USA), vol.43, no.2, p.251-4 (Aug. 1983).
Proton pumping in closed vesicular systems containing bacteriorhodopsin that is initiated by an orange flash is diminished by a subsequent blue flash. This blue light effect is due to light absorbed by the photocycle intermediate M412 (M), which was formed by the orange flash. A kinetic analysis of the blue-light-induced reduction of proton pumping shows that of the two components of M, only the slowly decaying component is involved in the reduction of proton movement. This may be the first correlation between a proton movement and a specific photochemical intermediate of bacteriorhodopsin. Furthermore, the authors report that blue light, acting on the slowly decaying intermediate, probably causes a movement of the protons in a direction opposite to that normally seen for light absorbed by bacteriorhodopsin. (15 refs.)

103950 Pulsing electromagnetic fields induce cellular transcription. R.Goodman (Dept. of Pathology, Columbia Univ., New York, NY, USA), C.A.L.Bassett, A.S.Henderson.
Science (USA), vol.220, no.4603, p.1283-5 (17 June 1983).
Weak, pulsing electromagnetic fields can modify biological processes. The hypothesis that responses to such induced currents depend on pulse characteristics was evaluated by using transcription as the target process. Two pulses in clinical use, the repetitive single pulse and the repetitive pulse train, were tested. These pulses produced different results from each other and from controls when transcription in dipteran salivary gland cells was monitored with tritiated uridine in transcription autoradiography, cytological nick translation, and analysis of isolated RNA fractions. The single pulse increased the specific activity of messenger RNA after 15 and 45 minutes of exposure. The pulse train increased specific activity only after 45 minutes of exposure. (18 refs.)

How far does thermal damage extend beneath the surface of CO_2 laser incisions? ....See Entry 103796

Analysis of the cable structure of blue-green algae ....See Entry 103809

Theoretical analysis of the effect of photoreactivation of γ-irradiated E. coli cells ....See Entry 103956

87.50G Ionizing radiations (u.v., X-ray, gamma-ray; particle radiation effects)

103951 Ionizing radiation: sources and biological effects.
Nucl. Saf. (USA), vol.24, no.3, p.372-82 (May-June 1983). (no refs.)

103952 Effect of X-ray irradiation on the intensity of superweak luminescence of the whole blood. I.V.Lisovskii, V.V.Chumakov, E.N.Dombrovskii.
Med. Radiol. (USSR), vol.28, no.7, p.50-1 (July 1983). In Russian.
X-ray irradiation of white rats by doses of 5-10 Gr produced intensification of superweak luminescence of the whole blood 24 hr after irradiation. There was no evidence of a precise dose-effect relationship according to the criterion of superweak luminescence of the blood: nevertheless, irradiation of the animals with doses of 5-8 Gr caused a statistically significant difference in the intensity of blood luminescence by comparison with that in rats irradiated with doses of 9-10 Gr, which brought about the development of an intestinal syndrome. (5 refs.) *A.J.B.*

103953 A cytophotometric study of protein in tumours after irradiation and the use of dihydromonocalcium phosphate. S.S.Yakovleva.
Med. Radiol. (USSR), vol.28, no.7, p.52-4 (July 1983). In Russian.
The author et al. previously demonstrated experimentally a significant increase in the effectiveness of the treatment of tumours by X-ray irradiation and administration of dihydromonocalcium phosphate (DMP). In the present study the mechanism of the antitumoural effect of this combined treatment is investigated by means of an examination of the protein content of tumours in white rats after irradiation and the use of DMP. The results indicate that under the conditions of X-ray irradiation, which scarcely alters the dimensions of the tumoural cells, the concentration and overall content of protein in the cells decreases, and adenosine triphosphate derived from DMP causes calcification of the tumours with subsequent deletion of the cellular elements. The combined treatment of X-ray irradiation and administration of DMP produces a marked reduction of the area of the tumoural cells. (9 refs.) *A.J.B.*

103954 Short-term induced hyperglycemia in experimental tumour radiation therapy. N.R.Vepkhvadze.
Med. Radiol. (USSR), vol.28, no.7, p.54-5 (July 1983). In Russian.
Recent studies have demonstrated the successful use of short-term induced hyperglycemia (SIH) as a modifying agent in the radiation therapy of tumours, e.g. its use both before and after irradiation of a substantial form of Erlich's carcinoma in mice (see S.P. Jarmonenko et al., ibid., no.2, p.46-50, 1981). The present work is an investigation of the effect of SIH in conjunction with radiation therapy on white male rats injected with sarcoma-45. SIH was induced by multiple intraperitoneal injections of a 40% solution of glucose. The results showed that SIH substantially reinforced the antitumoural effect of irradiation. This was manifested by acceleration of the rate of regression of tumours, an increase in the number of animals displaying temporal remission, and also by increase in the number of 'cured' animals. The creation of SIH after irradiation, rather than before, appeared to be the more effective. (4 refs.) *A.J.B.*

103955 Mechanism of radiation-induced damage of secondary DNA structure. B.I.Sukhorukov, L.I.Shabarchina (Inst. of Biological Phys., USSR Acad. of Sci., Pushchino, USSR).
Radiobiologiya (USSR), vol.23, no.3, p.296-301 (1983). In Russian.
Describes the mechanism of radiation-induced damage of a secondary DNA structure that a double-helical brim conformation adjacent to a local defect in the secondary structure, and the thermoactivated threshold process of a 'confluence' of the defects are present in the irradiated DNA. It is supposed that the major type of the radiation damage to the spatial DNA structure is a triple helix repaired with the aid of the specific endonuclease. (22 refs.)

103956 Theoretical analysis of the effect of photoreactivation of γ-irradiated E. coli cells. V.A.Pitkevich, V.V.Duba, M.N.Myasnik, I.V.Petrova, V.G.Skvortsov (Sci. Res. Inst. of Medical Radiology, USSR Acad. of Medical Sci., Obninsk, USSR).
Radiobiologiya (USSR), vol.23, no.3, p.307-11 (1983). In Russian.
The assumption that the formation of purimidine dimers in E. coli cells, placed in a transient aqueous medium exposed to γ-quanta, is conditioned by Cerenkov radiation laid the basis for the development of a biophysical model to explain the photoreactivation effect observed. The dependence of the effect upon γ-radiation energy and the volume of the exposed suspension is predicted and compared with experimental data. (25 refs.)

103957 Paramagnetic centers in tissues of γ-irradiated rats treated with hormones. L.N.Markevich (Inst. of Biological Phys., USSR Acad. of Sci., Pushchino, USSR), I.K.Kolomitseva, L.P.Kayushin, Ya.I.Azhipa.
Radiobiologiya (USSR), vol.23, no.3, p.312-17 (1983). In Russian.
In the experiments reported it was shown that γ-radiation (8-16 Gy) did not influence the number of paramagnetic centers of hemal ($g=2.42$, $g=2.25$) and nonhemal ($g=1.94$) iron of rat tissues: free radicals were significantly reduced 5 min after 16 Gy irradiation. The combined effect of γ-radiation (8 Gy) and ubiquinone-9 decreased the number of the above-mentioned ESR signals after 48 h. The number of free radicals in the rat liver, kidneys and spleen was almost twice reduced 28 days following castration. The administration of methyl testosterone increased the free radical amount in the heart and was ineffective in other rat organs. (15 refs.)

103958 Circulating macromolecular complexes in rats surviving radiation, thermal and mixed radiation-and-thermal traumas. D.V.Korogodin, O.I.Kurochkina, A.M.Poverennyi, A.I.Britun (Sci. Res. Inst. of Medical Radiology, USSR Acad. of Medical Sci., Obninsk, USSR).
Radiobiologiya (USSR), vol.23, no.3, p.369-71 (1983). In Russian.
In experiments on rats it was shown that radiation and thermal traumas caused a reduction in the number of circulating macromolecular complexes, determined by the nephelometric method, by the end of the first 24 h following the damaging effect; on the 3rd day, the amount of these complexes was a minimum. The combined radiation-and-thermal damage produced an additive effect. The authors discuss the nature of the observed decrease in the number of circulating macromolecular complexes. (5 refs.)

103959 Changes in water-electrolyte exchange in the rat brain after γ-irradiation of the head. I.B.Ushakov, V.P.Fedorov.
Radiobiologiya (USSR), vol.23, no.3, p.372-5 (1983). In Russian.
Biochemical and morphological methods were used to study the direct damaging effect of radiation (5.16 C/kg) on rat brain structures. The reaction of the astrocytic-capillary complex leading to disturbances in trophism and water-electrolyte exchange was investigated. (16 refs.)

103960 Effect of adrenalectomy and irradiation on some indices of protein metabolism in rat erythrocytes. I.A.Serebrennikova, N.I.Kolesova (Tomsk State Medical Inst., Tomsk, USSR).
Radiobiologiya (USSR), vol.23, no.3, p.381-3 (1983). In Russian.
The experiments reported show that amount of residual and amino nitrogen in erythrocytes increases considerably 24 h after irradiation (5 Gy, 25 MeV betatron) of intact and sham ectomized rats. Adrenalectomy followed by irradiation with the same dose reduces the activity of proteolytic processes in rat erythrocytes. (13 refs.)

103961 The results of cytogenetic analysis of human peripheral blood lymphocytes performed at various times after radiotherapy. A.K.Ryabukha, L.P.Krivosheeva (Central Sci. Res. Inst. of Roentgenology & Radiology, USSR Ministry of Health, Leningrad, USSR).
Radiobiologiya (USSR), vol.23, no.3, p.383-6 (1983). In Russian.
A study was made of the changes in the chromosome apparatus of peripheral blood leukocytes after radiotherapy of patients with uterux cervix cancer (a cumulative dose 70-90 Gy). Cells with chromosome apparatus lesions and a maximum number of chromosome aberrations were intensively eliminated during the first 3-5 years following irradiation. Later (up to 7-9 years) their level stabilized to be 5-6 times higher than the control. (13 refs.)

103962 Modifying effect of radiation on sodium and water transport in rabbit small intestine in different irradiation conditions. A.V.Mtskhvetadze, M.A.Aivazishvili (Georgian Cancer Res. Center, Georgian Ministry of Health, Tbilisi, USSR).
Radiobiologiya (USSR), vol.23, no.3, p.386-9 (1983). In Russian.
A study was made of the effect of X-radiation on sodium and water transport within a section of rabbit small intestine. The effects induced by radiation doses of 0.21 and 0.39 C/kg were compared. The authors discuss the possibility of modification of the radiation lesions by the administration of cystamine prior to irradiation. (5 refs.)

103963 'Pseudonormal' thymocytes: a peculiar response of lymphoid elements of the thymus cortex to high doses of ionizing radiation. S.E.Aleksandrova, V.A.Gulyaev (Sci. Res. Inst. of Medical Radiology, USSR Acad. of Medical Sci., Obninsk, USSR).
Radiobiologiya (USSR), vol.23, no.3, p.401-3 (1983). In Russian.
The method of electron microscopy was used to study the phenomenon of 'paradoxical resistance' of thymocytes to very high radiation doses (40 and 200 Gy). The formation of 'pseudonormal' thymocytes, which represented a

peculiar form of radiation death of these cells, was shown to be a function of radiation dose and time after irradiation. (5 refs.)

103964 Changes in the small intestine functions of rats after radiation and thermal affection. V.S.Nesterenko, A.V.Piskarev (Sci. Res. Inst. of Medical Radiology, USSR Acad. of Medical Sci., Obninsk, USSR).
Radiobiologiya (USSR), vol.23, no.3, p.404-6 (1983). In Russian.
A study of the small intestine functions after radiation and thermal affection of rats has revealed an inhibited absorption of carbohydrates, fats and proteins. The disturbance of the resorption of these substances results from a change in the motor-evacuator function and a decrease in the activity of the appropriate enzymes in the small intestine mucosa. (10 refs.)

103965 Postirradiation recovery of yeast Pichia pinus. A.V.Glazunov, P.N.Lobachevskii (Joint Inst. of Nuclear Res., Dubna, USSR).
Radiobiologiya (USSR), vol.23, no.3, p.409-12 (1983). In Russian.
A study was made of the postirradiation recovery of yeast Pichia pinus exposed to γ-quanta and α-particles. No recovery was noted in haploid cells: the nonreversible component $k=1$. In diploid cells, the nonreversible component $k=0.7$ and 0.8 after exposure to γ-quanta and α-particles, respectively. (8 refs.)

103966 Recent results of the German Thorotrast study—epidemiological results and dose effect relationships in Thorotrast patients. G.Van Kaick, D.Lieberman, D.Lorenz, W.J.Lorenz, H.Luhrs, K.K.Scheer, H.Wesch (Inst. fur Nuklearmedizin, Deutschen Krebsforschungszentrums Heidelberg, Heidelberg, Germany), H.Muth, A.Kaul, H.Immich, G.Wagner, K.Wegener.
Health Phys. (GB), vol.44, suppl.1, p.299-306 (1983). (Proceedings of an International Conference on Radiobiology of Radium and the Actinides in Man, Lake Geneva, WI, USA, 11-16 Oct. 1981).
The German Thorotrast Study includes 5159 Thorotrast patients and 5160 control patients. 887 Thorotrast patients and 660 control patients could be clinically and biophysically examined and followed-up. The mean age at injection or hospitalization in the case of the control group was 28 yr. The mean injected volume of Thorotrast was calculated to be 24.7 ml and the X-ray films of 249 Thorotrast patients showed paravascular deposits. In the meantime 432 Thorotrast patients and 122 patients of the control group have died. Among the deceased patients the authors have registered (Thorotrast vs. control): hepatic tumours 152/0; myeloproliferative diseases 10/0; Hodgkin's diseases 2/0; nonHodgkin's lymphomas 5/1; bronchogenic carcinomas 13/6; pleural mesothelioma 1/0; bone sarcoma 1/1(?); sarcoma at injection site 1/0; hepatic cirrhosis 90/6; bone marrow failure 8/1; other neoplastic diseases 46/19; other nonneoplastic diseases 151/88. The cumulative incidence of liver tumors depends on the dose rate to liver tissue and is not influenced by the age at injection. A dose effect relationship for the myeloproliferative diseases is not yet apparent. (17 refs.)

103967 Comparison of radiological changes in humans and beagles with skeletal deposits of radium. J.P.Morgan, R.R.Pool (School of Veterinary Medicine, Univ. of California, Davis, CA, USA).
Health Phys. (GB), vol.44, suppl.1, p.353-63 (1983). (Proceedings of an International Conference on Radiobiology of Radium and the Actinides in Man, Lake Geneva, WI, USA, 11-16 Oct. 1981).
Semimonthly injections of ^{226}Ra were given to a group of beagle dogs. Periodic skeletal radiography followed, as well as histological studies of the bones. Measurements were also made of radium body content in 2259 occupationally or iatrogenically exposed persons. Of these, 1768 had skeletal radiography (one or more times). In humans, the radiographic changes were, in decreasing order of frequency, osteolytic cortical and cancellous bone destruction, bone sclerosis, pathological fracture, and avascular necrosis of bone. In beagles, osteolytic destruction and pathological fractures were common, avascular necrosis was not observed, but there was frequently cortical thickening and new-bone formation in cancellous bone. In both population groups, there was a high incidence of bone sarcoma. In the beagles, one high-dosage group numbering 38 dogs had 49 malignant bone tumors. Among the 2259 measured persons, there were 60 who had bone sarcoma, and 29 who had cancer of the mastoids or paranasal sinuses. No significant skeletal effects have been diagnosed radiologically in persons with systematic intakes of ^{226}Ra or ^{228}Ra below about 10 μCi or with skeletal doses below about 100 rad. (15 refs.)

103968 Chromosome damage in peripheral lymphocytes from American thorium workers. S.F.Hoegerman, H.T.Cummins (Center for Human Radiobiology, Argonne Nat. Lab., Argonne, IL, USA).
Health Phys. (GB), vol.44, suppl.1, p.365-71 (1983). (Proceedings of an International Conference on Radiobiology of Radium and the Actinides in Man, Lake Geneva, WI, USA, 11-16 Oct. 1981).
An analysis of the frequency of chromosome aberrations in lymphocytes from 47 thorium workers and three external controls is presented. Thirty-seven of these cases were divided into three age-matched groups based upon the means of the sums of their emanating radium-224 and bismuth-212 (Ra+Bi) burdens. The low burden group (mean Ra+Bi burden$=-0.06\pm0.03$ nCi) had two two-break chromosome aberrations in 1200 cells, the moderate burden group (mean Ra+Bi burden 0.21 ± 0.03 nCi) had three such aberrations in 1000 cells and the high burden group (mean Ra+Bi burden$=0.99\pm0.21$ nCi) had five such aberrations in 1500 cells. While there is a two-fold increase in the two-break aberration frequency in pooled data from the two higher exposure groups (8/2500 cells) as compared with the lowest exposure group (2/1200 cells), the difference between these subsamples is not statistically significant ($p=0.32$). The frequency of dicentrics and centric ring chromosomes (8/3300 cells) in the pooled higher body burden groups from the total sample (mean Ra+Bi burden$=0.56\pm0.9$ nCi) does however show a very highly significant increase over the historical control frequency. (15 refs.)

103969 Dose-response relationships for bone cancers from plutonium in dogs and people. B.A.Muggenburg, J.A.Mewhinney, W.C.Griffith, F.F.Hahn, R.O.McClellan, B.B.Boecker, B.R.Scott (Inhalation Toxicology Res. Inst., Lovelace Biomedical & Environmental Res. Inst., Albuquerque, NM, USA).
Health Phys. (GB), vol.44, suppl.1, p.529-35 (1983). (Proceedings of an International Conference on Radiobiology of Radium and the Actinides in Man, Lake Geneva, WI, USA, 11-16 Oct. 1981).
The risk of bone cancers developing from internally deposited plutonium must be estimated from studies in laboratory animals because no plutonium-induced cancers must have observed in people. Studies of the effects of ^{226}Ra and ^{239}Pu injected into beagle dogs at the University of Utah and $^{238}PuO_2$ inhaled by beagle dogs at the authors' institute provide a key link to understanding the long term effects of inhaled α-emitting radionuclides in people. Injected radium and plutonium are rapidly deposited in bone whereas plutonium deposited in lung by inhalation is translocated to bone more slowly, depending on its chemical form. The development of bone cancers is a late occurring effect seen after either injection of plutonium or radium or inhalation of plutonium. The incidence of bone cancers from α radiation to the skeletons of dogs was compared to bone cancer incidences in radium dial painters to estimate bone cancer risk from inhaled plutonium in people. A risk factor of 1200 bone cancers/10^6 rad to skeleton (average dose) was estimated. (10 refs.)

103970 Relative effectiveness of ^{241}Am vs. ^{226}Ra approached by haemopoietic stem cell studies in various bone marrow sites of contaminated mice. G.E.R.Schoeters, O.L.J.Vanderborght (Radiobiology Dept., Belgian Nuclear Centre, Mol, Belgium).
Health Phys. (GB), vol.44, suppl.1, p.555-70 (1983). (Proceedings of an International Conference on Radiobiology of Radium and the Actinides in Man, Lake Geneva, WI, USA, 11-16 Oct. 1981).
Haemopoietic stem cell assays allow investigation of local radiation damage at any time after contamination. These techniques were used to determine the relative effectiveness of ^{241}Am and ^{226}Ra in inducing damage in various cortical and trabecular bone marrow sites. Male Balb/c mice were injected with either 230 or 660 kBq $^{226}RaCl_2$/kg body weight with one of three doses of monomeric ^{241}Am citrate at 138, 552 or 768 kBq ^{241}Am/kg body weight. At 7 time intervals after injection (from 4 hr to 100 days) the colony-forming capacity of pluripotent stem cells (CFU-s) and macrophage-granulocyte committed stem cells (CFU-c) was assayed in sternal marrow, marrow of lumbar vertebrae, of the trabecular distal end of the femur and of the femoral shaft (in which were distinguished axial marrow and marrow situated peripherally near the cortical bone). ^{226}Ra retention and ^{241}Am retention were measured in these bone sites. Skeletal doses and doses to the bone marrow sites were calculated. On the base of injected activity, ^{241}Am was more effective than ^{226}Ra in reducing the number of CPU-s and CFU-c but the effectiveness varied in the various bone marrow sites. CFU-s and CFU-c response is considered in relation to the retrained radioactivity in the surrounding bone matrix and in relation to the mean marrow dose. (42 refs.)

103971 A note on radium body content and breast cancer in UK radium luminisers. K.F.Baverstock, J.Vennart.
Health Phys. (GB), vol.44, suppl.1, p.575-7 (1983). (Proceedings of an International Conference on Radiobiology of Radium and the Actinides in Man, Lake Geneva, WI, USA, 11-16 Oct. 1981).
Re-examines data from an earlier report by the authors (see K.F. Baverstock et al., Lancet i, p.430-3, 1981). The authors feel that in that study the excess breast cancer could have been only marginally the result of a soft tissue dose from α-particles. The external γ-ray dose from the working environment might have been responsible. However, attention is drawn to the possibility that causes other than radiation may have contributed. (3 refs.)

103972 UDS and SCE in lymphocytes of persons occupationally exposed to low levels of ionizing radiation. H.Tuschl, R.Kovac, H.Altmann (Inst. fur Biologie, Seibersdorf, Austria).
Health Phys. (GB), vol.45, no.1, p.1-7 (July 1983).
Unscheduled DNA synthesis (UDS) induced by in vitro UV irradiation was investigated in lymphocytes of persons occupationally exposed to low doses of ionizing radiation (maximum registered radiation dose: 98 mrad/month). For radiation exposures >14 mrad/month above background level, increased rates of UDS after in vitro UV irradiation of lymphocytes were found. The bromodeoxyuridine differential chromatid labeling technique was applied to the examination of spontaneous and Mitomycin C (MMC)-induced sister chromatid exchanges (SCE) in the same population. No statistically significant difference could be determined in spontaneously occurring SCEs, while MMC induced SCEs were significantly reduced in persons exposed to radiation doses >14 mrad/month, thus indicating increased repair capability for DNA lesions inflicted by a second insult after protracted low-dose irradiation. (26 refs.)

103973 A demographic model for performing site-specific health risk projections. J.J.Collins, R.T.Lundy, D.Grahn (Argonne Nat. Lab., Argonne, IL, USA).
Health Phys. (GB), vol.45, no.1, p.9-20 (July 1983).
An extension of an earlier life table model for estimating health risks in occupationally exposed workers is presented (see ibid., vol.40, p.439, 1981). The extension of the earlier methodology incorporates specific fertility assumptions and therefore produces a model that is able to perform health risk projections for populations living in or around sites that release agents with potentially adverse health consequences. Results show that fertility patterns are important for assessing risk, even for short-term projections. The interaction of initial age structure, competing risks from other causes of death, and fertility patterns are all important in determining future levels of excess mortality from various pollutants. (10 refs.)

103974 Iodine-129 uptake and effects of lifetime feeding in rats. S.A.Book (Lab. for Energy-Related Health Res., Univ. of California, Davis, CA, USA).
Health Phys. (GB), vol.45, no.1, p.61-6 (July 1983).
Irradiation of thyroid glands in rats at a dose rate of approximately 1 rad/day from continually ingested ^{129}I resulted in no significant increase in thyroid tumors compared to controls, nor in other thyroidal effects, nor was there any difference in longevity between the two groups. Marked decreases in ^{131}I uptake by thyroid glands of ^{129}I-fed rats were observed, but these decreases reflected 'blocking' of the thyroid by the large quantities of iodine required because of the low specific activity of ^{129}I. In view of the lack of effects on the thyroid gland invoked by lifetime exposures to ^{129}I, and considering the low specific activity of the radionuclides and the limited capacity of the thyroid gland for iodine, the hazard from ^{129}I appears to be extremely limited. (24 refs.)

103975 Radiation-induced DNA strand breaks and cell pycnosis in the developing rat cerebellum. H.Cerda (Dept. of Phys. Biology, Gustaf Werner Inst., Uppsala, Sweden).
Int. J. Radiat. Biol. (GB), vol.44, no.2, p.113-21 (Aug. 1983).
DNA strand breaks and cell pycnosis induced by ^{60}Co gamma radiation were studied in the developing rat cerebellum. Rats 2, 5 or 12 days old were irradiated and the repair of DNA strands breaks was studied at various intervals up to seven hours. DNA strand breaks were repaired in 30 min and post-repair DNA degradation was observed about 90 min after irradiation in 12 day old rats and some time later in the younger ones. The pycnotic activity in the external granular layer of the cerebellar cortex seen in histological preparations developed in a similar way, the older rats showing earlier signs of cel pycnosis and a faster degradation of DNA. A correspondences was found between DNA degradation and cell pycnosis. (8 refs.)

103976 Effects of ionizing radiation on nitric oxide myoglobin. I. Effects on the NO-haem moiety. A.R.Kamarei, M.Karel (Dept. of Nutrition & Food Sci., MIT, Cambridge, MA, USA).
Int. J. Radiat. Biol. (GB), vol.44, no.2, p.123-34 (Aug. 1983).
Bovine nitric oxyde myoglobin (NOMb) was irradiated with 40-4000 krad of γ-radiation, and the effects on the haem studied using absorption spectroscopy and electron spin resonance (e.s.r.) spectroscopy. The bright red colour of NOMb changed to brown upon irradiation. This is similar to changes observed in radiation sterilized nitrite-containing meats. NOMb become progressively denitrosylated, with met-myoglobin (metMb) as the immediate product. Upon increasing doses of radiation (up to 800 krad) at 0°C parallel to

NOMb denitrosylation, metMb was gradually converted, by water radiolytic products, to other products, believed to be ferromyoglobin and ferrimyoglobin peroxide. A minor quantity of 'choleglobin-type' pigments may also be formed at the highest doses. (38 refs.)

103977 Effects of ionizing radiation on nitric oxide myoglobin. II. Effects on the globin moiety. A.R.Kamarei, M.Karel (Dept. of Nutrition & Food Sci., MIT, Cambridge, MA, USA).
Int. J. Radiat. Biol. (GB), vol.44, no.2, p.135-42 (Aug. 1983).
For pt.I see ibid., vol.44, no.2, p.123-34, 1983. Irradiation of nitric oxide myoglobin (NOMb) induces changes in the haem as well as protein moiety of NOMb, especially at doses of 400-800 krad. On the basis of the experiments reported the changes in the protein include: (*a*) Conformational changes, with apparent partial denaturation of globin α-helix as evidenced by circular dichroism. (*b*) Preferential scission of the polypeptide chain and dimerization via covalent bond(s) as evidenced by SDS-polyacrylamide gel electrophoresis. Products with a spectrum of hydrodynamic volumes between those of the monomer and the dimer are also formed. (*c*) The shift of NOMb pIs toward more acid pHs (probably due to modification and/or destruction of basic amino acid residues by water radiolytic products) as evidenced by isoelectronic focusing. (23 refs.)

103978 Micronucleus induction in Vicia faba roots. I. Absence of dose-rate, fractionation, and oxygen effect at low doses of low LET radiations. I.Marshall (Kernforschungszentrum Karlsruhe, Inst. fur Kernphys., Karlsruhe, Germany), M.Bianchi.
Int. J. Radiat. Biol. (GB), vol.44, no.2, p.151-62 (Aug. 1983).
Micronucleus indication in Vicia faba roots has been evaluated after irradiation with ^{60}Co γ-rays. The dependence of the damage on dose, dose rate, fractionation, and oxygen has been studied. The best fit to the experimental data in the dose region between 7 and 190 cGy is represented, for single-dose exposures, by a linear+quadratic relationship. In the low-dose region, between 7 and 20 cGy, where the linear dose dependence is dominant, no dose-rate, fractionation, or where the linear dose dependence is dominant, no dose-rate, fractionation, or oxygen effect could be observed. These effects were, however, present in the high-dose region, where the quadratic dependence is dominant. (32 refs.)

103979 Incidence of radiation-induced skin tumours in mice and variations with dose rate. E.V.Hulse, S.J.Lewkowicz, A.L.Batchelor, D.G.Papworth (M.R.C. Radiobiology Unit, Harwell, Didcot, England).
Int. J. Radiat. Biol. (GB), vol.44, no.2, p.197-206 (Aug. 1983).
Mice were exposed to weakly penetrating beta-particles from an external source, using 12 different surface doses ranging from 5.4 to 260 Gy and given at four different dose rates from 200 to 1.7 cGy/mon. As in previous investigations, both epidermal and dermal tumours occurred with the latter predominating. The lowest surface dose to produce a statistically significant increase in skin tumours can have an exceptionally long latent period leads to the suggestion that there is some relatively radioresistant factor which normally restrains potential radiation-induced cancer cells in the skin from becoming tumours until the skin is subjected to high local doses. Tumour-induction was unaffected by reducing the highest zone rate by a factor of 10 and the dose-response curves were almost identical. Further reductions of dose rate, encompassing a further factor of 10, in general resulted in fewer tumours. (25 refs.)

103980 Natural cell-mediated cytotoxicity among A-bomb survivors residing in the United States. E.T.Bloom (Geriatric Res., Education & Clinical Center, West Los Angeles, VA, USA), E.L.Korn, D.S.Toji, T.Makinodan.
Int. J. Radiat. Biol. (GB), vol.44, no.2, p.213-18 (Aug. 1983).
Natural cell-mediated cytotoxicity (NCMC) by lymphocytes from Japanese atomic bomb survivors now living in the United States was measured. Seventy-one individuals were exposed to an estimated '0.00' Gy ('0 rads') (S_0 group) and 58 to greater than '0.00 Gy' (S_+ group) at the time of the bomb. Of this 58, 51 (88 per cent) received less than 0.50 Gy and 30 (52 per cent) received less than 0.10 Gy. NCMC was measured against ^{51}Cr-labelled K562 target cells. Activity by lymphocytes from S_+ group donors was significantly greater than that for the S_0 group ($p=0.028$ by the stratified Wilcoxon rank-sum test). This difference between the S_+ and S_0 populations was detected 35 years after exposure to the bomb. It is therefore feasible and important to examine appropriate biologic parameters to elucidate the effects of low doses of radiation in humans. (25 refs.)

103981 Response of mouse lung to irradiation at different dose-rates. R.P.Hill (Ontario Cancer Inst., Princess Margaret Hospital, Toronto, Ontario, Canada).
Int. J. Radiat. Oncology Biol. Phys. (GB), vol.9, no.7, p.1043-7 (July 1983).
Groups of LAF1 mice were given thoracic irradiation using ^{60}Co γ-rays at dose-rates of 0.05 Gy/min (LDR) or 1.1 Gy/min (HDR) and the death of the animals was monitored as a function of time. It was found that the time pattern of animal deaths was similar for the two different dose-rates. Dose response curves for animals dying at various times up to 500 days after irradiation were calculated and the LD_{50} values determined. The curves for the LD_{50} values, plotted as a function of the time at analysis for treatment at HDR or LDR, were essentially parallel to each other but separated by a factor (LDR/HDR) of about 1.8. This indicates that the sparing effect of LDR treatment is the same for deaths occurring during the early pneumonitis phase or during the late fibrotic phase of lung damage. The available information on the response of patients to whole thoracic irradiation, given for either palliation or prior to bone marrow transplantation, suggests that for similar dose-rates to those studied here the ratio (LDR/HDR) is only 1.2-1.3. This difference between the animal and human data may reflect the modifying effect of the large doses of cytotoxic drugs used in combination with the irradiation of bone marrow transplant patients. (24 refs.)

103982 RBE of SPLEEN CFU-S to low dose rate Cf-252 or photon radiation in vivo. Y.Maruyama, C.Nava, J.Feola, J.L.Beach, Hung-Nien Hwang, A.Williams (Dept. of Radiation Medicine, Univ. of Kentucky Medical Center, Lexington, KY, USA).
Int. J. Radiat. Oncology Biol. Phys. (GB), vol.9, no.7, p.1049-56 (July 1983).
The biological effects of low dose rate (LDR) Cf-252 radiation were compared to LDR Cs-137 photon radiation and acute ^{60}Co radiation. The RBE_n for endogenous CFU-S in vivo was 2.1 for neutron radiation at a dose rate of 9.9 cGy/hr of Cf-252 radiation. The value was consistent with previous in vitro experiments where a value of 2.1 was found. For the low doses and low dose rates studied, the authors tested at acute assay dose following the LDR irradition to determine dose-effect and RBE_n. Organ size shrinkage and regeneration patterns after LDR Cf-252 and Cs-137 were also studied and showed greater growth delay for Cf-252 irradiated lympho-hemopoietic tissues. (28 refs.)

103983 1982 Resident's Essay Award: the immunologic effects of lymphoid irradiation in human and non-human primates: cellular changes and the potential for renal transplantation. E.C.Halperin, G.Haas, D.E.Dosoretz, M.Gitterman, L.Barrett, A.B.Cosimi, H.D.Suit (Dept. of Radiation Medicine, Massachusetts General Hospital, Boston, MA, USA).
Int. J. Radiat. Oncology Biol. Phys. (GB), vol.9, no.7, p.1083-9 (July 1983).
The alterations which occur in T lymphocyte numbers during a course of therapeutic irradiation in humans with Hodgkin's disease were measured. The effects of lymphoid irradiation prior to renal transplantation were studied in cynomolgus monkeys. The irradiation depleted the peripheral blood populations of all lymphocyte populations in both humans and monkeys. It is suggested that while measured cellular changes are reflections of the immunologic state, they are not necessarily the determining factors of graft/host interactions. (17 refs.)

103984 Influence of the physical structure of irradiated starches on their electron spin resonance spectra kinetics. J.J.Raffi, J.-P.L.Agnel (CEN Cadarache, Saint-Paul lez Durance, France).
J. Phys. Chem. (USA), vol.87, no.13, p.2369-73 (23 June 1983).
The authors' study deals with the shape and kinetic changes of the ESR spectra of eight irradiated starches, from several hours to several months after γ-irradiation. Whatever the origin and water content of the starches two major radicals or groups of radicals are observed. The kinetic law depends on the water content; two main zones are pointed out which are relative to the amorphous and crystalline parts of starches. (21 refs.)

103985 Inactivation of Ehrlich ascites tumor cells by heavy ions. U.Bertsche, G.Iliakis (Inst. fur Biophys., J.W. Goethe-Univ. Frankfurt, Frankfurt/Main, Germany), G.Kraft.
Radiat. Res. (USA), vol.95, no.1, p.57-67 (July 1983).
Exponentially growing and plateau-phase cultures of Ehrlich ascites tumor cells were irradiated with heavy ions ($Z \geq 20$) and assayed for loss of reproductive capacity either immediately or at delayed times after irradiation. The results indicated no modification of the exponential dose response due to conditions which usually favor the repair of potentially lethal damage (PLD) at low ionization density. Postirradiation treatment of the cells with β-arabinofuranosyladenine, a DNA synthesis inhibitor known to act on PLD repair, resulted in effects similar to those observed without this drug and confirmed the hypothesis that at such high values of ionization density only lethal, unmodifiable damage can be expressed. The inactivation cross-section values calculated from the slope of the measured survival curves showed no significant correlations with commonly used parameters of radiation quality such as LET or z^2/β^2. Instead, a functional dependence on the primary ion energy was indicated, being smaller by a factor of two at low energies (≤ 2 MeV/amu) compared with values at energies above 4 MeV/amu, where agreement with the morphological nuclear cross section of the culture was found. (19 refs.)

103986 Alternative types of duodenal ulcer induced in mice by partial X-irradiation of the thorax. A.Michalowski, S.Uehara, W.-B.Yin, J.Burgin, J.A.Silvester (MRC Cyclotron Unit, Hammersmith Hospital, London, England).
Radiat. Res. (USA), vol.95, no.1, p.78-86 (July 1983).
The study reported extends the authors' earlier observations (see A. Michalowski, Br. J. Radiol., vol.54, p.713, 1981; A. Michalowski and J. Burgin, in Progress in Radio-Oncology II, p.105-10) on gastrointestinal pathology in thorax-irradiated female CFLP mice. It shows that exposure of the lower mediastinum to single doses of 14-30 Gy X-rays results in the formation of the proximal duodenal ulcer accompanied frequently by erosion of the antral gastric mucosa. X-irradiation of the lateral thoracic fields is responsible for single ulcers in the proximity of duodenal papilla, often associated with a circumscribed area of degeneration of the fundic mucosa of the stomach. In view of the small amount of radiation received by the subdiaphragmatic parts of the alimentary tract, these gastro-duodenal lesions represent abscopal effects of thoracic irradiation. (28 refs.)

103987 Evidence that repair and expression of potentially lethal damage cause the variations in cell survival after X-irradiation observed through the cell cycle in Ehrlich ascites tumor cells. G.Iliakis, M.Nusse (Inst. fur Biophys., Frankfurt/Main, Germany).
Radiat. Res. (USA), vol.95, no.1, p.87-107 (July 1983).
The survival of synchronously growing Ehrlich ascites tumor cells was measured after X-irradiation in various stages of the cell cycle. Cells at the beginning of S or in G2+M phase showed a high level of killing, whereas cells irradiated in G1 or in the middle of S phase were more resistant. These changes resulted from a change in the survival curve shoulder width (D_q) as cells passed through the cell cycle, and the mean lethal dose (D_0) remained practically unchanged (0.8 ± 0.05 Gy). When synchronization of the cell population was further sharpened using nocodazole, exponential survival curves were obtained at the beginning of S phase and at mitosis with a $D_0=0.8$ Gy. When cells (in all stages) were incubated in balanced salt solution for 6 hr after irradiation, repair of potentially lethal damage (PLD) was observed, resulting in an increase in D_q, while D_0 remained constant. Treatment of the cells after irradiation with either caffeine (2-6 mM) or β-arabinofuranosyladenine (β-araA) (60-100 μM) or hypertonic medium resulted in an expression of PLD and reduced the D_q of the survival curve, which approached or reached an exponential line with $D_0=0.8 \pm 0.1$ Gy. It is suggested that the variations observed in cell survival through the cell cycle might reflect variations in the final amount of PLD either repaired or expressed as the cells progress through the various stages of the cell cycle. (52 refs.)

103988 Radiation-induced injury of the esophagus. R.A.Lepke, H.I.Libshitz (Dept. of Diagnostic Radiology, Univ. of Texas, Houston, TX, USA).
Radiology (USA), vol.148, no.2, p.375-8 (Aug. 1983).
Forty patients with functional or morphologic esophageal abnormalities following radiotherapy were identified. Abnormalities included abnormal motility with and without mucosal edema, stricture, ulceration and pseudodiverticulum, and fistula. Abnormal motility occurred 4 to 12 weeks following radiotherapy alone and as early as 1 week after therapy when concomitant chemotherapy had been given. Strictures developed 4 to 8 months following completion of radiotherapy. Ulceration, pseudodiverticulum and fistula formation did not develop in a uniform time frame. Radiation-induced esophageal injury is more frequent when radiotherapy and chemotherapy are combined than it is with radiotherapy alone. (10 refs.)

Health effects guidance for uranium in drinking water .... See Entry 103740

Relative biological effectiveness of neutrons in conditions of mixed γ- and neutron-irradiation .... See Entry 103937

Influence of alternating magnetic field on the bactericidal effect of ionizing radiation .... See Entry 103938

V79 survival following simultaneous or sequential irradiation by 15-MeV neutrons and ^{60}Co photons .... See Entry 103940

The RBE for mouse skin irradiated with 3-MeV neutrons: single and fractionated doses .... See Entry 103941

Changes in the immunobiological reactivity under the combined effect of microwave-, infrasonic- and γ-radiations .... See Entry 103948

Stepwise-control concept for the ray therapy of tumors .... See Entry 104025

Radiation therapy and antitumoral immunity. The immunomodifying effects of ionizing radiation .... See Entry 104026

Iso-effect tables and therapeutic ratios for epidermoid cancer and normal tissue stroma .... See Entry 104033

Estimation of the genetically significant dose from diagnostic X-ray procedures in the Islamic Republic of Iran .... See Entry 104057

Assessments of the radiological consequences of postulated accidental releases from the Sizewell PWR .... See Entry 104074

Linear electron accelerator used to study the radiobiological effects of high doses of fast electrons .... See Entry 104129

Determination of ^{18}O trapping in X-irradiated amino acids by means of nuclear reactions .... See Entry 104148

87.60 MEDICAL AND BIOMEDICAL USES OF FIELDS, RADIATIONS, AND RADIOACTIVITY

(see also 28.80 Nuclear radiation technology, including shielding)

103989 Discriminant analysis in radiation therapy treatment planning for carcinoma of the cervix uteri. K.R.Hibbitts, D.E.Raeside, G.D.Adams, C.R.Bodardus,Jr. (Dept. of Radiological Sci., Univ. of Oklahoma Health Sci. Center, Oklahoma City, OK, USA).
Proceedings of the Fifteenth Hawaii International Conference on System Sciences 1982, Honolulu, HI, USA, 6-8 Jan. 1982 (HI, USA: Hawaii Int. Conference Syst. Sci. 1982), p.12-21 vol.2
Discriminant analysis is applied to radiation therapy treatment planning for carcinoma of the cervix uteri, with the intention of assisting the radiation therapist in assessing the likelihood that a prescribed radiation therapy regime will lead to a successful outcome. (10 refs.)

103990 Computer systems and their applications in nuclear medicine. V.M.Spitzer (Dept. of Radiology, Univ. of Colorado Health Sci. Center, Denver, CO, USA).
Proceedings of the Fifteenth Hawaii International Conference on System Sciences 1982, Honolulu, HI, USA, 6-8 Jan. 1982 (HI, USA: Hawaii Int. Conference Syst. Sci. 1982), p.22-31 vol.2
Computer controlled scintillation cameras and digital image processing is commonplace in modern nuclear medicine departments. The nature and origin of diagnostic nuclear medicine data is outlined. Basic computer system configurations which are commercially available for this type of data processing are presented. Some common image processing applications either utilizing or requiring the computer are also included. (19 refs.)

Medical imaging systems .... See Entry 98677

87.60B Sonic and ultrasonic radiation

103991 Measurement of liver volume by ultrasound and computed tomography. P.Fritschy, G.Robotti, G.Schneekloth, P.Vock (Dept. of Diagnostic Radiology, Univ. Hospital, Inselspital, Bern, Switzerland).
J. Clin. Ultrasound (USA), vol.11, no.6, p.299-303 (Aug. 1983).
A morphometric method to calculate liver volumes from transverse sections is evaluated (point-integrating method). In the first part of the study, 10 liver specimens were investigated by computed tomography (CT) and ultrasound (US); the calculated volumes were compared to the volumes obtained by water displacement of the organs. While CT showed an ideal agreement (r=0.994), volumes calculated from US sections correlated less well (percentage differences from +12.5% to −9%, r=0.915). In the second part of the study, the livers of 10 randomly selected patients were investigated by CT and US. Liver volumes were calculated using the point-integration method. Compared to the CT examination, US results show a good correlation with a correlation coefficient of r=0.977. The point-integration method is very valuable to measure organ volumes from transverse sections. The method can be applied 'offline' to photographic films, data do not have to be recorded electronically. The time required to calculate the volume of an organ is comparable to other methods. (20 refs.)

103992 Diagnostics with ultrasound. J.M.Thijssen.
PT/Elektrotech. Elektron. (Netherlands), vol.38, no.6, p.44-7 (June 1983). In Dutch.
Diagnostics using ultrasonics has been designated 'echography' in the medical field. The types of scan available and the traces obtained are briefly outlined. A comparative table is given of echograms against X-ray pictures. Advantages of the former include the nonionising effect, better contrast, tissue imaging, dynamic application and cheapness (by a factor of 10). Some types of clinical application are described. These include the pulsed Doppler technique to measure the flow in blood vessels, echo-cardiology and the acquisition of echograms of gynaecological and optical interest. A brief mention is made of other principles with diagnostic possibilities, such as nuclear magnetic resonance, digital subtraction angiography, single photon emission tomography and X-ray computerised tomography. (3 refs.) *G.C.*

103993 Measurement of ultrasonic attenuation within regions selected from B-scan images. K.J.Parker, R.C.Waag (Dept. of Electrical Engng., Univ. of Rochester, Rochester, NY, USA).
IEEE Trans. Biomed. Eng. (USA), vol.BME-30, no.8, p.431-7 (Aug. 1983).
Describes the calculation of absolute ultrasonic attenuation as a function of frequency by processing backscattered signals obtained from a clinical imaging instrument. The signal processing steps are developed from a mathematical model of scattering in an attenuating medium with random inhomogeneities. Attenuation data are derived from the imaging system by recording amplitude-compressed ultrasonic echo waveforms along with transducer position information and time-varying gain values. The input-output characteristics of the receiver are employed to remove the effects of compression and gain. Attenuation values are calculated for selected regions within scans of two tissue phantoms and a normal breast. The values agree with other independent measurements and illustrate the requirements for incorporating quantitative attenuation measurements with clinical imaging. (27 refs.)

103994 Beam steering with linear arrays. O.T.Von Ramm (Dept. of Biomedical Engng. & Medicine, Duke Univ., Durham, NC, USA), S.W.Smith.
IEEE Trans. Biomed. Eng. (USA), vol.BME-30, no.8, p.438-52 (Aug. 1983).
The principles and techniques of real-time imaging with phased array ultrasound scanners are reviewed. Topics include (1) the geometric optics of beam steering and focusing with a linear array in the transmit and receive modes; (2) limitations on image data acquisition due to ultrasound propagation velocity; (3) optical diffraction theory for linear arrays including effects of amplitude grating lobes. Limitations on the image quality of phased array imaging systems are also discussed, including (1) nonideal response of array transducers; (2) target ambiguities caused by phase error grating lobes; (3) refraction errors; (4) delay line design. Finally, an analysis is presented of current techniques for improving ultrasound image quality using phased array methods including phase compensation, spatial compounding, frequency compounding, and parallel processing. (43 refs.)

103995 Ultrasound transducers for pulse-echo medical imaging. J.W.Hunt, M.Arditi, F.S.Foster (Dept. of Medical Biophys., Ontario Cancer Inst., Toronto, Ontario, Canada).
IEEE Trans. Biomed. Eng. (USA), vol.BME-30, no.8, p.453-81 (Aug. 1983).
The transducer is probably the single most important component of any ultrasonic imaging system. A basic introduction to the problems and paradoxes of transducer design is given. After introducing the piezoelectric equations and discussing important transducer material such as lead zirconate titanate and polyvinylidene difluoride, the techniques for modeling the electromechanical impulse response are reviewed. Quarter-wave matching and short pulse techniques are discussed. The prediction of the ultrasound field of plane, spherical, and conical transducers is reviewed with emphasis on the spatio-temporal impulse response technique. Finally, the use of the above approaches is illustrated in a very practical fashion for three interesting transducer geometries: (1) a split aperture device with two focal lengths, (2) a five-element annular array, and (3) a 37.5 degree conical/annular array hybrid transducer. (122 refs.)

103996 An ultrasonic technique for imaging the ventricle in three dimensions and calculating its volume. W.E.Moritz (Dept. of Electrical Engng., Univ. of Washington, Seattle, WA, USA), A.S.Pearlman, D.H.McCabe, D.K.Medema, M.A.Ainsworth, M.S.Boles.
IEEE Trans. Biomed. Eng. (USA), vol.BME-30, no.8, p.482-92 (Aug. 1983).
Real-time two-dimensional ultrasonic scanners provide a series of cross-sectional images of the ventricle. The authors have developed a technique which can determine the spatial position and orientation of a collection of such scans with respect to a reference coordinate system. The scans need not be parallel, may intersect, and need not demonstrate a complete cross section. The borders of interest are digitized to identify a set of points representing the surface of the ventricle. These points are used to generate a 3-D reconstruction of the chamber and are processes to give an estimate of ventricular volume. The technique has been validated using ten formalin-fixed hearts excised from dogs, sheep, and cows, with an actual volume range of 31.8-570.6 cm^3. Each ventricle was imaged five times by three observers for a total of 150 studies, by the least squares linear regression analysis, calculated volume=0.98 (actual volume) + 1.39 cm^3, r=0.99. The average error for all studies was 5 percent, while 88 percent of the individual calculated volume were within 10 percent of the actual volume. The method appears to offer the potential for the accurate assessment of ventricular volume in man. (22 refs.)

103997 Assessment of electromagnetic characteristics of the Willeford Central Auditory Processing Test Battery. S.L.Shea, M.J.M.Raffin (Univ. of Montana, Missoula, MT, USA).
J. Speech & Hear. Res. (USA), vol.26, no.1, p.18-21 (March 1983).
Electromagnetic characteristics of eight tape recordings of the Willeford Central Auditory Processing Test Battery were assessed. Measurements indicate that when recording levels are referenced to the calibration tone preceding a given subtest of that battery, significant intertape differences, intertest differences, and interchannel differences in the recording levels of test items exist. Mean recording levels of items used in the Rapidly Alternating Speech Perception, Low-Pass Filtered Speech, and Competing Sentences subtests typically were within 10 dB of the reference tone. Recording levels for the Binaural Fusion subtest yielded intertape differences of as much as 26.5 dB. Given the large intertape inconsistencies in recording levels, extreme caution should be exercised in the use of these recordings. (14 refs.)

103998 A noninvasive acoustic method using frequency perturbations and computer-generated vocal-tract shapes. D.A.Beckman (Univ. of Arkansas Medical Sci. Campus, Little Rock, AR, USA), D.C.Wold, J.C.Montague,Jr..
J. Speech & Hear. Res. (USA), vol.26, no.2, p.304-14 (June 1983).
Improved processing of acoustic data was investigated with two adult Down's syndrome subjects. Sustained vowel samples were processed through a fast-Fourier-transform spectrum analyzer, and digital waveform data were used to obtain period-by-period measurements of the fundamental frequencies. Unusual frequency perturbation (jitter), later identified as diplophonia, was found for one of the Down's subjects. In addition, the first three formant frequencies of the vowels were determined and, utilizing an algorithm described by Ladefoged et al. (1978), computer-generated vocal-tract shapes were plotted. Differences in vocal-tract shapes, especially for the back vowels, were observed between the Down's female and the normal shape. Correlations between vocal-tract shapes of the Down's subjects and those for a normal man or woman were computed. A partial three-way factor analysis was carried out to determine those load factors or coefficients for each subject that were due to individual differences. These procedures, offering synthesized techniques portraying the interpharyngeal/oral functioning of the speech structures, may eventually have direct noninvasive diagnostic and therapeutic benefit for voice/resonance-disordered clients. (43 refs.)

103999 Work in progress: common carotid artery contours reconstructed in three dimensions from parallel ultrasonic images. D.H.Blankenhorn, H.P.Chin, S.Strikwerda, J.Bamberger (Univ. of Southern California School of Medicine, Los Angeles, CA, USA), J.D.Hestenes.
Radiology (USA), vol.148, no.2, p.533-7 (Aug. 1983).
Three-dimensional sonograms of the common carotid artery were obtained using a device which takes images in parallel planes. Tests in phantoms simulating atherosclerotic vessels the same size as the common carotid artery indicated that the coefficient of variation of a single luminal measurement was 2-5%. (10 refs.)

104000 A comparison of two methods for determining ultrasonic intensity for medical transducers. D.G.Shombert, R.A.Robinson (Nat. Center for Devices & Radiological Health, Food and Drug Administration, Rockville, MD, USA).
Ultrasonics (GB), vol.21, no.5, p.234-6 (Sept. 1983).
The spatial and temporal average intensity (I_{SATA}) is determined for four diagnostic ultrasound transducers by two methods: (a) direct measurements (beam profiling) with a miniature hydrophone, as described in the AIUM-NEMA standard, and (b) estimating from measurements of total power and assumptions about beam size. The latter method is frequently used by diagnostic ultrasound manufacturers when reporting output levels to users and regulatory agencies. However, due to the conventions for defining beam area, this method actually overestimates the spatial average intensity. For the four transducers tested, the estimated I_{SATA} exceeds the measured I_{SATA} by several hundred percent. The spatial peak, temporal average intensity (I_{SPTA}) was

also measured for the four transducers and is less than the estimated I_{SATA} in every case. (4 refs.)

104001 Quantitative ultrasonic imaging in medical diagnosis. M.J.Flynn, P.L.Carson, C.R.Meyer (Dept. of Radiology, Univ. of Michigan, Ann Arbor, MI, USA).
Proceedings of the Fifteenth Hawaii International Conference on System Sciences 1982, Honolulu, HI, USA, 6-8 Jan. 1982 (HI, USA: Hawaii Int. Conference Syst. Sci. 1982), p.42-53 vol.2
The use of computers for recording and analysing ultrasonic signals obtained from the insonation of human patients now permits a more definitive diagnosis of several diseases to be made. Recent results of ultrasonic velocity and attenuation imaging for breast diagnosis are presented and approaches for correlating image texture with the histology of diffuse organ diseases are described. (45 refs.)

104002 Computer enhancement and analysis of complete and selective displays of two-dimensional echocardiograms. D.E.Lovelace, S.Rasmussen, B.C.Corya, S.B.Knoebel (Krannert Inst. of Cardiology, Indiana Univ., School of Medicine, Indianapolis, IN, USA).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.321-4
Develops a clinically adaptable computer system for accessing and directly digitizing 100% of unprocessed (raw) ultrasound signals for potential tissue type identification applications. The authors describe the system along with application of combining this system with a mathematically derived integrated backscatter ratio to detect changes in posterior LV myocardium following left circumflex coronary artery ligation in dogs. (no refs.)

104003 Compound sector scan echocardiography using a sub-probe of same frequency. M.Kuwahara, S.Eiho, H.Kitagawa, N.Asada, M.Yokoyama (Automation Res. Lab., Kyoto Univ., Kyoto, Japan).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.325-8
Phased array sector scan echocardiography has been widely used in the field of cardiology, but it has some problems to be solved such as rather poor resolution and restricted range of view of its image. To solve these problems, the authors propose a compound sector scan echocardiographic system with an additional sub-probe which transmits and receives an ultrasound pulse train of the same frequency as the main-probe at the different precordial position. The overlapped two echocardiograms obtained from the two probes are displayed on a CRT monitor in real time. (6 refs.)

104004 Mitral valve tracking of directly digitized 2D echocardiograms. D.N.Smith, A.J.Buda, Delp. A.J., J.M.Jenkins, C.R.Meyer, F.H.Splittgerber, B.Pitt (Univ. of Michigan, Ann Arbor, MI, USA).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.329-32
The automatic estimation of mitral valve orifice area and shape changes would be useful in the assessment of valvular and myocardial disease. To assist in that estimation the authors have developed a method to directly acquire two-dimensional digital line mode data at a rate of 20 to 25 frames a second. An algorithm was developed to automatically track the mitral valve orifice boundary throughout the cardiac cycle, following an initial manually entered border on a single frame. The automated tracking algorithm will assist in the derivation of shape and area change parameters of the mitral valve through the cardiac cycle and should provide further information regarding valvular structural integrity and cardiac function. (11 refs.)

104005 Computer-assisted evaluation of patterns of ventricular contraction during induced rapid tachycardias using two-dimensional echocardiography. J.A.Werner, H.L.Green, J.R.Gorham, E.L.Bolson, B.W.Gross, C.L.Janko, G.Kime (Div. of Cardiology, Univ. of Washington, Seattle, WA, USA).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.333
Summary form only given, substantially as follows. Two dimensional echocardiography (2DE) offers precise spatial localization of ventricular anatomy. Patterns of segmental movement during the cardiac cycle should relate to patterns of electrical activation of corresponding anatomic sites and should change depending upon the origin and pathways of conduction. The authors performed 2DE simultaneously with electrophysiologic induction of artrial and ventricular tachycardias (T) in 62 patients (pts) studied to identify and suppress symptomatic dysrhythmias. 2DE of one cardiac cycle each in normal sinus rhythm (NSSR) and the induced rhythm were analyzed frame-by-frame and digitized using prototype digital border terminal interfaced to a microprocessor. A computer procedure adapted from cineangiographic analysis, known as the center-line method (CL), identified 100 separate ventricular segments and plotted independent perpendicular motion from their positions at the peak of the QRS-R wave or the maximum diastolic dimension assessed visually. Contour plots were generated for the beats in NSR and T comparing motion of each segment through the cardiac cycle and scanned for sites of earliest activation and segmental changes in motion using each patient's normal heat as the control.

104006 Computer assisted analysis of backscattered ultrasonic signal for in vitro atherosclerosis detection. L.Landini, E.Picano, A.Benassi, A.Distante, A.L'Abbate (CNR Clinical Physiology Inst., Univ. of Pisa, Pisa, Italy).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.335-8
Establishes in vitro whether specific alterations in ultrasonic backscatter may characterize the atherosclerotic process, providing a quantitative assessment of severity. Two indices have been evaluated: one studying the transfer function (γ_1), the other measuring the integrated value of the FFT spectrum (IBI) of the signal. According to the results, backscattered signals seem to offer indicative parameters of changes in the arterial wall structure caused by atherosclerotic process. Therefore these results offer a clue to future studies for in vivo detection of atherosclerotic changes in superficial vessels. (6 refs.)

104007 The analysis of two-dimensional echocardiograms using a time-varying image approach. E.J.Delp, A.J.Buda, M.R.Swastek, D.N.Smith, J.M.Jenkins, C.R.Meyer, B.Pitt (Univ. of Michigan, Ann Arbor, MI, USA).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.391-4
Discusses the use of dynamic scene analysis in automatic interpretation of two-dimensional echocardiograms. The approach is to process every frame of the cardiac cycle and use redundant information from previous frames to aid in finding features (primarily edges) in the current frame. The authors also discuss the use of preprocessing of the echo frames. Preliminary results of the design an edge detector algorithm using dynamic scene analysis is presented. Possible shape features for the measurement of cardiac status are presented. (15 refs.)

104008 Automated endocardial definition of 2-D echocardiograms: a comparison of four standard edge detectors and improved threshold techniques. D.T.Linker, A.S.Pearlman, T.K.Lewellen, L.H.Huntsman, W.E.Moritz (Div. Cardiology, Univ. of Washington, Seattle, WA, USA).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.395-8
Quantitative two dimensional echocardiography allows non-invasive determination of left ventricular volume, ejection fraction and regional wall motion from ventricular endocardial outlines. Accurate outlining by hand is tedious and difficult to perform repeatedly. To study the possibility of automating part of this operation, short axis views of the left ventricle in human subjects were digitized and transferred to an image processing system. Roberts, Sobel, Prewitt and compass edge detectors were applied to the images. Processing using the Ek algorithm and thresholding were also tested. Gain settings at the time of recording had an important effect on the results. Normal gain levels resulted in marked drop-out of borders oriented nearly parallel to the ultrasonic beam, while maximum gain levels produced spurious edges. An intermediate gain level gave the best results. All four edge detectors produced roughly equivalent results, but processing with the Ek algorithm produced the best results as judged by the lack of drop-out and spurious edges. (5 refs.)

104009 Automated computer enhancement and analysis of left ventricular two-dimensional echocardiograms. E.Garcia (Cedars-Sinai Medical Center, Los Angeles, CA, USA), A.Ezekiel, R.Levy, W.Zwehl, K.Ong, E.Corday, J.Areeda, S.Meerbaum, S.Corday.
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.399-402
Describes development of automated image enhancement and age detection algorithms. Image are enhanced using space-time smoothing and dynamic range expansion. Space-time smoothing consists of a 27-point binary weighted pixel average. Dynamic range expansion consists of modifications of the gray level translational table and more recently of histogram equalization. Automatic edge detection of the endocardium is performed frame-by-frame by convolving a Laplacian operator with the enhanced images. The initial evaluation indicates that computerized enhancement and edge detection of 2D echocardiograms allows accurate analysis of LV cross-sectional areas and LV volumes, and offers important advantages of objectivity and speed. (7 refs.)

ECG criteria for left ventricular hypertrophy: use of ECG and echo computerized databases ....See Entry 104107

87.60D Electric and magnetic fields (d.c. and pulsed)

104010 SQUID biomagnetic measurements. D.E.Farrell (Phys. Dept. Case Western Reserve Univ., Cleveland, OH, USA), P.Zanzucchi.
CRC Crit. Rev. Solid State & Mater. Sci. (USA), vol.11, no.2, p.99-122 (1983).
Results obtained by measurement of the weak magnetic fields associated with organs in the human body have significant potential for a number of areas in the health sciences. A substantial amount of recent research activity has therefore been directed toward the goal of making biomagnetic measurements of useful resolution in an ordinary laboratory environment. For certain simple types of measurement the major problems have been solved and systems developed to the point of clinical usefulness. In other important instances, e.g. measurement of fetal brain activity, the goal has been approached but not yet attained. This review discusses both general principles and practical considerations involved in the optimization of a measurement system. Particular attention is given to the new area of biomagnetic susceptometry which has attracted considerable clinical interest. Specific examples of state of the art biomagnetic measuring systems are discussed and the potential for further improvement assessed. (61 refs.)

104011 Theoretical sensitivity of perivascular electromagnetic flowmeters deduced from the distribution of an applied inter-electrode potential. V.T.O'Sullivan (Nuffield Inst. for Medical Res., Oxford, England).
Phys. Med. & Biol. (GB), vol.28, no.8, p.973-81 (Aug. 1983).
A hypothetical electromagnetic blood flowmeter is considered in which the electrode system and the magnetic field are invariant in the direction of flow. If a voltage from an external source is applied between the electrodes, a potential distribution is produced on the outside of the vessel. It is shown that the sensitivity of the flowmeter to axisymmetric flow can theoretically be deduced from the potential distribution provided the vessel and blood have uniform, isotropic conductivities. The method, if applicable to practical flowmeters, would permit in vivo monitoring of flowmeter sensitivity. (10 refs.)

104012 Hyperthermia by magnetic induction: experimental and theoretical results for coaxial coil pairs. J.R.Oleson, T.C.Cetas (Div. of Radiation Oncology, Arizona Health Sci. Center, Tucson, AZ, USA), P.M.Corry.
Radiat. Res. (USA), vol.95, no.1, p.175-86 (July 1983).
High-frequency magnetic induction for producing elevated temperatures in human tumors can be accomplished with several electrode arrangements. The physical characteristics of a coaxial pair of electrodes or current loops placed on either side of the body are described. This electrode arrangement can improve the depth of power deposition within the body relative to that obtained with an electrode circumferentially encircling the body or a single surface applicator ('pancake coil'). Results are reported of measured and calculated magnetic field distributions and power density distributions obtained with a coaxial pair. The effect of varying load geometry upon the power density distribution was shown to be significant in several static phantom experiments. Electrode geometry was also important, as shown by calculations of power deposition as a function of electrode diameter in a simple model of body tissue conductivities. The power density was found to diminish at given depths as the electrode diameter decreased. Finally, values of magnetic fields were measured during treatment of human subjects with a coaxial electrode pair and were found to vary significantly from subject to subject. This resulted from variation in the geometry and electrical characteristics of tissues among subjects, and indicates the difficulty of formulating a standard accurate model for use with this magnetic induction technique. (22 refs.)

Magnetic resonance in medical techniques: new possibilities ..See Entry 104021

87.60G Laser beams, microwaves, and other electromagnetic waves

(inc. NMR; for X-rays and gamma-rays, see 87.60J)

104013 Spectral irradiances of and maximal permissible exposures to two indirect ophthalmoscopes. J.Kossol (Non-Ionizing Radiation Lab., Pennsylvania Coll. of Optometry, Philadelphia, PA, USA), C.Cole, P.Dayhaw-Barker.
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.7, p.616-21 (July 1983).
Recent reports in the literature have indicated that exposure to certain high intensity sources used in clinical procedures may be damaging to the retina. To investigate this problem, the spectral irradiance of two indirect ophthalmoscopes (American Optical (AO) and Keeler) was measured. The instruments do show operational differences, the most striking of which was the difference in the total irradiance produced at the maximum voltage setting, the Keeler instrument providing nearly 3.6 times greater irradiance than the AO indirect ophthalmoscope. The sources are evaluated as blue light hazards, and maximal permissible exposures (MBE) are calculated and compared to the MPE established by ANSI Z-136 guidelines. (12 refs.)

104014 A confrontation test of visual fields in the low-vision patient. R.Pace, J.G.Strong (School of Optometry, Univ. of Waterloo, Waterloo, Ontario, Canada).
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.7, p.622-4 (July 1983).
Reports a simple method for measuring the extent of the visual field in patients for whom this measurement is difficult. One Maddox rod is used before the eye under test. Through the Maddox rod lens, this eye sees a white streak produced by a penlight. While fixating this white streak another penlight is brought into the field of view from the periphery. The patient is required to report only whether he sees one or two light streaks. The results correlate well with field measurements made on the tangent screen in patients with simulated field losses. (4 refs.)

104015 Thermometry in radiofrequency hyperthermia of malignant tumours. V.F.Lopatin, V.E.Klyuch.
Med. Radiol. (USSR), vol.28, no.7, p.29-32 (July 1983). In Russian.
The technical and methodological problems associated with intratissue and intracavitary thermometry in strong electromagnetic fields are discussed. The technical difficulties arise chiefly from the fact that the metallic conductors linking the thermosensitive elements act as receiving antennae of electromagnetic energy, which can create large errors in temperature measurement. Hence at the present time much effort is being devoted to the development and testing of contact thermometry techniques designed to reduce or eliminate electromagnetic interference between the electromagnetic field and the thermal sensors. The principles of some of these methods are described. In addition much work is being done on techniques of contactless thermometry, e.g. the use of infrared pyrometers. The development and introduction of high-precision methods of contactless intratissue thermometry should help to provide a more reliable and complete picture of the temperature distribution over the area of the body being examined. (10 refs.) *A.J.B.*

104016 Operator exposure to radiofrequency fields near a hyperthermia device. M.A.Stuchly, M.H.Repacholi, D.W.Lecuyer (Radiation Protection Bur., Health & Welfare Canada, Ottawa, Ontario, Canada).
Health Phys. (GB), vol.45, no.1, p.101-7 (July 1983).
Radiofrequency-induced hyperthermia has recently gained acceptance in cancer therapy. One of a few commercially available systems is the Magnetrode, a device operating at 13.56 MHz with an output power up to 1000 W. Heating of the prescribed part of the patient's body is accomplished by one of the coil electrodes. To assess exposure to the operator of the device, the intensities of the electric and magnetic fields in the vicinity of three Magnetrode coils were measured, while a human phantom or a human being was in the coil. Exposure to the device operator is compared with the recommendations of the Canadian safety code and the recent ANSI recommendations. (9 refs.)

104017 A method for the detection of amyloid in human tissue embedded in epon using a combination of polarizing light microscopy and electron microscopy. D.C.Cottell (Dept. of Pathology, Univ. Coll., Dublin, Ireland).
J. Microsc. (GB), vol.131, pt.1, p.119-25 (July 1983).
The method described uses a combination of congo red staining and polarizing microscopy. The method involves the removal of the embedding medium from semi-thin sections prior to staining with congo red and examination in the polarizing microscope. Typical apple green birefringence was detected in areas of amyloid deposition; these areas were mapped for selective trimming and ultra-thin sections taken serially were examined in the electron microscope. The method was found to be reliable, easy to use and particularly of value as a sampling procedure prior to investigation in the electron microscope. (22 refs.)

104018 Responses to 'Viewpoint: Lasers in Biomedicine'. J.A.Parrish (Wellman Lab., Massachusetts General Hospital, Boston, MA, USA), M.Wolbarsht, R.Goldstein, J.A.Dixon, T.Fuller, A.G.Doukas, R.R.Alfana, R.A.Guidi.
Laser Focus (USA), vol.19, no.8, p.57-9 (Aug. 1983).
Presents several responses from medical practitioners, researchers and laser manufacturers to an article by Michael W. Berns (see ibid., vol.19, no.6, p.66, 1983) in which forecasts and assessments were made for laser applications in biomedicine. (no refs.)

104019 Radiometer receivers for microwave thermography. D.V.Land (Univ. of Glasgow, Glasgow, Scotland).
Microwave J. (USA), vol.26, no.5, p.196-201 (May 1983).
Discusses microwave thermography which is the technique of measuring the natural thermal radiation from the human body in the microwave region. Describes a prototype radiometer system operating at 3.1 GHz. It is a single sideband superheterodyne with a 14 dB gain, 2.5 dB noise figure RF preamplifier. The IF amplifier has a bandwidth of 350 MHz, a noise figure of 2.5 dB and a gain of 46 dB. A tunnel diode detector is used and the radiometer modulation frequency is 1 kHz. A temperature resolution of approximately 0.1K is obtained for a response time of three seconds. (11 refs.)

104020 Colorimetric and cytophotometric investigation of an improved Papanicolaou staining procedure in cervical cells. A.Ruter (Univ. Wurzburg, Wurzburg, Germany), D.Wittekind, H.M.Aus.
Microsc. Acta (Germany), vol.87, no.3, p.245-69 (May 1983). In German.
The staining patterns of a modified Papanicolaou staining method and of its constituent procedures are compared with those from the common Papanicolaou method. The staining results are investigated by CIE-DIN-standardized color analysis. The medical investigator is able to discriminate more colors than this cytophotometric method, but this method is superior in the exact determination of colors. For neither of the Papanicolaou staining methods it is possible to indicate one or two wavelengths for cytophotometric measurement using narrow-band filters which allows an optimal automated separation of nuclei, cytoplasms and background of all cell types. This usual color analyzing method enables a better evaluation of the common Papanicolaou staining patterns. (12 refs.)

104021 Magnetic resonance in medical techniques: new possibilities. B.Dance.
Mundo Electron. (Spain), no.130, p.139-43 (July 1983). In Spanish.
Recent collaboration between physicists and medical investigators has led to the use of Nuclear Magnetic Resonance (NMR) techniques for producing images of the organs of living people without surgery. The new Topical Magnetic Resonance (TMR) technique is currently being developed with superconducting magnets for monitoring the energy-giving phosphate metabolism within living animals without taking fluid samples from them. These new techniques which employ radio frequency waves combined with magnetic fields and which are believed to cause no hazard to the patients are reviewed. (no refs.)

104022 Reconstructing NMR images from projections under inhomogeneous magnetic field and nonlinear field gradients. Ching-Ming Lai (Anologic Corp., Wakefield, MA, USA).
Phys. Med. & Biol. (GB), vol.28, no.8, p.925-38 (Aug. 1983).
Both inhomogeneity in the main magnetic field and nonlinearity in the gradient fields introduce errors in NMR images reconstructed from projections. It is found that the image artefacts caused by these two sources are separable. The inhomogeneous main field blurs the image while the nonlinear gradients distort the image. Firstly, blurring is removed by reconstructing the image curvilinearly in a coordinate system defined by the gradient fields. The distortions in the image are then corrected by taking an inverse coordinate transformation from the gradient-field coordinates to the spatial coordinates. Experiments performed by computer simulations are presented to demonstrate that, for the first time, accurate images can be found under large inhomogeneity and nonlinearity in the fields. Mathematical derivations and computational techniques are also described and discussed. (11 refs.)

104023 Monitoring variations of biological impedances using microwave Doppler radar. A.Thansandote, S.S.Stuchly, A.M.Smith (Dept. of Electrical Engng., Univ. of Ottawa, Ottawa, Ontario, Canada).
Phys. Med. & Biol. (GB), vol.28, no.8, p.983-90 (Aug. 1983).
A microwave Doppler radar for continuously monitoring time-varying biological impedances is described. The radar compares the phase of the signal scattered from a region of biological tissue with that of the transmitted signal. The phase changes of the scattered signal are an indication of the net impedance changes within the test region due to various physiological processes, e.g. the displacements of blood vessels during the cardiac cycle. A Doppler radar, equipped with a matched antenna, was tested with a simulation model and its detection characteristics was found to be a sinusoidal function of the antenna-object spacing. Tests with helathy human subjects were also performed at 3 GHz and 10.5 GHz. It was found that the 3 GHz Doppler radar has significantly greater penetration in tissues but is less sensitive to changes of the biological impedance than the 10.5 GHz system. (12 refs.)

104024 Permissible regimes of laser operation in medical applications. Yu.V.Afanas'ev, V.A.Isakov.
Sov. Phys.-Lebedev Inst. Rep. (USA), no.10, p.12-16 (1982). Translation of: *Sb. Kratk. Soobshch. Fiz. AN SSSR Fiz. Inst. P.N. Lebedeva*, no.10, p.15-19 (1982).
It is shown that in operations in which damaged parts of biological tissue are removed, the applied laser fluxes should be sufficiently large to allow the participation of gas-dynamic processes in the interaction. In this case, the danger of thermal injury to the undamaged tissue is considerably lowered. (3 refs.)

How far does thermal damage extend beneath the surface of CO_2 laser incisions? .... See Entry 103796

NMR imaging [computerized tomography] .... See Entry 104106

87.60J Corpuscular radiation and radioisotopes

(inc. X-rays and gamma-rays)

104025 Stepwise-control concept for the ray therapy of tumors. V.K.Ivanov.
Autom. & Remote Control (USA), vol.43, no.12, pt.2, p.1587-91 (Dec. 1982). Translation of: *Avtom. & Telemekh. (USSR)*, vol.43, no.12, p.105-10 (Dec. 1982).
An algorithm is proposed for the stepwise optimization of ray therapy which minimizes the survival of cancer cells in a set of admissible treatments for each irradiation. In case of unusual situations the cure may be interrupted. A set of programs for realizing this algorithm on a digital computer is described. (10 refs.)

104026 Radiation therapy and antitumoral immunity. The immunomodifying effects of ionizing radiation. V.B.Klimovich.
Med. Radiol. (USSR), vol.28, no.7, p.77-84 (July 1983). In Russian.
The results of numerous clinical and experimental studies on immunooncology are described, and their significance in regard to the interrelationships of the various factors in radiation therapy and antitumoral immunity is discussed. From examination of these results it may be concluded that immunological factors play a significant part both in the realization of the therapeutic effects of irradiation and also in restraining its effectiveness. Studies of the immunological aspects of oncology and radiology should therefore be directed towards the search for methods of controlling the immune reactions of an organism. Such an approach could reveal ways of increasing significantly the efficacy of radiology. (58 refs.) *A.J.B.*

104027 A computerized system for the elastic matching of deformed radiographic images to idealized atlas images. R.Bajcsy, R.Lieberson, M.Reivich (Univ. of Pennsylvania, Philadelphia, PA, USA).
J. Comput. Assisted Tomogr. (USA), vol.7, no.4, p.618-25 (Aug. 1983).
A system of computer programs is described which, for the first time, is able to use computerized tomographic data to automatically locate, measure, and describe anatomical structures of interest with accuracy and consistency. Input to the system consists of any digitized radiographic data. Computer assisted tomographic (CAT) scans of the head were used in this first implementation. Using these data and a predefined atlas picture representing an idealized view of the average normal image, an individualized atlas was created. From the individualized atlas, structure size, density, location displacement, and distortion may be calculated. The individualized atlas created using high resolution data, such as the CAT scan, may then be directly superimposed on pictures obtained using lower resolution modalities, such as positron emission tomographic scan images. This allows the precise location of structures poorly visualized by the secondary imaging modality. This system is capable of using either two- or three-dimensional data. (12 refs.)

104028 Quantitative image reconstruction with weighted backprojection for single photon emission computed tomography. E.Tanaka (Div. of Phys., Nat. Inst. of Radiological Sci., Chiba-shi, Japan).

J. Comput. Assisted Tomogr. (USA), vol.7, no.4, p.692-700 (Aug. 1983).

The new method described is basically a filtered backprojection with some modifications. The algorithm consists of three steps: normalization of observed projections, modified convolution operation, and weighted backprojection. The weighting function for backprojection is determined to provide perfect attenuation compensation for a uniform attenuation medium and to keep the statistical noise in the reconstructed image low. The relative contributions of two conjugate projections to the image can be controlled by the reconstruction parameters, enabling improvement of the signal-to-noise ratio and spatial resolution at off-center area compared with the conventional averaging method of two conjugate projections. Simulation studies indicated that the method provides a satisfactory image for an extended source of ^{99m}Tc (μ=0.15 cm^{-1}) having a diameter of up to approximately 35 cm. A myocardium phantom is adequately reconstructed from a 180 ~225°C angle scan. The effect of nonuniform attenuation medium surrounding the source region can be corrected. This paper presents the mathematical basis of the procedure, the evaluation of the statistical noise, and some illustrative computer simulations. (23 refs.)

104029 Gold-195 m: new diagnostic possibilities in nuclear medicine with an ultra-short-lived radionuclide. J.Schneider.

Biomed. Tech. (Germany), vol.28, no.7-8, p.173-6 (July-Aug. 1983). In German.

195 m-Au with a half-life of 30.5 sec, and a gamma-energy of 261 keV is available from a generator system. The generator contains a sterile, pyrogen-free column, which is loaded with 195 m-Hg (half-life 41.6 hr). The generator is available in an additional lead casing as a bedside system. 195 m-Au obtained through a continuous decay of 195 m-Hg, is eluated with a sterile thiosulphate solution and applied to the patient in a small bolus. Clinical evaluation can be done in various projections and under various loading steps in 3- to 5-min.-intervals. (16 refs.)

104030 Mean transit time image—a new method of analyzing brain perfusion studies. Z.Szabo, F.Ritzl (Dept. of Nuclear Medicine, Municipal Hospital Wuppertal, Wuppertal, Germany).

Eur. J. Nucl. Med. (Germany), vol.8, no.5, p.201-5 (1983).

Point-by-point calculation of the mean transit time based on gamma fit was used to analyze brain perfusion studies in a vertex view. The algorithm and preliminary results in normal brain and in different stages of cerebral perfusion abnormality (ischemia, stroke, migraine, tumor, abscess) are demonstrated. In contrast to the traditional methods using fixed, a priori defined regions of interest this type of mapping of the relative regional cerebral perfusion shows more clearly the irregular outlines of the disturbance. Right to left activity ratios in the arterial part of the time-activity curves showed significant correlation with the mean transit time ratios (Q_t=1.185-0.192Q_a, n=38, r=0716, P<0.001). (43 refs.)

104031 Medium energy proton accelerator for therapy. B.Gottschalk (Harvard Cyclotron Lab., Cambridge, MA, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3063 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).

The author presents the specifications for a small synchrotron making low-current adjustable-energy proton beams for radiotherapy, which is to be built within the next three years. (no refs.)

104032 Dual-energy Compton-scatter densitometry. A.L.Huddleston (Dept. of Radiology, Texas Tech. Univ., Lubbock, TX, USA), J.B.Weaver.

Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.7, p.997-1002 (July 1983).

The determination of the electron density of a substance may lead to characterization of the structure and function of the substance. Medical applications of this assessment may provide useful information describing the status of human tissues, such as bone. The non-invasive method presented is the dual-energy Compton-scattering technique, which incorporates the determination of an effective attenuation coefficient for the substances under study. The theoretical considerations of dual-energy Compton scattering are presented, as well as the results of experiments using samples of materials of known electron density. The radionuclide gadolinium-153 provides two photon energies, 41 keV and 100 keV for the scatter measurements. This method is found to have an accuracy of 1-3%. (8 refs.)

104033 Iso-effect tables and therapeutic ratios for epidermoid cancer and normal tissue stroma. L.Cohen, M.Creditor (Dept. of Radiation Oncology, Michael Reese Hospital, Chicago, IL, USA).

Int. J. Radiat. Oncology Biol. Phys. (GB), vol.9, no.7, p.1065-71 (July 1983).

Available literature on radiation injury to normal tissue stroma and ablation of epidermoid carcinoma was surveyed. Computer programs (RAD3 and RAD1) were then used to derive cell kinetic parameters and generate iso-effect tables for the relevant tissues. The two tables provide a set of limiting doses for tolerance of normal connective tissue (16% risk of injury) and for ablation of epidermoid cancer (16% risk of recurrence) covering a wide range of treatment schedules. Calculating the ratios of normal tissue tolerance to tumor control doses for each treatment scheme provides an array of therapeutic ratios, from which appropriate treatment schemes can be selected. (40 refs.)

104034 The simulation of electron beam therapy employing cone collimation. D.Jones (Northwest Medical Phys. Center, Seattle, WA, USA).

Int. J. Radiat. Oncology Biol. Phys. (GB), vol.9, no.7, p.1097-8 (July 1983).

A simple device is described which is used to determine treatment distance and beam direction in electron therapy employing cone collimation. A technique for the production of irregular field templates and localization films is given. (no refs.)

104035 Characterization of laser-produced plasma X-ray sources for use in X-ray radiography. D.L.Matthews, E.M.Campbell, N.M.Ceglio, G.Hermes, R.Kauffman, L.Koppel, R.Lee, K.Manes, V.Rupert, V.W.Slivinsky, R.Turner, F.Ze (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).

J. Appl. Phys. (USA), vol.54, no.8, p.4260-8 (Aug. 1983).

The authors report the absolute conversion efficiency ξ_x from the incident laser light energy to X-ray photons for the laser-produced plasmas. Potential X-ray backlighting (radiography) line sources having photon energies from 1.4 to 8.6 keV are studied as a function of laser wavelength, pulsewidth, and intensity. The laser intensity and pulsewidth range from 10^{14} to 10^{16} W/cm^2, 100 ps to 2 ns and include incident wavelengths of 1.06, 0.53, and 0.35 μm. The authors found that *K*-shell X-ray line emission ξ_x: (1) decreases with increasing X-ray energy, (2) decreases with increasing laser intensity, (3) decreases rapidly with pulselength, and (4) moderately increases with decreasing laser wavelength. On the contrary, for Au *M* band emission, at a fixed laser intensity and pulsewidth, ξ_x significantly increases (~25X) upon decreasing the laser wavelength from 1.06 to 0.35 μm. (14 refs.)

104036 The influence of scattered radiation on the CT numbers of bone on a scanner with a fixed detector array. R.P.Moran (Dept. of Radiation Oncology, McGill Univ., Montreal, Quebec, Canada), W.S.Y.Kwa, S.A.G.Chenery.

Phys. Med. & Biol. (GB), vol.28, no.8, p.939-51 (Aug. 1983).

A dependence of the CT number upon radial position of a bone plug in a unit density phantom is observed with a scanner employing a fixed detector array. The effect of the signal produced by scattered radiation from the phantom is analysed. A scatter correction consisting of a fixed fraction of the incident X-ray intensity is considered. The resultant error from such a correction is found to depend upon the ratio of the scatter to the primary detected intensities and is shown to be consistent with the observed results. (12 refs.)

104037 A study of image discrepancies due to object time-dependence in transmission and emission tomography. W.R.Ip, J.E.Holden, S.S.Winkler (Dept. of Medical Phys. & Radiology, Univ. of Wisconsin, Madison, WI, USA).

Phys. Med. & Biol. (GB), vol.28, no.8, p.953-62 (Aug. 1983).

In conventional computed tomography (CT) imaging of a point object, projection filtering causes the back-projected contributions to image positions away from the point to sum to zero. If the point object intensity is time-dependent, and all the projections are not acquired simultaneously, this cancellation cannot be complete and artefacts result. Loss of spatial invariance makes a general linear-system approach to the problem impossible. The authors have studied the properties of such artefacts by the computer simulation of decaying exponential time-dependence in three different spatial distributions and four transmission and emission CT geometries. Spatially complex time-dependent objects typically produce artefacts that can be treated as an additional broad-spectrum noise source with a power comparable to that of other CT noises. Artefacts from broad ranges of similar time-dependence can add coherently to cause patches of artefact, particularly in geometries with a strong correlation between projection acquisition time and projection angle. As expected, artefacts are reduced for all geometries as scan duration is reduced. In the authors' model, with a most rapid decay constant of 1.2 min^{-1}, negligible artefacts were observed for a six second scan duration. (8 refs.)

104038 The ramp injection of radiotracers for blood flow measurement by emission tomography. C.C.Duncan (Dept. of Pediatric Neurology, Yale Univ. School of Medicine, New Haven, CT, USA), R.M.Lambrecht, A.Rescigno, C.-Y.Shiue, G.W.Bennett, L.R.Ment.

Phys. Med. & Biol. (GB), vol.28, no.8, p.963-72 (Aug. 1983).

A prototype instrument based on the coincidence detection of annihilation radiation was built to control the arterial concentration of a radionuclide as a uniformly increasing ramp function over a preset injection interval (ranging from 1.6 min to 13.6 h). The device was designed to accommodate radionuclides of different physical and biological half-life, and the physiological characteristics of the system being studied. A kinetic model based on the Kety-Schmidt integral (1948) was developed to permit the determination of cerebral blood flow (CBF). Both the kinetic model and the ramp injector were tested in cats studied with the PETT III positron emission tomograph and 4-(^{18}F)-fluoroantipyrine as the CBF tracer. The ratio λ/f of the brain-to-blood partition coefficient (λ) and blood flow (f) were determined simultaneously by serial measurements with positron emission tomography. (22 refs.)

104039 Neutron radiography and autoradiography at the J. Stefan Institute. J.Rant, M.Copic, V.Dimic, R.Ilic, M.Najzer, G.Pregl ('J. Stefan' Inst., 'E. Kardelj' Univ. of Ljubljana, Ljubljana, Yugoslavia).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.281-90

At 250 kW TRIGA Mark II reactor in Ljubljana two different neutron radiographic facilities are constructed. One facility is primarily used for NR inspection of macroscopic objects, while the other is intended for microneutronography and neutron induced autoradiography. Neutron radiography was used in examination of abnormally elongated Al-clad TRIGA fuel elements and applied for few users in aircraft, chemical, ski and metallurgical industry. Experimental and theoretical study has been done, elucidating the role of back-diffused betas in imaging process with beta-emitting converter screens and the spatial resolution of radiographic techniques has been determined. A comprehensive and fundamental study of neutron radiographic and autoradiographic properties of various SSNTD-s is in progress. The applications of neutron induced autoradiography with SSNTD-s are presented. Ultra high resolution heavy charged particle relief autoradiography with gelatine as an imaging material was introduced. (54 refs.)

104040 The use of neutron radiography and microdensitometry in the study of instrumental effectiveness on dental tissue in the process of mineralization. J.M.Vulcain, J.Tamisier (UER d'Odontologie, Univ. de Rennes, Rennes, France), J.H.Espie, R.Masse, A.Laporte.

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.555-63

Neutron-radiography is used as a non-destructive method of exposing the peripheral part of the root canal which, in the course of endodontic treatment, is to be removed by root therapy instruments. Samples are treated with an agent of contrast with high screen power for neutrons: gadolinium which is used in the form of a citrate solution, it slowly diffuses through non-mineralized structures and settles like the other rare earths on the interface of mineralized tissues and of those in the process of mineralization. This mechanism is on occasion controlled by the richness of proteoglycans in this tissue. Once the samples are saturated, a neutron-radiographic image is made, then analyzed by microdensitometry so as to obtain a quantitative parameter. After instrumentation of the samples, a new neutron-radiographic image, and a new microdensitometric analysis are made. The results thus obtained make it possible to quantify the effectiveness of the various instruments available for endodontic treatments. (26 refs.)

104041 Fast neutron radiography in biology and medicine. E.Duhmke, L.Greim (Radiological Clinic, Univ. of Kiel, Kiel, Germany).

Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.573-80

Fast neutrons are necessary for neutron radiography of extended biological objects. Applying cellulose nitrate foils to assure specific neutrograms undisturbed by X- and γ-ray effects, a multifoil stack can be used as detector in order to improve image quality and to reduce neutron dose down to less than 10 rem. Neutron radiography enables one to observe the exsiccation process in biological materials, e.g. wood, which could not be achieved by X-ray radiography. In medicine neutron radiography could be of value for detecting pathological changes within bone such as replacement of bone marrow by fat or tumor, as shown in human vertebral columns. (9 refs.)

104042 Digital radiography—some system design considerations. P.O.Scheibe (ADAC Lab., Sunnyvale, CA, USA).
Proceedings of the Fifteenth Hawaii International Conference on System Sciences 1982, Honolulu, HI, USA, 6-8 Jan. 1982 (HI, USA: Hawaii Int. Conference Syst. Sci. 1982), p.2-11 vol.2
Constraints on design and realization of digital radiography (DR) systems are obtained from fundamental considerations. These considerations and other factors are illustrated by discussion of a DR system for fluorography. (6 refs.)

104043 Removal of streaking artifact in computed tomography. R.L.Morin (Dept. of Radiology, Univ. of Minnesota, Minneapolis, MN, USA), D.E.Raeside.
Proceedings of the Fifteenth Hawaii International Conference on System Sciences 1982, Honolulu, HI, USA, 6-8 Jan. 1982 (HI, USA: Hawaii Int. Conference Syst. Sci. 1982), p.32-41 vol.2
In transmission Computed Tomography, relative X-ray attenuation measurements are made at various angles around a patient's body. These input projection data are reconstructed to yield a cross-sectional view of internal structure. If the body section contains material which severely attenuates the X-ray beam (e.g., surgical clips, lead fragments) high density streaks which obliterate internal structure will be produced in the process of image reconstruction. This loss of diagnostic information renders the scan useless. A technique has been developed which removes this imaging artifact. The approach views the affected projection data as misinformation. These data are assigned new values and image reconstruction is performed without changing existing computer hardware or software. Projection data for a head section containing a lead fragment were obtained by Monte Carlo simulation. Three methods of obtaining replacement data were examined. A nearest neighbor pattern recognition technique yielded excellent results. (36 refs.)

104044 The effect of noise in computed tomographic reconstructions on detectability. K.M.Hanson (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
Proceedings of the Fifteenth Hawaii International Conference on System Sciences 1982, Honolulu, HI, USA, 6-8 Jan. 1982 (HI, USA: Hawaii Int. Conference Syst. Sci. 1982), p.67-70 vol.2
The detectability of features in an image is ultimately limited by the random fluctuations in density or noise present in that image. The noise in CT reconstructions arising from the statistical fluctuations in the one-dimensional input projection measurements has an unusual character owing to the reconstruction procedure. Such CT image noise differs from the 'white' noise normally found in images in its lack of low-frequency components. The noise power spectrum of CT reconstructions can be related to the effective density of X-ray quanta detected in the projection measurements, designated as NEQ (noise-equivalent quanta). The detectability of objects that are somewhat larger than the spatial resolution is directly related to NEQ. Since contrast resolution may be defined in terms of the ability to detect large, low-contrast objects, the measurement of a CT scanner's NEQ may be used to characterize its contrast sensitivity. (37 refs.)

104045 A digital X-ray image processing system for measurement of phasic blood flow in coronary arteries. P.Spiller, J.Jehle, B.Politz, F.K.Schmiel (Medizinische Klinik B, Univ. Dusseldorf, Dusseldorf, Germany).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.223-6
Densitometric evaluations of cineangiograms have shown that flow rates in coronary arteries can be determined from the propagation of contrast material (CM). The method is based upon the measurement of the transit time of the CM through a fixed distance of the vessel. As the temporal resolution of this technique is limited by the cine frame rate to 10 ms, a relatively high measurement error results, if the transit time amounts to only some 10 ms. To solve this problem a digital image processing system was developed by which the displacement of the CM during a fixed time interval is measured. The images of the cineangiograms are scanned by a video camera, A/D-converted (8 bit, 10.5 MHz) and buffered as a matrix in a fast semiconductor memory. Pairs of two consecutive cine frames are subtracted from each other in order to form a display which shows only the differences of the two analyzed frames. Thus the passage of the front of the contrast medium is visualized. From a series of difference images phasic flow velocities can be determined. The accuracy of this method to measure coronary artery flow was proved by comparison with photodensitometrically determined data. (4 refs.)

104046 Real-time study of cardiac functions. M.Kiri, K.Kume, I.Tanaka (Shimadzu Corp., Kyoto, Japan), J.Ohno.
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.295-8
Presents new nuclear imaging system which enables the real-time monitoring of cardiac functions during exercise studies. The data from the gamma camera is collected in image mode about every 30 beats spanning the average cycle with fifteen to thirty 64×64 images. At the end of every 30 beats, the cardiac functional parameters such as the ejection fraction (EF), the heart rate (HR), the relative cardiac output (CO), and the relative end diastolic (ED) volume are calculated and displayed along with the averaged volume curve. This system is not a conventional minicomputer system but a LSI-based system, equipped with a large capacity LSI image memory and a powerful image processing hardware units. Now the physician can decide more precisely the extent of the exercise the patient can do, and he can acquire sufficient data for analysis. Moreover, sensitive and accurate analysis of the cardiac functions can be done, taking into account the observed states of the patient during the exercise study. (3 refs.)

104047 Using a gamma camera to follow left ventricular function during transient ischaemic attacks. M.Morgan, M.Croom, G.Davies, P.Crean, T.Pratt, W.Bencivelli, A.Maseri (Royal Postgraduate Medical School, London, England).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.299-302
Presents a system to follow changes in ventricular volumes during rapid haemodynamic transients using gamma camera imaging. Current ventricular function assessment by gamma camera (gated blood pool or first pass studies) does not allow the assessment of haemodynamic changes. The system uses a minicomputer to record data, in list mode, from the gamma camera, and to process them to obtain time activity curves beat by beat from regions of interest. A moving average over 21 beats allowed sufficient statistical accuracy to produce reliable data which accurately describes the sequence of ventricular changes without significant distortion of the signal. (4 refs.)

104048 Quantification of regional ventricular function with vector Fourier analysis of gated images. J.Machac, K.Miceli, S.F.Horowitz, M.Prior, S.J.Goldsmith (Div. of Cardiology, Mount Sinai Medical Center, New York, NY, USA).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.303-6
A method of analysis of radionuclide cardiac gated blood pool studies is presented. Effective mean regional phase and amplitude summation vectors are obtained, using trisectional subdivision of the left and right ventricles. This system was applied to the analysis of timing abnormalities caused by left bundle branch block. Results for 6 normal subjects and 6 patients with left bundle branch block are presented. Timing differences between left and right ventricles as well as within each ventricle are demonstrated. This method offers a unified quantitative approach to the simultaneous analysis of both magnitude and timing abnormalities of myocardial contraction. (10 refs.)

104049 Improved quantitation of stress/redistribution TL-201 scintigrams and evaluation of normal limits. K.Van Train, E.Garcia, J.Maddahi, D.Brown, A.Waxman, J.Areeda, D.Berman (Cedars-Sinai Medical Center, Los Angele, CA, USA).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.311-14
To overcome problems associated with subjective interpretation of stress/redistribution Tl-201 scintigrams, the authors previously developed and validated a method for the quantification of Tl-201 myocardial distribution and washout. Improvements in this method have been to increase objectively by reducing operator interaction and the addition of a comprehensive final report form. Abnormality in this analysis is determined by comparing the patient's stress and washout profiles with normal limits statistically derived from a group of normal patients. Since the decision on which normal population to use is still controversial, an evaluation was made of two different 'normal' populations. From this evaluation an accurate definition of normal limits was established and these limits were incorporated into the analysis. (8 refs.)

104050 Analysis of regional function in radionuclide ventriculography: physiological signal, scintillation noise, and regional size. M.A.Douglas, J.J.Bailey, P.P.van Rijk, S.L.Racharach, R.O.Bonow, M.V.Green (Nat. Inst. of Health, Bethesda, MD, USA).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.315-18
The left-ventricular region-of-interest (ROI) in 64 radionuclide ventriculograms was divided into radial sectors (2-, 3-, 4-, 6-, and 12-sectors/ROI). Time-activity curves (TACs) were derived globally (total ROI) and sectorially. The pointwise deviation of the TAC was used as a noise estimator and the amplitude of the first Fourier harmonic used as a signal estimator. The relationship of signal/noise ratios, so defined, to Fourier analysis is described. The results suggest strongly that the physiologic signal is largely contained in 4 harmonics and that higher harmonics relate to noise of various sources and should be suppressed. Filtering at 4 harmonics will improve the S/N ratio by 8-17 fold. It is also shown that the poorer counting statistics in regions smaller than 1/4 ROI degrade the S/N ratio in a high proportion of TACs; such TACs cannot be distinguished from background TACs in terms of S/N or harmonic content, and therefore cannot yield reliable parameters of regional myocardial function. (7 refs.)

104051 A new method for the temporal evaluation of ventricular wall motion from digitized contrast ventriculography. O.Ratib, A.Righetti (Cardiology Center, Univ. Hospital, Geneva, Switzerland), G.Brandon, L.Rasoamanambelo.
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.409-12
Describes a new approach which permits an easy evaluation of the temporal sequence of regional ventricular wall motion from contrast cineangiograms. Phase analysis is applied for the assessment of the sychronicity of regional wall motion from the measurement of displacement of the ventricular endocardial edges instead of changes in density of each picture element. This technique can therefore be applied to images obtained either after peripheral or after conventional intraventricular injection. (9 refs.)

Industrial and medical applications of accelerators with energies less than 20 MeV .... See Entry 99771

Short-term induced hyperglycemia in experimental tumour radiation therapy .... See Entry 103954

The results of cytogenetic analysis of human peripheral blood lymphocytes performed at various times after radiotherapy .... See Entry 103961

Radiation-induced injury of the esophagus .... See Entry 103988

Measurement of liver volume by ultrasound and computed tomography .... See Entry 103991

A method for the detection of amyloid in human tissue embedded in epon using a combination of polarizing light microscopy and electron microscopy .... See Entry 104017

Estimation of the genetically significant dose from diagnostic X-ray procedures in the Islamic Republic of Iran .... See Entry 104057

Lung dose calculations using computerized tomography: is there a need for pixel based procedures? .... See Entry 104059

Substantiation of local hyperthermia in radiation therapy .... See Entry 104110

Design of a dedicated heavy ion accelerator for radiotherapy .... See Entry 104114

87.60L Preparation of radioactive materials for medical and biomedical uses

104052 External tandem target system for efficient production of short-lived positron emitting radionuclides. K.Koh, R.Finn, T.Wooten, J.Dwyer, Y.Sheh, J.Sinnreich (Cyclotron Facility, Mount Sinai Medical Center, Miami Beach, FL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3064-6 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
Recent developments in radiopharmaceutical chemistry allow the incorporation of short-lived, positron-emitting radionuclides into a variety of compounds which when used with a positron emission tomograph provide a means of monitoring physiological disorders by a standard technique. To effectively meet the increased 'in-house' clinical demands while maintaining a production schedule, a tandem target was designed and has been installed for the simultaneous 'on-line' preparation of oxygen-15 labelled compounds such as CO_2^{15},

H_2O^{15}; and nitrogen-13 labelled compounds such as $^{13}NH_3$, $^{13}N_2O$, and $^{13}N_2$. The processing time required for the synthesis of the nitrogen-13 products as compared to the essentially instantaneous formation of oxygen-15 labelled compounds has provided the necessary time delay for clinical utilization. The characteristics of this external tandem target system as well as the automation for the dual processing is presented. (5 refs.)

104053 Development and use of the ^{195m}Hg-^{195m}Au generator for first pass radionuclide angiography of the heart. R.Bett (AERE, Harwell, Didcot, England), J.G.Cuninghame, H.E.Sims, H.H.Willis, D.S.Dymond, W.Flatman, D.L.Stone, A.T.Elliott.
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.7, p.959-63 (July 1983).
Describes the preparation and characteristics of a ^{195m}Hg-^{195m}Au generator for clinical use in first-pass radionuclide angiography of the heart. The generator has an efficiency of elution of 20-30% which is maintained over the whole of its useful life. Over 100 patients have taken part in clinical trials with the generator. (11 refs.)

Industrial and medical applications of accelerators with energies less than 20 MeV ....See Entry 99771

Gold-195 m: new diagnostic possibilities in nuclear medicine with an ultra-short-lived radionuclide ....See Entry 104029

87.60M Radiation dosimetry

104054 Recent results of the German Thorotrast study—dose relevant physical and biological properties of Thorotrast equivalent colloids. W.Riedel, A.Dalheimer, M.Said, U.Walter (Klinikum Steglitz, Freien Univ. Berlin, Berlin, Germany), A.Kaul.
Health Phys. (GB), vol.44, suppl.1, p.293-8 (1983). (Proceedings of an International Conference on Radiobiology of Radium and the Actinides in Man, Lake Geneva, WI, USA, 11-16 Oct. 1981).
As a prerequisite for quantifying the nonradiation effect of Thorotrast, nonradioactive and radioactive aquasols with identical physicochemical properties and with biophysical behavior comparable to that of Thorotrast were developed and produced for a second long-term animal experiment. Comparative investigations with hafnium and zirconium (zirconotrast) dioxide aquasols showed the latter to be most appropriate considering the size of both the dispersoids and the aggregates in the liver tissue. The average particle diameters of ThO_2, ZrO_2 and HfO_2 proved to be values of 9.3 nm, 15 nm and 45 nm, respectively. Radioactive zirconotrast was prepared by radiochemical incorporation of ^{230}Th and ^{228}Th at dose rates which produce accumulated doses in the liver of rats equivalent to those of commercial ^{230}Th enriched Thorotrast after 1.5 yr. Five different colloids were prepared with α-energy emission rates increased by factors of 1, 2.5, 5, 10 and 25 compared to Thorotrast and then injected into rats. (6 refs.)

104055 Microdosimetry of plutonium in lungs. W.Hofmann (Div. of Biophys., Univ. of Salzburg, Salzburg, Austria).
Health Phys. (GB), vol.44, suppl.1, p.419-29 (1983). (Proceedings of an International Conference on Radiobiology of Radium and the Actinides in Man, Lake Geneva, WI, USA, 11-16 Oct. 1981).
Chord length distributions for alveolar cells and cell nuclei were determined by superimposing computer-generated α-particle tracks on magnified images of randomly selected rat lung sections using the Quantitative Television Microscope. Specific energy distributions were then calculated by applying image analysis techniques. These microdosimetric calculations suggest that radiation carcinogenesis can be described in physical terms by the number of cells hit in a defined tissue volume, the specific energy distribution in these cells, the resulting number of nonlethally damaged cells which are susceptible to transformation, and their spatial distribution. If multicellular effects are involved in radiation carcinogenesis, then hot spots might be more carcinogenic than the uniform distribution at low doses and less carcinogenic at high doses. (20 refs.)

104056 Distribution and dosimetry studies after incorporation of ^{239}Np (^{239}Pu) in mice. W.A.Muller, U.Linzner.
Health Phys. (GB), vol.44, suppl.1, p.577-80 (1983). (Proceedings of an International Conference on Radiobiology of Radium and the Actinides in Man, Lake Geneva, WI, USA, 11-16 Oct. 1981).
4-week-old female NMRI mice were injected intraperitoneally with 6.5 mCi ^{239}Np per Kg body weight. The retention pattern over 336 hr is shown. About 50% of injected ^{239}Np was retained in the skeleton and 5% in the liver. Dose calculations were made for both ^{239}Np and ^{239}Pu (the daughter of ^{239}Np). A long-term experiment for osteosarcoma risk from ^{239}Np skeletal β-doses is also discussed. (11 refs.)

104057 Estimation of the genetically significant dose from diagnostic X-ray procedures in the Islamic Republic of Iran. M.Sohrabpour, N.P.Saheli, P.Zarsav, D.Reza Esmaeeli (Nuclear Res. Center, Atomic Energy Organization of Iran, Tehran, Iran).
Health Phys. (GB), vol.45, no.1, p.21-9 (July 1983).
The genetically significant dose from diagnostic X-ray sources has been estimated. Age and sex distribution was based on a survey of 13100 patients. Dosimetry was performed on patients and on an equivalent-man Rando phantom. Child-expectancy factors were estimated from the census results of fertility and mortality rates. The genetically significant dose value for the diagnostic procedures to the Iranian population was estimated to be 9.2 mrem/yr in 1980. (9 refs.)

104058 A suggested limit for population exposure to radiofrequency radiation. D.F.Cahill (Health Effects Res. Lab., US Environmental Protection Agency, Research Triangle Park, NC, USA).
Health Phys. (GB), vol.45, no.1, p.109-26 (July 1983).
In order to determine whether the current database was sufficient to support an interim determination of a limit for USA population exposure to radiofrequency (RF) radiation (0.5 MHz-100 GHz), a critical and comprehensive review of the available literature on the biological effects of RF radiation was recently completed. In the analysis of this data, a number of simplifying assumptions has to be employed; among them was the use of the specific absorption rate (SAR) as the mass-normalized, frequency-independent measure of RF energy input into biological systems. The biological effects reported in acceptable studies were assessed in terms of their associations with (1) core temperature increases, (2) SAR, (3) SAR as a percentage increase over resting metabolic rate, and (4) direct evidence for human effects. Based on information now available and analyzed from these four perspectives, a conservative SAR threshold value of approx. 0.4 W/kg is apparent. Since the unknowns and uncertainties are potentially significant, one might consider, from the standpoint of prudence, the further application of a safety factor of 10. Given the present state of knowledge, the resultant SAR limit of 0.04 W/kg is, in the author's opinion, unlikely to be associated with the adverse health effects in the general population. (138 refs.)

104059 Lung dose calculations using computerized tomography: is there a need for pixel based procedures?. J.Van Dyk (Phys. Div., Ontario Cancer Inst., Princess Margaret Hospital, Toronto, Ontario, Canada).
Int. J. Radiat. Oncology Biol. Phys. (GB), vol.9, no.7, p.1035-41 (July 1983).
Radiotherapy of tumors within the thorax often requires radiation beams that traverse lung tissues. Not only do lungs consist of large volumes of low density tissues but, in addition, lung tissues are more radiosensitive than most other tissues. Computed tomography (CT) provides the detailed anatomic and geometric data ideally suited for accurate lung dose calculations. However, most radiotherapy centers do not have direct access to a CT scanner for planning purposes. In addition, it is argued by some that it is not necessary to use the CT pixel data directly for lung dose calculations but that it is sufficient to have the lung geometry outlined and to assume some average bulk density (not related to that specific patient) for the total lung volume. This study analyzes the potential errors in lung dose calculations when different lung density assumptions are made. The conclusions show that different levels of accuracy can be achieved with different levels of sophistication in lung density assumptions. However, the delivery of radiation absorbed dose to lung to an accuracy of 5% for all patients will require the detailed anatomical density data that are provided by CT. (18 refs.)

104060 Radium retention and dosimetry in the St. Bernard. R.D.Lloyd, G.N.Taylor, C.W.Jones, C.W.Mays (Radiobiology Lab., Univ. of Utah, Salt Lake City, UT, USA).
Radiat. Res. (USA), vol.95, no.1, p.150-7 (July 1983).
The percentage total-body retention (R) of ^{226}Ra was determined in 14 young adult St. Bernards for the first 4 years after injection to be represented by the equation, $R=34.8\ e^{-0.165t}+24.6\ e^{-0.00537t}+40.6\ e^{-0.000503t}$, where t is the time after injection in days. It was found that the ^{222}Rn/^{226}Ra ratio in the skeleton was similar to that measured previously for young adult beagles given ^{226}Ra. Excretion of injected ^{226}Ra averaged about 32% in the first 2 weeks, with about 2/3 of the total appearing in the faeces. St. Bernards appear to retain more ^{226}Ra than do beagles injected at the same age. The last two terms of the retention equation were used to calculate the average skeletal radiation dose rate and cumulative radiation dose normalized to each dog's individual retention measurements. Allowance was made in the calculations for the changing skeletal retention of ^{222}Rn and its radioactive daughters as a function of time. (25 refs.)

104061 Radiation doses from the transport of radioactive materials. K.B.Shaw (Nat. Radiological Protection Board, Chilton, England), B.Holyoak.
Radiol. Prot. Bull. (GB), no.53, p.8-11 (July 1983).
The transport of technetium generators for hospital use accounts for about 49% of the occupational exposure for the normal transport of radioactive materials. Other isotopes for medical and industrial use contribute about 38% of the occupational exposure and the remainder can be attributed to transportation as a result of the nuclear fuel cycle including the transport of irradiated nuclear fuel. The occupational collective dose for all modes of transport is estimated at 1 man Sv y^{-1} (100 man rem y^{-1}). (1 ref.)

104062 The exposure of the EC population from nuclear industry effluents. M.Broomfield (Nat. Radiological Protection Board, Chilton, England).
Radiol. Prot. Bull. (GB), no.53, p.23-7 (July 1983).
The collective dose commitment to the European Community (EC) population from routine effluents released from nuclear power stations and reprocessing plants within the Community in 1978 amounts to about 500 man Sv. Most of this is received within a few years of the discharge, while approximately 90 man Sv is delivered at very low dose rates over several thousands of years. The collective dose commitments associated with discharges from the nuclear power stations are small, in no case exceeding a few man Sv. Carbon-14. (4 refs.)

Charged-particle transport in one-dimensional systems [dosimetry application] ....See Entry 99050

Inter-laboratory standardization of glass dosimeters ....See Entry 99732

Fast neutron detection with Al_2O_3 thermoluminescence dosimeter ....See Entry 99733

The 'CBA' dosimeter for determination of high dose ....See Entry 99736

Neutron dosimetry with spherical ionisation chambers. V. Experimental measurements and comparison with calculations of the cavity size dependence of the specific ionisation ....See Entry 99738

Bulk response of some polymeric nuclear track detectors to ionizing radiation ....See Entry 100186

On the use of cellulose nitrate as solid state nuclear track detector. II. Response to light particles and applications ....See Entry 100191

The pairing extrapolation ionization chamber for (n,γ) mixed field dosimetry ....See Entry 100194

Ionizing radiation: sources and biological effects ....See Entry 103951

Recent results of the German Thorotrast study—epidemiological results and dose effect relationships in Thorotrast patients ....See Entry 103966

Dose-response relationships for bone cancers from plutonium in dogs and people ....See Entry 103969

Incidence of radiation-induced skin tumours in mice and variations with dose rate ....See Entry 103979

Response of mouse lung to irradiation at different dose-rates ....See Entry 103981

Spectral irradiances of and maximal permissible exposures to two indirect ophthalmoscopes ....See Entry 104013

Fallout $^{239/240}$Pu and ^{238}Pu in human tissues from the Federal Republic of Germany ....See Entry 104066

Measured ^{234,238}U and fallout ^{239,240}Pu in human bone ash from Nepal and Australia: skeletel alpha dose ....See Entry 104068

Site specific derived limits for stack discharges ....See Entry 104075

Linear electron accelerator used to study the radiobiological effects of high doses of fast electrons ....See Entry 104129

Fast neutron beam formed at the isochronous cyclotron U-240, and study of its dosimetric characteristics ....See Entry 104130

87.60P Radiation protection

(inc. radiation monitoring)

An alpha-particle imaging system for detecting plutonium contamination ....See Entry 99734

Access control system in the Hamaoka Nuclear Power Station ....See Entry 99737

Radiation environment during the commissioning and power runup in the fifth unit at the Novyiu Voronezh nuclear power station ....See Entry 99739

Radon concentration and exhalation measurement with a semiconductor detector and an electrostatic precipitator working in a closed circulation system ....See Entry 103772

87.60R Radioactive pollution

(see also 86.70 Environmental science)

104063 Measurement techniques for radium and the actinides in man at the Center for Human Radiobiology. R.E.Toohey, A.T.Keane, J.Rundo (Radiological & Environmental Res. Div., Argonne Nat. Lab., Argonne, IL, USA).
Health Phys. (GB), vol.44, suppl.1, p.323-41 (1983). (Proceedings of an International Conference on Radiobiology of Radium and the Actinides in Man, Lake Geneva, WI, USA, 11-16 Oct. 1981).
Various techniques are employed to determine the amounts, retention, and distribution of radioactivity in human subjects in vivo. The principal method is γ-ray spectrometry with large NaI(Tl) scintillation crystals ('whole-body counting'). The geometries used include an arc of 1.5-m radius in which all parts of the body are roughly equidistant from the detector, a reclining chair and a flat bed with detectors placed above and below the subject. When a sufficient amount of radioactivity is present in a subject, scanning techniques assist in determining its distribution in the body. Specialized instruments such as xenon-filled proportional counter and a dual-crystal (phoswich) detector are used to measure low-energy photon emitters, primarily plutonium and americium. There are three primary methods of calibrating the detectors. The first is analytical, in which a rigorous mathematical treatment is employed; the second involves the administration of tracer amounts of radioactivity to human volunteers; the third consists of determining detector response to known amounts of radioactivity in a phantom. All three methods can be intercompared, and further evaluated by comparing the results of measurements in vivo with those of postmortem analyses. (81 refs.)

104064 Identification of ^{241}Am in the axillary lymph nodes with an intrinsic germanium detector. S.G.Graham, S.J.Kirkham (AWRE Aldermaston, Reading, England).
Health Phys. (GB), vol.44, suppl.1, p.343-52 (1983). (Proceedings of an International Conference on Radiobiology of Radium and the Actinides in Man, Lake Geneva, WI, USA, 11-16 Oct. 1981).
A routine measurement with two 200 mm-diameter phoswich detectors, placed one each side of the sternum, yielded an apparent lung content of 17 nCi ^{241}Am for a subject. Inspection of the data revealed that there were many more counts from the left side than from the right and that there was greater number of Np L X-rays observed, relative to the Lγ-ray, than would be expected for a uniform lung distribution of ^{241}Am. These observations suggested a shallow localised deposit in the left side of the chest. The subject's working history could not rule out an inhalation exposure, but he was known to have had a wound contaminated with Pu/Am in his left hand 16 yr previously. The wound had contained approx. 0.02-0.03 μCi ^{241}Am initially, most of which was excised from the wound site after 50 days. Prompted by this knowledge the authors used a 50 mm-diameter intrinsic Ge detector to examine the wound and relevant lymph node sites. The results demonstrated a localised deposit of ^{241}Am in the axillary lymph node sites. The results demonstrated a localised deposit of ^{241}Am in the axillary lymph nodes with approx. 1 nCi ^{241}Am at the wound site. Subsequent measurements made with the phoswich detectors suggested that there was approx. 7 nCi ^{241}Am in the lymph nodes with approx. 1 nCi ^{241}Am in the liver, thereby accounting for most of the detectable ^{241}Am contamination in the thorax. (8 refs.)

104065 Uranium and thorium isotopes and their state of equilibria in lungs from uranium miners. M.E.Wrenn, N.P.Singh (Dept. of Pharmacology, Univ. of Utah, Salt Lake City, UT, USA), G.Saccomanno.
Health Phys. (GB), vol.44, suppl.1, p.385-9 (1983). (Proceedings of an International Conference on Radiobiology of Radium and the Actinides in Man, Lake Geneva, WI, USA, 11-16 Oct. 1981).
Radiochemical analysis of seven lungs obtained at autopsy show that concentrations ranged between 6 and 63 pCi/kg for ^{238}U and 6-66 pCi/kg, for ^{234}U. Similarly, ^{230}Th ranged from 17 to 54 pCi/kg, two orders of magnitude higher than ^{230}Th observed in the lungs of the general population from the Western mining region. For individual lungs, ^{238}U and ^{234}U were close to equilibrium with an average ratio of ^{238}U/^{234}U of 0.94 and a range of 0.80-1.02. Surprisingly, ^{230}Th was close to equilibrium with ^{234}U with a ^{230}Th/^{234}U ratio of 1.1 and a range from 0.54 to 2.6. Equilibrium between U and Th isotopes is in contrast to the disequilibrium reported in beagles which chronically inhaled carnotite, where the ^{230}Th/^{234}U ratio was observed to range from 5.4 to 7.4 with an average of 6.3. The average radiation dose rate to lung from each of the three radionuclides was calculated. The combined radiation dose rate (at death) due to three long-lived radionuclides ^{238}U, ^{234}U and ^{230}Th varied from 2.5 to 14.2 mrad/yr with a mean of 9.6 mrad/yr. The concentration of ^{226}Ra and daughters in the lung was not determined. (10 refs.)

104066 Fallout $^{239/240}$Pu and ^{238}Pu in human tissues from the Federal Republic of Germany. K.Bunzl, W.Kracke (Inst. fur Strahlenschutz, Neuherberg, Germany).
Health Phys. (GB), vol.44, suppl.1, p.441-9 (1983). (Proceedings of an International Conference on Radiobiology of Radium and the Actinides in Man, Lake Geneva, WI, USA, 11-16 Oct. 1981).
To determine the present level of plutonium in human tissues of people in the FRG, due solely to fallout from weapons testing, 30 sets of tissues and bones from Munich residents were obtained at autopsy. Each set of tissues consisted of the entire lung, the entire liver, 300 g vertebrae, 300 g ribs and the lymph nodes. All subjects were males, born before 1940. Wet ashing, followed by solvent extraction, electrodeposition, and α-spectrometry were used to isolate and quantitate the plutonium isotopes present. The median concentrations of $^{239/240}$Pu (in fCi/kg wet weight) observed were: livers (530), vertebrae (92), ribs (73), lymph nodes (58) and lungs (28). The ratio of ^{238}Pu/$^{239/240}$Pu (in %) was livers 3.5, lungs 5.6, ribs 4.0 and vertebrae 3.2. Age trends for the plutonium concentration in livers, vertebrae and ribs were not observable. Possible correlations between the plutonium concentrations in livers, lungs and bones are discussed. The results are in many respects similar to observations in the USA and Southern Finland. (24 refs.)

104067 Actinides concentrations in human tissues. H.Kawamura, G.I.Tanaka (Div. of Radioecology, Nat. Inst. of Radiological Sci., Ibaraki, Japan).
Health Phys. (GB), vol.44, suppl.1, p.451-6 (1983). (Proceedings of an International Conference on Radiobiology of Radium and the Actinides in Man, Lake Geneva, WI, USA, 11-16 Oct. 1981).
Fallout, ^{239,240}Pu concentrations in some autopsy tissues from the general population in Japan are described. Body burden and relative distribution among tissues of plutonium were obtained by extrapolating using the mass of relevant tissues of the normal Japanese adult. ^{239,240}Pu-to-^{90}Sr body burden ratio was obtained. ICRP models were used to estimate body burden and relative contribution of ingestion intake. Need for data on the intraskeletal distribution of fallout plutonium and more information on gastrointestinal absorption in man was stressed. (18 refs.)

104068 Measured ^{234,238}U and fallout ^{239,240}Pu in human bone ash from Nepal and Australia: skeletel alpha dose. I.M.Fisenne, P.M.Perry, N.Y.Chuy (Environmental Measurements Lab., US Dept. of Energy, New York, NY, USA), N.H.Harley.
Health Phys. (GB), vol.44, suppl.1, p.457-67 (1983). (Proceedings of an International Conference on Radiobiology of Radium and the Actinides in Man, Lake Geneva, WI, USA, 11-16 Oct. 1981).
Human bone samples from Nepal and Australia were analyzed for isotopic uranium and fallout plutonium. The Nepalese samples were obtained for a 3-yr period (1976-78) while the Australian samples are representative of a single year (1977). The surface air plutonium concentrations for the latitude bands of these countries were either measured and/or estimated from 1954 through 1978. With the plutonium air concentrations and age-dependent breathing rates as input data, the measured human bone results were compared with skeletal estimates derived from the ICRP Task Group Inhalation Model, and the agreement was found to be reasonably good. The measured isotopic uranium concentrations in these samples provide a benchmark against which to assess fallout plutonium based upon a comparison of the skeletal α radiation dose from a natural actinide to these populations. (30 refs.)

104069 Plutonium concentration in human tissues: comparison to thorium. N.P.Singh, M.E.Wrenn (Dept. of Pharmacology, Univ. of Utah, Salt Lake City, UT, USA), S.A.Ibrahim.
Health Phys. (GB), vol.44, suppl.1, p.469-76 (1983). (Proceedings of an International Conference on Radiobiology of Radium and the Actinides in Man, Lake Geneva, WI, USA, 11-16 Oct. 1981).
The concentration of ^{238}Pu and ^{239,240}Pu, and of ^{228}Th, ^{230}Th, and ^{232}Th were measured in 10 sets of human tissues from Washington, DC, and 12 sets from rand Junction, CO. The tissues were collected at autopsy by qualified pathologists from normal healthy persons most of whom died suddenly. The subjects had acquired plutonium from fallout of global nuclear testing and burnup of a space nuclear generator utilizing ^{238}Pu. The organ distribution pattern shows that most of the plutonium was accumulated in bone and liver with 54-60% in bone and 34-43% in liver. Only 3-6% was found in lung including lymph nodes; kidney, spleen, thyroid and gonads together contained around 1%. The analytical results show three major differences between plutonium and thorium concentrations and organ distributions: (1) for plutonium the liver is a major locus for storage ($\sim$40% of that found in the total body), whereas little thorium is accumulated in the liver (around 4%); (2) the relative amounts of ^{230}Th and ^{232}Th are much higher in lung and lymph nodes (10-28%) than currently for plutonium (3-6%); (3) the ratio of thorium concentrations in lymph nodes to lung is significantly higher than the ratio of plutonium concentrations in lymph nodes to lung showing thereby that fallout plutonium is more soluble than natural thorium. (25 refs.)

104070 Iodine-129 in mule deer thyroids in the Rocky Mountain West. O.D.Markham (Radiological & Environmental Sci. Lab., US Dept. of Energy, Idaho Falls, ID, USA), T.E.Hakonson, F.W.Whicker, J.S.Morton.
Health Phys. (GB), vol.45, no.1, p.31-7 (July 1983).
Thyroids from mule deer (Odocoileus hemionus) were collected in New Mexico, Colorado, Wyoming, and Idaho and ^{129}I/^{127}I atom ratios were determined. Iodine-129/127 atom ratios were significantly ($P<0.005$) different among states. Ratios in Wyoming and Idaho control thyroids were significantly ($P<0.05$) larger than ratios in New Mexico and Colorado. Fallout from past atmospheric nuclear tests at the Nevada Test Site is suggested as a possible explanation for the differences in ratios. Average ^{129}I/^{127}I ratios in thyroids of other large mammals collected 54 km west and 116 km northeast of the Idaho National Engineering Laboratory (INEL) in southeastern Idaho were up to 15 times those found in control thyroid samples from Idaho. Atmospheric effluents from the Idaho Chemical Processing Plant located on the INEL were likely responsible for the increased ratios in animals collected in the INEL vicinity. Although of no health consequence to the animals, ^{129}I in deer thyroids may be a sensitive indicator of contaminants from nuclear fuel reprocessing plants and atmospheric nuclear tests or accidents. (20 refs.)

104071 Retention of inhaled $^{238}PuO_2$ in beagles: a mechanistic approach to description. J.A.Mewhinney, J.H.Diel (Lovelace Biomedical & Environmental Res. Inst., Albuquerque, NM, USA).
Health Phys. (GB), vol.45, no.1, p.39-60 (July 1983).
Groups of beagle dogs received inhalation exposure to one of three sizes of monodisperse or a polydisperse aerosol of $^{238}PuO_2$. Periodic sacrifice of pairs of dogs through 4 yr after inhalation exposure provided data on the retention, translocation and mode of excretion of ^{238}Pu. Fragmentation of $^{238}PuO_2$ particles deposited in lung led to enhanced dissolution, translocation and excretion of ^{238}Pu compared to previous studies using $^{239}PuO_2$. A mechanistic simulation model was formulated to account for particle dissolution and fragmentation. This model provided adequate prediction of the time course of lung retention, uptake and retention in other organs and excretion. Predictions of the model provided more accurate description of the data than the Task Group on Lung Dynamics model incorporated in the ICRP Publication 30. The mechanistic model provided estimates of cumulative radiation dose to liver and bone that are a factor of five greater and to lung that are a factor of two less than predicted by the Task Group Lung Model. (32 refs.)

104072 Levels of ^{226}Ra, ^{210}Pb and ^{TOTAL}U in fish near a Saskatchewan uranium mine and mill. S.M.Swanson (Saskatchewan Res. Council, Saskatoon, Saskatchewan, Canada).
Health Phys. (GB), vol.45, no.1, p.67-80 (July 1983).
Reports experiments showing that radionuclide levels in fish from the Beaverlodge Lake area, Saskatchewan, Canada, varied significantly among lakes, species and tissues, but did not vary with fish sex or age. Fish from lakes affected by an operating uranium mine and mill had radionuclide levels one to two orders of magnitude above levels in fish from an uncontaminated control lake. Concentrations were greatest in white suckers, intermediate in lake whitefish, and low in lake trout. Skin and bone contained the highest radionuclide levels; levels in flesh were much lower. Bioconcentration factors varied among sites, species and tissues. The primary radionuclide transfer pathway appears to be via sediments, either through direct contact or through food organisms. Bottom-feeding species had the highest radionuclide levels while piscivorous fish had the lowest levels. The internal dose rate to noncontrol fish are comparatively low; any effects are likely to occur at the genetic level. (24 refs.)

104073 Radon-222 and progeny measurements in 'typical' East Tennessee residences. W.A.Goldsmith, J.W.Poston, P.T.Perdue, M.O.Gibson (Health & Safety Res. Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Health Phys. (GB), vol.45, no.1, p.81-8 (July 1983).
Modified Wrenn chambers for continuous monitoring of ^{222}Rn, featuring several improvements including a computer-assisted electronics package, have been developed at the authors' institute. A field test of these instruments was conducted by placing them in the homes of staff members. Field testing was conducted in seven houses for periods ranging from 4 to 18 days. During this testing period, the ^{222}Rn concentration in these houses was monitored continuously. Radon-222 concentrations in the basements of three of the seven houses were in excess of 100 Bq/m^3 almost continuously. One residence had instantaneous concentrations approaching 1000 Bq/m/^{3}. Samples of soil and building materials from these residences indicated that ^{226}Ra concentrations were in the normal range (40 Bq/kg). Radon progeny measurements were made in five of these houses on a 'typical' day. Results obtained were as follows: for basements, a geometric mean of 0.016 WL (geometric SD of 2.9); for upper floors a geometric mean of 0.014 WL (geometric SD of 2.9). This paper summarizes the results obtained in the field test. (10 refs.)

104074 Assessments of the radiological consequences of postulated accidental releases from the Sizewell PWR. G.N.Kelly (Nat. Radiological Protection Board, Chilton, England).
Radiol. Prot. Bull. (GB), no.53, p.15-20 (July 1983).
Assessments have been carried out under contract to a number of organisations presenting evidence to Sizewell PWR enquiry which began at Snape Maltings in Suffolk, UK, in January 1983. These organisations are the Central Electricity Generating Board, the Nuclear Installations Inspectorate, the Greater London Council and the Friends of the Earth Trust. The main features of these assessments are summarised. (10 refs.)

104075 Site specific derived limits for stack discharges. J.Hallam (Nat. Radiological Protection Board, Chilton, England).
Radiol. Prot. Bull. (GB), no.53, p.20-3 (July 1983).
Deals with the procedure for estimating site specific derived limits for discharges of radioactivity into the atmosphere taking into account the conditions of the release and the location of the exposed population. The author considers: input parameters; calculation of basic parameters; calculation of a site specific derived limit. (2 refs.)

An alpha-particle imaging system for detecting plutonium contamination .... See Entry 99734
Health effects guidance for uranium in drinking water .... See Entry 103740
Occurrence of uranium in drinking water in the US .... See Entry 103741
Release of man-made krypton 85 to the atmosphere .... See Entry 103759
Comparison of radiological changes in humans and beagles with skeletal deposits of radium .... See Entry 103967
A note on radium body content and breast cancer in UK radium luminisers .... See Entry 103971
A demographic model for performing site-specific health risk projections .... See Entry 103973
Iodine-129 uptake and effects of lifetime feeding in rats .... See Entry 103974
Microdosimetry of plutonium in lungs .... See Entry 104055
The exposure of the EC population from nuclear industry effluents .... See Entry 104062

87.65 AERODSPACE BIOPHYSICS AND MEDICAL PHYSICS (EFFECTS OF ACCELERATIONS, WEIGHTLESSNESS AND ENVIRONMENT)

(see also 94.80 Aerospace facilities and techniques; space research)

104076 The significance of gravity on biological systems. A.H.Brown (Univ. of Pennsylvania, Philadelphia, PA, USA).
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.3-9
Gravity is one of the three or four most important environmental factors that affect organisms. The author develops some thoughts which, if not altogether new, can be described in ways that may not have been heard before. In addition he recalls some early pioneering studies in space biology that contain lessons which ought not to be forgotten. He also introduces some novel ideas that may be found useful. (19 refs.)

104077 The Biorack. D.A.M.Mesland, A.F.L.Soons (Special Projects Div., ESA Tech. Directorate, Noordwijk, Netherlands).
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.11-15
The Biorack is a multi-user-facility for research on small biological specimens in the microgravity environment of Spacelab. The units that constitute the Biorack, i.e. incubators, a cooler/freezer combined unit, a glovebox and various ancillary items are described, both from the functional and from the performance point of view. Biorack will first fly on the German D1 Spacelab mission, due for mid-1985. The experiments for this flight have been selected by ESA and a summary is given of the associated scientific research areas. (no refs.)

104078 Ground-based studies on gravitropism and on maximum yield of wheat. F.B.Salisbury (Plant Sci. Dept., Utah State Univ., Logan, UT, USA).
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.17-19
There is a necessity for ground-based, fundamental research in support of and generation of ideas for space experiments. The author reviews a few highlights from his studies, mostly those relating to the gravitropic responses of higher plants, particularly leafy dicot stems. (6 refs.)

104079 A method to record the circadian rhythm in a unicellular green algae under extraterrestrial conditions. D.Mergenhagen (Inst. fur Allgemeine Botanik, Hamburg, Germany).
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.21-4
Since it is still an open question whether an endogenous timer (a 'physiological clock') or so far unknown external timers (=zeitgebers) drive the circadian rhythm in living organisms, the observation of a free-running circadian rhythm under conditions free of terrestrial zeitgebers could help to prove the existence of an endogenous clock. The photoaccumulation behavior of the green algae Chlamydomonas reinhardii is subjected to such a circadian rhythm. A device is described to study the rhythm in this organism on board of the Space Shuttle. Preliminary results with miniaturized test cuvettes show that the observed rhythm does not differ from rhythms obtained with the laboratory standard test system. (4 refs.)

104080 How to prove the sensivity of plants towards gravity?. D.Volkmann, A.Sievers (Botanical Inst., Univ. of Bonn, Bonn, Germany).
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.25-6
The sensitivity of organisms towards external stimuli, e.g. light, chemicals or gravity, is one main problem of stimulus perception and response. In the case of gravity, data concerning the sensitivity are provided only very incompletely by experiments using clinostats. Therefore it is proposed that the graviperceiving system of plant roots should be investigated under microgravity in space. The approach considered is to correlate the data of response kinetics with the ultrastructure of the graviperceiving cells. (6 refs.)

104081 Effects of space environmental factors on cell proliferation. H.Planel, R.Tixador, G.Gasset, G.Richoilley, J.C.Bes (Lab. de Biologie Medicale, Faculte de Medecine, Toulouse, France).
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.29-31
CYTOS experiments, performed aboard the Soviet orbital station Salyut 6, have shown that exposure to space environmental factors results in an increase in cell growth rate, cell volume and cell water content. Changes have been also reported in protein and electrolyte content. The respective roles of microgravity and cosmic rays, in these responses, will be investigated using, in the BIORACK, cultures exposed to zero g or placed in a 1g centrifuge. (13 refs.)

104082 Growth and differentiation of Bacillus subtilis at microgravity. H.J.Rhaese (Inst. fur Mikrobiologie/Molekulare Genetik, Univ. Frankfurt, Frankfurt/Main, Germany), P.Schiller.
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.33-6
The purpose of Biorack experiment 28D planned for the D1 mission is to investigate the effect of prolonged microgravity on growth and differentiation (sporulation) of the prokaryote Bacillus subtilis. Short generation times (about 25 min) and remarkable sizes of population (10^8-10^9 individuals) allow one to study the effect of this very important physical factor on proliferation in 10 and more generations. Likewise, the influence of microgravity on spore formation, especially on asymmetric septum formation, a typical differentiation assocated event observed at the beginning of sporulation, can be studied in large populations (10^8-10^9). Growth will be monitored by optical density measurements and differentiation by electron microscopic studies (after the end of the mission) using samples fixed with glutaraldehyde at different stages of sporulation. (9 refs.)

104083 Effects of low gravity on mammalian cell polarization at the ultrastructural level. M.Bouteille, M.Gregoire, F.Bard, C.A.Bourgeois, A.M.Dupuy-Coin, D.Hemon, G.Geraud (Lab. de Pathologie Cellulaire, Paris, France).
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.41-3
The purpose of the authors' experiment is to investigate the possibility that weightlessness induces changes at the ultrastructural level of the cell and at its metabolism. By means of ultrastructural three-dimensional and stereological methods, a search for such changes will be done in highly polarized, suspended plasma cells. The experiments will take place in the Biorack of Spacelab. (8 refs.)

104084 The problem of long-term function of neutrophils in studies on the effects of gravity on motility, shape and structure of locomotor cells. A.Zimmermann, H.U.Keller, H.Cottier (Inst. of Pathology, Univ. of Bern, Bern, Switzerland).
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.45-8
Polarisation and locomotor responses of neutrophil granulocytes decrease with storage time at 4°C and preincubation at 37°C. Maintenance of these functions could not be improved by increasing the buffer capacity of the medium, addition of vitamins, pyruvate and nonessential amino acids or dihydroxybenzoic acid, or by lowering the cell concentration. (6 refs.)

104085 Graviperception, mitotic activity and cell differentiation in lentil seedling roots. G.Perbal, N.Darbelley, D.Driss-Ecole, G.Salle (Lab. de Cytologie et Morphogenese Vegetales, Univ. Pierre et Marie Curie, Paris, France).
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.49-52
The gravity sensing cells of lentil roots are located in the center of the root cap. They contain voluminous amyloplasts which can move under the influence of gravity. In vertically oriented roots, these organelles lie on large aggregates of endoplasmic reticulum, the role of which is not well understood. When the roots are placed horizontally, bending occurs. This is due to an asymmetry of growth of the upper and lower sides of the stimulated roots. Mitotic activity and cell differentiation in roots appear to be influenced by the mechanism of graviperception. The space experiment proposed will therefore analyse the role of the endoplasmic reticulum-amyloplasts complex in the perception of gravity and the effects of microgravity on cell differentiation and meristematic activity in lentil roots. (31 refs.)

104086 Physarum polycephalum: contraction behavior, direction and velocity of protoplasmic streaming in near weightlessness. V.Sobick, I.Block (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt eV, Cologne, Germany).
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.53-6
To investigate the open question of whether cells are sensitive to acceleration stimuli, the authors propose a Biorack experiment with the slime mold Physarum polycephalum. The experiment is based upon the clinostat results: 1. A significant, but transient, decrease in the strand's radial activity period duration occured during Og simulation; 2. The velocity of the protoplasmic streaming (shuttle streaming) increased up to the termination of the Og simulation. To analyse these reaction under microgravity conditions in Spacelab a special hardware has been developed. It mainly consists of sub sample containers (SSC), a glove box microscope combined with a photodiode system (for measuring the strand's radial activity) and a cine camera (for registration of the velocity and direction of the shuttle streaming). After the mission the experimental data will be evaluated in the authors' laboratory. (7 refs.)

104087 Experiment A08/32/CH: 'effect of spaceflight on lymphocyte activation'. A.Cogoli, A.Tschopp (Lab. fur Biochem., Eidgenossische Tech. Hochschule, Zurich, Switzerland).
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.57-61
In the experiment proposed lymphocytes in blood samples withdrawn from the flight crew prior, during and after flight will be exposed to the mitogen Con A and cultured in-vitro. Cell proliferation, protein biosynthesis, ultrastructure and other biological parameters will be determined. The objectives are: a) biomedical, i.e. the adaptation of the immune response to the stress of spaceflight; b) basic research, i.e. the differentiation of cells cultured at low-g; c) biotechnological, i.e. methods for bioprocessing in space will be tested. The hypothesis that low-g depresses lymphocyte activation whereas high-g has a stimulatory effect will be challenged. Two other related experiments will be performed on Spacelab: 1ES031 on S1-1 and 240 on S1-4. (16 refs.)

Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206) .... See Entry 98659

87.70 BIOMEDICAL ENGINEERING

104088 Muscle function test device for measuring forces in the region of the angle joint. K.-W.Beste (Zentrum Radiologie, Medizinischen Hochschule Hannover, Hannover, Germany).
Biomed. Tech. (Germany), vol.28, no.7-8, p.168-73 (July-Aug. 1983). In German.
Strong ankle joint musculature is necessary for walking. Therefore in testing a patients walking capability, the force during dorsal flexion and plantar flexion should be measured in addition to the blood flow in the lower leg. For that purpose a muscle test device was designed on which the patient is placed in a flat position on a movable couch. The patient treads against foot-sheets which are connected with two measuring devices made of aluminium alloy (30×350×120 mm). Four strain gauges are fixed onto each of these sheets measuring the forces exerted by the pressure of the sole (plantar flexion) and the opposite tension (dorsal flexion). The resistance variations of the strain gauges are determined with an electronical indicating device including a bridge circuit, sample-hold technique and a digital voltmeter. The measuring sheets were loaded with calibration weights. A linear relation between weight and indicated digital value of the strain gauges was found in the range 0-250 kg. (37 refs.)

104089 Removal of eye movement and ECG artifacts from the non-cephalic reference EEG. C.Fortgens, M.P.De Bruin (Dept. of Neuropsychiatry, Psychiatric Centre Rosenburg, Hague, Netherlands).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.1, p.90-6 (July 1983).
A method is described that automatically eliminates eye movement artifacts from EEG records and creates an extracranial reference electrode in one single process. The usefulness of this method is illustrated for both standard EEG recording as well as for CNV and P300 potentials. The artifact signals are measured with a special set of electrodes and are combined in order to subtract the artifacts from contaminated EEG records. The subtraction ratios, are determined as those that minimize the variance in the resulting corrected EEG signal. (26 refs.)

104090 Spike detection based on a pattern recognition approach using a microcomputer. P.Guedes de Oliveira, C.Queiroz (Dept. of Electronics, Univ. of Aveiro, Aveiro, Portugal), F.Lopes da Silva.
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.1, p.97-103 (July 1983).
A system for the detection of spikes and sharp waves in EEGs of epileptic patients is described. The system uses a pattern recognition technique and it is implemented in a hybrid microcomputer. It performs the on-line simultaneous analysis of 4 EEG channels and thus it is appropriate for long-term EEG recording. The performance of the system was considered satisfactory when compared with that of a panel of electroencephalographers. (26 refs.)

104091 Elimination of EMG interference during recording of somatosensory evoked potentials elicited by posterior tibial nerve stimulation in patients with cervical spinal cord injury. P.L.Perot,Jr., C.L.Vera, E.L.Fountain (Dept. of Neurological Surgery, Medical Univ. of South Carolina, Charleston, SC, USA).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.1, p.104-9 (July 1983).
Recording somatosensory evoked potentials (SEPs) to posterior tibial nerve stimulation in some patients with acute injuries of the cervical spine can be difficult due to the presence of involuntary activity of the neck and jaw muscles. The electrical potentials derived from this myogenic activity have a distribution along the sagittal line of the head which is uniform in amplitude while the amplitude of the SEPs recorded from points along this sagittal line is maximal over a point close to the vertex and less in front and behind this point. This fact has been utilized to devise a 'bipolar' derivation with one electrode on the vertex and two electrodes, one in front and one behind it on the sagittal line tied together as a reference. This effectively eliminates potentials of muscle origin from the SEP record. Other 'bipolar' combinations are not as effective in obtaining evoked potentials free of this muscle interference. (10 refs.)

104092 A dedicated microcomputer-based instrument for interval analysis of multicomponent wave forms in single fibre EMG. G.R.Davis, I.T.Brown, M.S.Schwartz, M.Swash (Dept. of Electrical & Electronic Engng., Queen Mary Coll., London, England).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.1, p.110-13 (July 1983).
Describes a self-contained microprocessor-based instrument compatible with conventional EMG equipment for the analysis of multicomponent single fibre EMG waveforms suitable for single operator use. Intervals between four components of a motor unit action potentials can be analysed using three types of threshold or window triggers. The amplitude, duration and polarity of each of these triggers can be varied independently. The instrument is portable and useful in the clinical setting. (2 refs.)

104093 Quantification of spindles in comatose patients. G.Pfurtscheller, G.Schwarz, B.Pfurtscheller, W.List (Dept. of Computing, Tech. Univ. of Graz, Graz, Austria).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.1, p.114-16 (July 1983).
Quantification of spindles in comatose patients is easily possible by measurement of ERD (event-related desynchronization). ERD can either be positive (e.g. alpha blocking or alpha attenuation) or negative (spindle activity within the alpha band) or can be missing. Follow-up measurements in a comatose patient demonstrate the different time courses of VEP (visual evoked potential) and ERD during clinical recovery. That means that VEP and ERD are generated by different neuronal systems as reactions to the same external stimulus. (9 refs.)

104094 A new head-mounted lip-jaw movement transduction system for the study of motor speech disorders. S.M.Barlow, K.J.Cole, J.H.Abbs (Speech Motor Control Labs., Univ. of Wisconsin-Madison, Madison, WI, USA).
J. Speech & Hear. Res. (USA), vol.26, no.2, p.283-8 (June 1983).
A new head-mounted lip and jaw transduction system is described, which features (a) an ultra-low mass tubular aluminum headmount mainframe with a unique coupling apparatus, (b) a low mass transducer unit, (c) nonrestraint of the head, and (d) a transduction artifact of .1 mm or less under most recording conditions. The importance of observing labial and mandibular movements in addition to electromyographic and aerodynamic signals is emphasized by reference to actual recordings of speech from subjects with neuromotor disorders. (21 refs.)

104095 The assessment of the post-thrombotic limb by foot volumetry and pedal venous pressure. J.N.Amoore (Dept. of Biomedical Engng., Univ. of Cape Town Medical School, Observatory, Cape Town, S Africa), L.B.van Oudenhove, E.Immelman, P.Jeffery.
J. Med. Eng. & Technol. (GB), vol.7, no.4, p.180-5 (July-Aug. 1983).
Various tests, such as foot volumetry, static and ambulatory venous pressure measurements, Doppler flow recordings and calf plethysmography, have recently been developed to aid and to attempt to quantify venous insufficiency. This paper describes a simple device for measuring foot volume changes during the prescribed exercise. The foot is placed in a water-bath and the change in foot volume is recorded by a strain-gauge pressure transducer. The transducer responds to the head of water change, which, in turn, is directly proportional to the volume change. Also described is a simple device for the measurement of pedal venous pressure using a standard, commercially available transducer. The methodology of the tests is discussed, together with sample results. (7 refs.)

104096 Analysis on diagnostic criteria of pediatric ECG. J.Hosaki (Tokyo Medical & Dental Univ., Tokyo, Japan), M.Okuni, S.Kusakawa, C.Mori, K.Hayakawa, S.Honda, K.Kitada, K.Yamauchi, S.Ito.
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.281-4
By use of an automatic ECG analysis system, 78 measurements of the ECGs of 3136 healthy Japanese children aged between 3 and 18 were examined for differences due to age and sex. The examination has revealed that the amplitudes of R waves and S waves in the left precordial leads of children aged 12 and over are lower for girls than for boys. It is desirable, therefore, to improve for aplication to computer analysis, the Japanese diagnostic criteria of left ventricular hypertrophy for girls of 12 years of age and over. (5 refs.)

104097 On-line monitoring of multiple precordial leads in high risk patients with coronary artery disease. R.V.Essen, R.Hinsen, R.Louis, W.Merx, J.Silny, G.Rau, S.Effert (RWTH Aachen, Aachen, Germany).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.349-52
A computerized on-line monitoring system was designed and realized for monitoring up to 16 ECG-leads simultaneously. The aim is to detect ischemia early enough in order to protect ischemic myocardium from necrosis. The results of the first application in 50 patients with acute (n=40) or impending infarction (n=10) are presented. The patients were monitored between 24 and 48 hours (mean 35.5 hours). Using an 'averaging' technique ECG signal quality was excellent. The computer program for the evaluation of Q- and R-wave amplitudes and ST-segment elevation or depression and elimination of ectopic beats worked without any problems. The total period of monitoring was 1772.5 hours. During this time 21 ischemic attacks could be documented. All attacks were accompanied by angina and none was asymptomatic. The duration of ischemia ranged from 15 to 40 minutes. Several attacks could be stopped immediately by therapy. (5 refs.)

104098 Beat-to-beat analysis of waveshape and rhythm in XECG using inner vector product hardware. J.A.van Alste, E.D.Luursema, H.E.P.Cruts, O.E.Herrmann (Twente Univ. of Technol., Enschede, Netherlands).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.355-8
The on-line computer processing of electrocardiograms obtained from elderly patients exercising on a rowing ergometer should include both beat-to-beat analysis of the waveshape and of the cardiac rhythm, in spite of the sometimes strong baseline noise and myopotentials distorting the ECG signals. This noise can be reduced using algorithms including extensive convolution and correlation operations. These algorithms are implemented on a small computer extended with a specially designed device for the calculation of inner vector products. The basic information for the analysis of waveshape and rhythm is also extracted from the ECG in real time. (3 refs.)

104099 The design and evaluation of a real-time arrhythmia monitoring algorithm. J.Y.Wang, M.N.Shaya, E.D.Helfenbein, D.M.Sullivan, M.R.Kramer, A.D.Forbes, H.B.Jimison (Hewlett-Packard Co., Waltham, MA, USA).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.363-6
A new arrhythmia detection and identification algorithm has been developed for use in intensive and coronary care units. The design employs digital filtering of the ECG signal and a combination of template matching and feature extraction techniques for beat classification. Three separate studies were performed to evaluate the new design using both annotated digital data bases and longterm analog ECG recordings. A total of 348 hours of ECG from 311 coronary care and ambulatory patients were included. The results of these studies are presented using statistical histograms and scatter diagrams. (6 refs.)

104100 Three dimensional graphic display of cardiac motion abnormalities in myocardial infarction. K.Tamura (Dept. of Medicine, Yamanashi Medical School, Yamanashi, Japan), M.Okada.
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.417-20
In order to recognize the occurrence of cardiac motion abnormalities in myocardial infarction, three dimensional graphic display (3-D) of cardiac motion was performed by Cardiomoveogram (CMG). CMG was developed in the laboratory based on the principle of electromagnetic body motion measurement. The non-contact and noninvasive probe was used. (1) The precordial CMG mapping was performed similarly to precordial ECG mapping technique. Altogether 49 records were obtained. In computer memories, digitized CMGs were arranged in a synchronized time base. Collecting the same points in time of these CMGs, 3D-CMGs were produced. (2) In healthy persons, the cardiac motions by 3D-CMG were comparable to physiological movement of

the heart. (3) In myocardial infarction, 3D-CMG clearly showed the occurrence of dyskinetic motion of the heart in extent and severity. (3 refs.)

104101 On the analysis of ambulatory long-term blood pressure recordings. N.Saranummi, J.Heinila, S.Kalli, M.Koskela, R.Poramo (Medical Engng. Lab., Tech. Res. Centre of Finland, Tampere, Finland), V.Turjanmaa, A.Uusitalo.
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.425-8
Ambulatory long-term recordings of the intra-arterial blood pressure from the brachial artery can be made using a pressure transducer-perfuser unit connected to a FM tape recorder. The technical performance of this combination has been measured and it is shown that it fulfils the necessary requirements for a high quality registration and replay system of the blood pressure signal. The system has been used to gather material on the normotensive behaviour of the long-term blood pressure. Work is now continued with selected patient groups to assess their characteristic blood pressure pattern. The long-term records are analyzed with a VAX 11/780 computer and plotted with a digital plotter. (7 refs.)

A model of the eye for use in medical education .... See Entry 98691

Wave I of early auditory evoked potentials in multiple sclerosis .... See Entry 103867

Demonstration of useful differences between magnetoencephalogram and electroencephalogram .... See Entry 103909

Assessment of electromagnetic characteristics of the Willeford Central Auditory Processing Test Battery .... See Entry 103997

A noninvasive acoustic method using frequency perturbations and computer-generated vocal-tract shapes .... See Entry 103998

SQUID biomagnetic measurements .... See Entry 104010

Theoretical sensitivity of perivascular electromagnetic flowmeters deduced from the distribution of an applied inter-electrode potential .... See Entry 104011

A confrontation test of visual fields in the low-vision patient .... See Entry 104014

A method for the detection of amyloid in human tissue embedded in epon using a combination of polarizing light microscopy and electron microscopy .... See Entry 104017

Magnetic resonance in medical techniques: new possibilities .. See Entry 104021

Monitoring variations of biological impedances using microwave Doppler radar .... See Entry 104023

Dual-energy Compton-scatter densitometry .... See Entry 104032

Real-time study of cardiac functions .... See Entry 104046

External tandem target system for efficient production of short-lived positron emitting radionuclides .... See Entry 104052

87.70E Diagnostic methods and instrumentation

(see also 87.60 Medical and biomedical uses of fields, radiations and radioactivity)

104102 Differentiation of epileptiform abnormalities from normal transients and artifacts on ambulatory cassette EEG. J.S.Ebersole, S.L.Bridgers, G.Cloe, R.Silva (Dept. of Neurology, Yale Univ., New Haven, CT, USA).
Am. J. EEG Technol. (USA), vol.23, no.2, p.113-25 (June 1983).
Ambulatory cassette EEG (A/EEG) is gaining in popularity as an aid in the diagnosis of epilepsy and its differentiation from other causes of episodic alteration in consciousness. A study to clarify and codify rules of differentiation in the hope that the current widening use of A/EEG will be accompanied by appropriate interpretive accuracy is reported. It is concluded that artifacts and normal transients can be recognized on A/EEG, and should be appreciated but not feared. What is to be feared, given the current state of the art and science of ambulatory monitoring, is the over-zealous interpretation of equivocal events. Conservatism should be the watchword in A/EEG interpretation. A false-negative interpretation will not rule out a diagnosis of epilepsy, but a false-positive reading may inappropriately and unfortunately rule it in. (20 refs.)

104103 Frequency difference and amplitude difference pattern analysis of the electroencephalogram. S.Yoshimori, Y.Takashima (Course of Electrical Engng., Osaka Univ., Osaka, Japan), H.Takeda, S.Hata.
Bull. Univ. Osaka Prefect. Ser. A (Japan), vol.31, no.2, p.217-23 (1982).
The frequency difference and amplitude difference pattern analysis system which processes EEG signals recorded from right and left occipital sites is described. This analysis is a unique method. A preliminary experimental result concerning normal men at rest with the eyes closed and open indicates that the patterns of alpha band may be classified into three types. This method may be used for detecting the abnormal EEG. (7 refs.)

104104 A micro-computer system for cell electrophoresis measurements. R.A.Belcher (Dept. of Electrical & Electronic Engng., Univ. Coll. of Swansea, Swansea, Wales).
Radio & Electron. Eng. (GB), vol.53, no.7-8, p.283-6 (July-Aug. 1983).
Experimental measurements of the velocity of blood cells have been used in research into the early detection of cancer in patients. These measurements have been made by manually timing cells moving across a television screen. This technique is tedious, involves the timing of over a hundred cells and is therefore subject to error. A low-cost microcomputer system was designed to automate the measurement of cell velocity in order to give faster and more accurate results. (5 refs.)

104105 A solution of the ECG inverse problem based on the solid angle model. H.Ohsawa, K.Abe, H.Takeda, K.Maehara, Y.Ishiki, Y.Shimizu, T.Takishima.
Rec. Electr. & Commun. Eng. Conversazione Tohoku Univ. (Japan), vol.52, no.1, p.11-17 (June 1983). In Japanese.
According to the solid angle or electric double layer model of the electrical activity of the heart, ischaemic ST segment deflections of the electrocardiogram are determined by the geometry of the ischaemic region. A solid angle approach to obtain the solution to an important class of ECG inverse problems is presented. Assuming the knowledge of the geometry of the heart and the electrode sites, the present method can estimate the ischaemic regions on both the epicardial and endocardial surfaces from the ST segment deflection data on the body surface. The usefulness is illustrated by its application to an experimental model using the excised canine heart, where the heart is fixed in a tank filled with physiological saline and the electrodes are located on the latticed cylinder surrounding the heart. (7 refs.)

104106 NMR imaging [computerized tomography]. K.Satoh, K.Kose.
Solid State Phys. (Japan), vol.18, no.2, p.101-10 (Feb. 1983). In Japanese.
The theoretical basis and mechanics of NMR imaging are explained. The Fourier, projection and revolving system imagers are outlined. An NMR-CT facility designed by the authors is described. It consists of a maximum 1500 Oe Golay coil with a 1D scan or 350 mm×100 mm 2D scan yielding 10^{-5} degree equality, an interface, TOSBAC 7/40 microcomputer with memory, CRT display and array processor. Detailed data of saturation recovery images and practical images are shown. The scanner has been utilized for diagnostic purposes. (24 refs.) *M.O.*

104107 ECG criteria for left ventricular hypertrophy: use of ECG and echo computerized databases. L.E.Teichholz, N.R.Greenspan, D.LeBlanc, M.E.Goldman, M.H.Swartz (Div. of Cardiology, Mount Sinai Medical Center, New York, NY, USA).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.277-80
The diagnosis of left ventricular hypertrophy using standard electrocardiographic criteria suffers from a lack of sensitivity. Echocardiographic measurement of left ventricular mass has been shown to correlate with autopsy data. The authors use the RISS data base system with echocardiographic and electrocardiographic data bases, the latter generated using the Marquette 12SL computer EKG system to analyze EKG criteria of left ventricular hypertrophy. Using left ventricular mass of 215 grams as cut-off for left ventricular hypertrophy, standard EKG criteria yielded sensitivities from 6 to 31%, specificities from 82 to 99% and accuracies from 51 to 56%. The criteria used for computer assisted interpretation had slightly better sensitivity (44%) and accuracy (64%) but the diagnosis of left ventricular hypertrophy still remains a significant problem. Further work is proceeding using multivariant analysis to improve criteria. The authors believe that the approach to improvement of EKG criteria for the diagnosis of left ventricular hypertrophy requires the analysis of a computer based data base generated by merging large EKG and echo data bases. (10 refs.)

104108 Manual vs. computerized electrocardiographic measurements of the P-wave: the diagnosis of left atrial enlargement. L.E.Ginzton, J.Floro, M.Laks (Harbor-Univ. of California Los Angeles, Medical Center, Torrance, CA, USA).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.289-92
The advent of computerized electrocardiographic interpretation has resulted in the routine measurement of a large number of electrocardiographic waveform parameters including amplitude, duration, slopes, and area to which diagnostic criteria may be applied. Unfortunately, there are few studies that have validated computerized measurements the P-wave with manual measurements. Therefore, the purpose of this study is: 1. to correlate manually derived electrocardiographic P-wave measurements with two-dimensional echocardiographic left atrial volume index and, 2. to compare these manual P-wave measurements with computerized measurements. (4 refs.)

104109 Automated vectorcardiographic analysis by an inexpensive microprocessor. K.Yamauchi (School of Medicine, Nagoya Univ., Nagoya, Japan), M.Yokoi, N.Okamoto, Y.Mizuno, T.Iwatsuka, N.Kitagawa, K.Sano.
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.429-32
Based on a 15-year experience with computerized electrocardiology, the authors have developed an inexpensive, compact microcomputer system for vectorcardiographic analysis. Diagnostic accuracy of this system was tested on 2722 vectorcardiograms (VCGs) including various abnormalities. Sufficient results were obtained in most diagnostic categories. A more accurate interpretation of VCG by this system will be expected from updating the software. (4 refs.)

Medical imaging systems .... See Entry 98677

Perimetry, visual evoked potentials and visual evoked spectrum array in homonymous hemianopsia .... See Entry 103849

Measurement of liver volume by ultrasound and computed tomography .... See Entry 103991

Diagnostics with ultrasound .... See Entry 103992

Measurement of ultrasonic attenuation within regions selected from B-scan images .... See Entry 103993

Beam steering with linear arrays .... See Entry 103994

Ultrasound transducers for pulse-echo medical imaging .... See Entry 103995

An ultrasonic technique for imaging the ventricle in three dimensions and calculating its volume .... See Entry 103996

Work in progress: common carotid artery contours reconstructed in three dimensions from parallel ultrasonic images .... See Entry 103999

A comparison of two methods for determining ultrasonic intensity for medical transducers .... See Entry 104000

Computer enhancement and analysis of complete and selective displays of two-dimensional echocardiograms .... See Entry 104002

Compound sector scan echocardiography using a sub-probe of same frequency .... See Entry 104003

Mitral valve tracking of directly digitized 2D echocardiograms .... See Entry 104004

Computer-assisted evaluation of patterns of ventricular contraction during induced rapid tachycardias using two-dimensional echocardiography .... See Entry 104005

Computer assisted analysis of backscattered ultrasonic signal for in vitro atherosclerosis detection .... See Entry 104006

The analysis of two-dimensional echocardiograms using a time-varying image approach .... See Entry 104007

Automated endocardial definition of 2-D echocardiograms: a comparison of four standard edge detectors and improved threshold techniques .... See Entry 104008

Automated computer enhancement and analysis of left ventricular two-dimensional echocardiograms .... See Entry 104009

Spectral irradiances of and maximal permissible exposures to two indirect ophthalmoscopes .... See Entry 104013

Radiometer receivers for microwave thermography .... See Entry 104019

Colorimetric and cytophotometric investigation of an improved Papanicolaou staining procedure in cervical cells .... See Entry 104020

Reconstructing NMR images from projections under inhomogeneous magnetic field and nonlinear field gradients .... See Entry 104022

A computerized system for the elastic matching of deformed radiographic images to idealized atlas images .... See Entry 104027

Quantitative image reconstruction with weighted backprojection for single photon emission computed tomography .... See Entry 104028

Gold-195 m: new diagnostic possibilities in nuclear medicine with an ultra-short-lived radionuclide .... See Entry 104029

Mean transit time image—a new method of analyzing brain perfusion studies .... See Entry 104030

Characterization of laser-produced plasma X-ray sources for use in X-ray radiography .... See Entry 104035

The influence of scattered radiation on the CT numbers of bone on a scanner with a fixed detector array .... See Entry 104036

A study of image discrepancies due to object time-dependence in transmission and emission tomography .... See Entry 104037

The ramp injection of radiotracers for blood flow measurement by emission tomography .... See Entry 104038

Removal of streaking artifact in computed tomography .... See Entry 104043

The effect of noise in computed tomographic reconstructions on detectability .... See Entry 104044

A digital X-ray image processing system for measurement of phasic blood flow in coronary arteries .... See Entry 104045

Using a gamma camera to follow left ventricular function during transient ischaemic attacks .... See Entry 104047

Quantification of regional ventricular function with vector Fourier analysis of gated images .... See Entry 104048

Improved quantitation of stress/redistribution TL-201 scintigrams and evaluation of normal limits .... See Entry 104049

Analysis of regional function in radionuclide ventriculography: physiological signal, scintillation noise, and regional size .... See Entry 104050

A new method for the temporal evaluation of ventricular wall motion from digitized contrast ventriculography .... See Entry 104051

Estimation of the genetically significant dose from diagnostic X-ray procedures in the Islamic Republic of Iran .... See Entry 104057

Lung dose calculations using computerized tomography: is there a need for pixel based procedures? .... See Entry 104059

87.70G Patient care and treatment

104110 Substantiation of local hyperthermia in radiation therapy. A.N.Dedenkov, O.K.Kurpeshev.
Med. Radiol. (USSR), vol.28, no.7, p.84-8 (July 1983). In Russian.
The use of local hyperthermia for reinforcing the effectiveness of radiation therapy of oncological patients is discussed, with reference to the data of many clinical and experimental investigations of this combined treatment. It is concluded that local hyperthermia is a very promising technique in the radiation therapy of malignant tumours. However, its wide use in clinics is conditional on the solution of certain technical problems, particularly the methods of heating and temperature measurement, and also on the results of continuing study of the damaging action of hyperthermia on various tissues, both independently and in conjunction with irradiation. (no refs.) *A.J.B.*

104111 Thermal characterization of electrosurgery. T.S.Neiman, B.Dunn (Dept. of Materials Sci. & Engng., Univ. of California, Los Angeles, CA, USA), J.E.Flocken.
Biomater. Med. Devices & Artif. Organs (USA), vol.11, no.1, p.93-101 (1983).
The volumetric heating response of soft tissues to electrosurgical cutting and coagulation was studied. A series of experiments was conducted with thermistor probes embedded in a surrogate medium during controlled application of the electrosurgery current. A series of temperature profiles was obtained for various thermistor probe locations. These temperature profiles were found to be linear, exponential, or double exponential, depending upon the probe-incision distance. Temperatures next to the site of tissue destruction approached 70°C, within 2 seconds of application of power. Temperature changes due to lateral heating were an order of magnitude greater than temperature changes directly under the incision. Anisotropic heat conduction was observed for muscle fibers oriented in different directions. (6 refs.)

104112 Restoration of upper extremity function. P.H.Peckham (Case Western Reserve Univ., Cleveland, OH, USA).
IEEE Eng. Med. & Biol. Mag. (USA), vol.2, no.3, p.30-2 (Sept. 1983).
Functional neuromuscular stimulation has been shown to be a viable means of providing controlled movements in paralyzed limbs. Low levels of electrical current are effective in eliciting impulses in nerves, which then propagate to and result in a contraction of the muscle. The FNS technique encompasses many aspects of the physical and biological sciences. When properly performed, electrical stimulation can be applied effectively for extended periods of time with no significant detrimental effects to the tissue. The muscle contractions that result can be graded in strength and will fatigue minimally with time. Several clinical applications of FNS to paralyzed patients have been investigated. The technique has demonstrated its viability in applications to both the upper and the lower limbs in patients sustaining a variety of neurological diseases, including stroke, cerebral palsy, and spinal cord injury. This technique promises to be an important adjunct to clinical care in the future. (5 refs.)

104113 The treatment of scoliosis using electrical stimulation of muscle. M.A.Herbert (Hospital For Sick Children, Toronto, Ontario, Canada).
IEEE Eng. Med. & Biol. Mag. (USA), vol.2, no.3, p.43-9 (Sept. 1983).
Electrical stimulation is being used throughout the world in the treatment of scoliosis. The results suggest that it is a suitable alternative to the brace. The relative advantages of the RF system and surface stimulation have yet to be clearly defined. The author discusses: animal experimentation; electro-spinal stimulation; an electro-spinal orthosis; lateral electrical surface stimulations; electro-spinal instrumentation. (20 refs.)

104114 Design of a dedicated heavy ion accelerator for radiotherapy. R.Gough, J.Alonso, T.Elioff, J.Fugitt, A.Garren, H.A.Grunder, H.Lancaster, R.Sah, B.Sorensen, J.Staples, R.Yourd (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.4, pt.2, p.3067-9 (Aug. 1983). (1983 Particle Accelerator Conference. Accelerator Engineering and Technology, Santa Fe, NM, USA, 21-23 March 1983).
A new heavy ion accelerator facility for radiotherapy is being designed at the Lawrence Berkeley Laboratory. Performance requirements have been established. Ions from helium to argon can be accelerated to a maximum energy of 800 MeV/nucleon with intensities in the range 10^8-10^9 particles per second. The accelerator subsystems consist of a linac injector, a synchrotron and a beam delivery system. Specifications have been developed for many of the technical components, and some details of the technical design are presented. (8 refs.)

104115 'Thermal mapping' in experimental cancer treatment with hyperthermia: description and use of a semi-automatic system. F.A.Gibbs,Jr. (Div. of Radiation Oncology, Univ. of Utah Medical Center, Salt Lake City, UT, USA).
Int. J. Radiat. Oncology Biol. Phys. (GB), vol.9, no.7, p.1057-63 (July 1983).
The regions of tumor which are least adequately heated during experimental hyperthermia treatments will most likely determine the ultimate probability of tumor control. Temperature inhomogeneity during local or regional hyperthermia is often marked, and stationary temperature probes yield very little information about the adequacy or inadequacy of tumor heating. Fine catheters can be placed through the tumor bearing region and temperatures recorded at various points within these catheters, thus yielding valuable data about temperature variations within the volume of interest. The 'thermal mapping system' (TMS) described provides a method for remotely sampling these temperature variations in a semi-automatic manner in several catheters simultaneously. Its application in conjunction with a commercial hyperthermia system is described and clinical examples of its use and importance are provided. (3 refs.)

104116 Recognition of ventricular fibrillation, other rhythms and noise in patients developing the sudden cardiac death syndrome. F.K.Forster, W.D.Weaver (Univ. of Washington, Seattle, WA, USA).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.245-8
Cardiac rhythms in 206 patients receiving emergency cardiac care including treatment for cardiac arrest were analyzed for the presence or absence of ventricular fibrillation (VF). The power spectral density of the electrocardiographic signal was determined. VF detection is based on a measure of relative power in particular frequency bands and other discrimination techniques applied to high and low frequency components plus harmonic peaks. 103 of 141 VF records (73%) were correctly indentified; 134 of 135 records (99%) of rhythms other than VF were properly discriminated (predictive accuracy=99%). The very low incidence of false positives makes the method suitable for development of safe automatic external VF detectors requiring minimal or no skilled human interaction. (8 refs.)

Industrial and medical applications of accelerators with energies less than 20 MeV .... See Entry 99771

A high performance control system for a heavy ion medical accelerator .... See Entry 99844

Cerebellar stimulation for spasticity .... See Entry 103831

Hyperthermia by magnetic induction: experimental and theoretical results for coaxial coil pairs .... See Entry 104012

Thermometry in radiofrequency hyperthermia of malignant tumours .... See Entry 104015

Operator exposure to radiofrequency fields near a hyperthermia device .... See Entry 104016

Responses to 'Viewpoint: Lasers in Biomedicine' .... See Entry 104018

Permissible regimes of laser operation in medical applications .... See Entry 104024

Stepwise-control concept for the ray therapy of tumors .... See Entry 104025

Medium energy proton accelerator for therapy .... See Entry 104031

The simulation of electron beam therapy employing cone collimation .... See Entry 104034

Lung dose calculations using computerized tomography: is there a need for pixel based procedures? .... See Entry 104059

87.70J Prosthetics and other practical applications

104117 Laboratory evaluation of commercial aspheric aphakic lenses. D.A.Atchison, G.Smith (Dept. of Optometry, Univ. of Melbourne, Parkville, Australia).
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.7, p.598-615 (July 1983).
Four types of commercial aspheric aphakic lenses were assessed with respect to mass, spectacle magnification, off-axis power errors, and peripheral distortion. The aspheric lenses have better distortion and off-axis imagery properties than spherical flat back lenses, but the improvement in distortion properties is small for those lenses whose design form specifies a flattish back surface. The claims concerning the distortion properties of these lenses are exaggerated. The shape (bending) of lenses has a large effect on spectacle magnification, peripheral distortion, and off-axis imagery. (9 refs.)

104118 The cortical hearing aid. C.R.Schafer.
DB Sound Eng. Mag. (USA), vol.17, no.5, p.35-8 (May 1983).
Discusses the cortical hearing aid, an instrument that apparently enables the stone deaf to understand speech and enjoy music. (8 refs.)

104119 Analysis of residual stress in failed T-28 femoral stems. R.D.Stroud, S.A.Brown, J.F.Shackelford (Univ. of California, Davis, CA, USA).
Biomater. Med. Devices & Artif. Organs (USA), vol.11, no.1, p.13-20 (1983).
Retrieved stainless steel (Type 316L) T-28 femoral stems occasionally exhibit cracks on the medial surface. Since this region is loaded in compression during gait, a simple fatigue fracture explanation is not sufficient to account for these cracks. It has been suggested that they are related to residual stress. It is known that residual stress can contribute a large part of the strain energy near a crack tip. Four failed T-28 femoral stems have been analyzed after surgical retrieval. All of them had multiple visible cracks on the medial side in the region 2-5 cm distal to the calcar collar. All had failed by transverse fractures connecting with a crack on the medial side. These stems have been examined for residual stress by X-ray diffraction methods; significant levels of residual stress were found to be present in the sections tested. Stresses in the transverse direction (medial to lateral) were found to be strongly tensile near the lateral edge and changed to compressive near the medial edge. The area in the center of the sections was found to have nearly zero residual stress. (13 refs.)

104120 Effect of healing on small internal diameter arterial graft compliance. R.White, L.Goldberg, F.Hirose, S.Klein, P.Bosco, R.Miranda, J.Long, R.Nelson, E.Shors (Univ. of California Los Angeles Medical Center, Torrance, CA, USA).
Biomater. Med. Devices & Artif. Organs (USA), vol.11, no.1, p.21-9 (1983).
The effects of healing on the compliance of small internal diameter vascular replacements were investigated. The compliance was correlated to the patency rate. It is concluded that differential ingrowth of a vascular prosthetic matrix has important long term functional significance. By directing the ingrowth of

the graft wall with fibrohistiocytic tissue, short term compliance remains similar to autogenous artery. (9 refs.)

104121 A new femoral component design based on the trabecular systems of the proximal femur. M.A.Gomez, S.L.-Y.Woo, R.C.Coutts (Div. of Orthopaedic Surgery & Rehabilitation, Univ. of California, San Diego, La Jolla, CA, USA).
Biomater. Med. Devices & Artif. Organs (USA), vol.11, no.1, p.39-50 (1983).
Presents a new design of the femoral component used in total hip arthroplasty. The design utilizes a tensile component which screws into the femoral stem from the lateral side of the femur. Two dimensional, plane stress finite element models of the proximal end of a normal femur, a femur with the new implant design, and a femur with a control Charnley-Cobra femoral component were developed. Loads simulating a one-legged stance were applied on the models. The normal and shear stresses, the octahedral shearing stress and the directions of principal stress were calculated for comparison with the normal femur. There was distinct improvement in bone stress distribution for the femur with the experimental implant as compared to the femur with the control prosthesis. The stress concentration normally observed in the mid-shaft area of the Charnley femoral stem was also not seen in the new design. (19 refs.)

104122 Stress analysis of a simplified compression plate fixation system for fractured bones. E.J.Cheal, W.C.Hayes, A.A.White,III (Dept. of Orthopaedic Surgery, Charles A. Dana Res. Inst., Boston, MA, USA), S.M.Perren.
Comput. & Struct. (GB), vol.17, no.5-6, p.845-55 (1983). (Proceedings of the 4th ADINA Conference, Cambridge, MA, USA, 15-17 June 1983).
A three-dimensional finite element model was generated of a plexiglass tube with an attached six-hole stainless steel compression plate to study the mechanics of internal fixation of fractured long bones. To demonstrate the importance of the plate-bone interface, this interface was represented three different ways in the finite element model. A plated tube with a uniform transverse osteotomy gap was also examined to study the mechanics of plated fractured bones. To validate the model, the results for the intact plated tube were compared to composite beam theory and strain gauge data from an instrumented physical model. Applications of the finite element model data included the prediction of screw failure modes, plate-induced osteopenia, and multiaxial strains in an interfragmentary region. (26 refs.)

104123 Control of movements by functional neuromuscular stimulation. P.E.Crago (Case Western Reserve Univ., Cleveland, OH, USA).
IEEE Eng. Med. & Biol. Mag. (USA), vol.2, no.3, p.32-6 (Sept. 1983).
Feedback is being designed into future functional neuromuscular stimulation orthoses to provide some of the functions normally provided by the nervous system. This article describes the types of feedback being considered and, in particular, the research being done on automatic feedback control systems to compensate for the nonlinear and time varying properties of muscle. (19 refs.)

104124 Performance characteristics for hearing aid microphone versus telephone and telephone/telecoil reception modes. J.C.Tannahill (Illinois State Univ., Normal, IL, USA).
J. Speech & Hear. Res. (USA), vol.26, no.2, p.195-201 (June 1983).
Two hearing aids and three telephone receivers were used to compare electroacoustic and word intelligibility data for hearing aid microphone reception versus telephone/telephone and telephone/telecoil reception. Measurements included test reference position gain and frequency response characteristics and word intelligibility scores. The results indicated that performance was similar for hearing aid microphone reception and telephone/telephone reception. Telephone/telecoil performance varied, depending on which telephone receiver was involved, but was poorer than hearing aid microphone performance. Recommendations were made concerning the selection of hearing aids and the management of hearing aid users relative to telephone/telecoil communication. (15 refs.)

104125 Biomechanics of the through-knee prosthesis. J.Hughes (Nat. Centre for Training & Education in Prosthetics & Orthotics, Glasgow, Scotland).
Prosthet. & Orthotics Int. (Denmark), vol.7, no.2, p.96-9 (Aug. 1983).
The biomechanics of the through-knee prosthesis is considered in detail and comparisons made with the above-knee case. Socket shape and suspension are discussed and comment offered on knee function in both stance and swing phases. (4 refs.)

104126 Recent developments in aids for profoundly deaf children. F.A.Saunders (Smith-Kettlewell Inst. of Visual Sci., San Francisco, CA, USA).
Wescon/81 Conference Record, San Francisco, CA, USA, 15-17 Sept. 1981 (El Segundo, CA, USA: Electron. Conventions 1981), p.28/3/1-5
The author describes continuing research with an electrotactile sensory aid for profoundly deaf children. The aid displays acoustic information on the skin of the abdomen, via a belt of electrotactile stimulators. The resulting tactile patterns provide cues for recognizing environmental sounds; enhance the accuracy of lipreading, and permit the child to monitor his own speech in comparison with the speech of others. The tactile patterns generated by specific sounds must be learned, much like acquiring a second language; substantial training and experience is required in order to obtain significant benefits in speech reception and speech production. Plans for a miniaturized, fully wearable aid and for computer-aided instruction are discussed. (6 refs.)

104127 Speech synthesis for the speech impaired. M.R.Barker (Rehabilitation Engng. Center, Children's Hospital at Stanford, Palo Alto, CA, USA).
Wescon/81 Conference Record, San Francisco, CA, USA, 15-17 Sept. 1981 (El Segundo, CA, USA: Electron. Conventions 1981), p.28/5/1-4
The author discusses speech synthesis in terms of its suitability as a communication aid for the speech impaired. By considering the total communication system, the effectiveness of any communication aid can be evaluated. The needs and capabilities of the user, the environment and the device characteristics are assessed. For speech synthesis as an output of a communication aid, intelligibility and availability are considered and some developments in speech output communication aids briefly mentioned. Speed of communication in real-time is identified as a problem yet to be solved. (8 refs.)

Mechanical analysis of the human pelvis and its application to the artificial hip joint—by means of the three dimensional finite element method ....See Entry 103922

Effect of pressurization on methylmethacrylate-bone interdigitation: an in vitro study of canine femora ....See Entry 103926

87.80 BIOPHYSICAL INSTRUMENTATION AND TECHNIQUES

104128 Echocardiography application in experiments on small laboratory animals. A.Krajewski, T.Wroblewski (Dept. of Pathophysiology, Inst. of Physiological Sci., School of Medicine, Warsaw, Poland).
Acta Physiol. Pol. (Poland), vol.33, no.5-6, p.661-4 (Sept.-Dec. 1982).
Rabbit heart echocardiograms were compared with autopsy measurements for assessing the accuracy of this non-invasive method in small animals. The correlation coefficient of these measurements was 0.72 for $p<0.01$. Additionally, the site of ultrasound probe application for heart visualisation from the left and right side of the chest was determined. It is stressed that the rules accepted for echocardiographic investigations in man must be applied with caution and criticism to the animals because of the different shape of the heart and chest wall. (2 refs.)

104129 Linear electron accelerator used to study the radiobiological effects of high doses of fast electrons. V.G.Videnskii, V.V.Gordeev (Sci. Res. Inst. of Medical Radiology, USSR Acad. of Medical Sci., Obninsk, USSR).
Radiobiologiya (USSR), vol.23, no.3, p.419-21 (1983). In Russian.
In order to study the early biological effects of whole-body and partial exposure of biological objects to high doses of fast electrons a simple and reliable method has been developed for the purposes of the control and correction of the dose-rates. Measurements were made of the spatial distribution, in air and water, of the doses used for irradiation of laboratory animals and cell suspensions with the nonuniformity coefficients indicated. (2 refs.)

104130 Fast neutron beam formed at the isochronous cyclotron U-240, and study of its dosimetric characteristics. E.E.Chebotarev, V.N.Bukanov, Yu.F.Kataevskii, N.A.Tkachenko, Ya.I.Serkiz (R.E. Kavetsky Inst. of Oncology Problems, Ukrainian Acad. of Sci., Kiev, Ukrainian SSR).
Radiobiologiya (USSR), vol.23, no.3, p.421-5 (1983). In Russian.
Gives a description of the channel equipped for radiobiological experiments with fast neutrons at the isochronous cyclotron U-240. A study made of some dosimetric characteristics of a mixed γ-and-neutron beam is reported. (6 refs.)

104131 Analysis and synthesis of bird vocalizations: an FFT-based software system. C.Clark (Field Res. Center, Rockefeller Univ., Millbrook, NY, USA), R.J.Dooling, T.Bunnell.
Behav. Res. Methods & Instrum. (USA), vol.15, no.2, p.251-3 (April 1983). (12th National Conference on the Use of On-Line Computers in Psychology, Minneapolis, MN, USA, 1982).
An FFT-based software package has been designed and implemented in order to analyze and synthesize bird vocalizations. The system is flexible so that screen editing can be performed on either the original waveform or the Fourier coefficients of the transform. The edited coefficients of selected notes, syllables, or songs are stored for later modification or combination with other song components to compose entirely new songs. These analyses and synthesis methods have proved to be extremely useful in the elucidation of birds' perceptive capabilities and the biological significance of their songs. (6 refs.)

104132 Cause of the drift of the zero point of the visual polarimeter. V.Ye.Zhvirblis.
Biophysics (GB), vol.27, no.4, p.783-7 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.4, p.744-7 (1982).
According to the author's observations the positions of the zero points of visual half-shaded polarimeters of the SM-1 type determined from the light transmission maximum of the polarizer-analyser system ($\alpha_{\max}$) experience complex periodic drift which has been explained by the action on the instrument of a certain exogenous physical factor (V. Zvirblis, Khim. i. zhizn', no.12, p.42, 1977). Recently, Burdin and Sizov (Bifizika, vol.26, p.368, 1981) advanced the assumption that this drift is caused by variations in the threshold of visual adaptation of the operator resulting from the effects of particular endogenous and/or exogenous factors. The author feels that there are quite cogent grounds for considering that during observations of drift of the zero point $\alpha_{\max}$ of the visual polarimeter by the 'fork' method a quite independent effect operates and the variations in the thresholds of visual adaptation contribute only to the experimental error. (8 refs.)

104133 A localized pattern photobleaching method for the concurrent analysis of rapid and slow diffusion processes. D.E.Koppel (Dept. of Biochem., Univ. of Connecticut Health Center, Farmington, CT, USA), M.P.Sheetz.
Biophys. J. (USA), vol.43, no.2, p.175-81 (Aug. 1983).
A scanning pattern photobleaching method for the analysis of lateral transport is described and discussed. Fluorescence bleaching with a localized pattern allows for the concurrent analysis of motions over two very different characteristic distances: ξ_0^{-1}, the repeat distance of the pattern, and W, the linear dimension of the illuminated region. The former motion is deduced from the decay of the modulation amplitude (of period ξ_0^{-1}) of fluorescence scans with the attenuated pattern, the latter from the recovery of the average fluorescence intensity. Such analysis should prove useful for the study of samples with a wide range of diffusion coefficients, and for the separation of effects arising from lateral diffusion and association dynamics. Theoretical analyses are presented for three related problems: (*a*) the effect of pattern localization on the decay of the modulation amplitude, (*b*) the effect of the pattern modulation on the recovery of the average local fluorescence intensity, and (*c*) the effect of a limited diffusion space (with linear dimensions of only a few pattern periods) on the decay of the modulation amplitude. (36 refs.)

104134 Phospholipid bilayers made from monolayers on patch-clamp pipettes. R.Coronado, R.Latorre (Dept. of Physiology & Biophys., Harvard Medical School, Boston, MA, USA).
Biophys. J. (USA), vol.43, no.2, p.231-6 (Aug. 1983).
Phospholipid bilayers were made from phospholipid monolayers at the air/water interface on patch-clamp pipettes. Lipid bilayers were characterised using the K^+ carrier nonactin and the channel formers gramicidin and alamethicin. Bilayers were also formed from monolayers spontaneously assembled in a suspension of native vesicles from cardiac sarcolemma and lobster axonal membranes and an excess of lipids. In these types of bilayers the authors observed several different channels including one contained in the axonal membrane that shows delayed rectifier behaviour. This technique permits the study of reconstituted channels on a time scale and noise comparable to cellular patch-clamp standards. (23 refs.)

104135 Teflon insulation for metal microelectrode shafts. C.J.Robinson (Rehabilitation R&D Center, Hines VA Hospital, Hines, IL, USA), H.Burton.
J. Electrophysiol. Tech. (GB), vol.10, no.2, p.75-9 (1983).
A method is described for applying multiple coats of Teflon insulation to the shafts of glass-insulated metal microelectrodes by using relatively standard laboratory equipment. This insulation has proven to be quite durable even when the electrodes have been used to make repeated transdural penetrations into monkey or cat cortex through an Evarts type chronic recording chamber. (5 refs.)

104136 Peripheral nerve fiber group separation in evoked potential research using cooling and polarization. R.K.Simpson,Jr., J.G.Blackburn, H.F.Martin, S.Katz (Dept. of Physiology, Medical Univ. of South Carolina, Charleston, CA, USA).
J. Electrophysiol. Tech. (GB), vol.10, no.2, p.81-92 (1983).
A method for peripheral nerve fiber group separation was applied to a primate model used in somatosensory evoked potential research. Cooling of the radial nerve employing a Peltier biothermode in combination with anodal polarization was utilized to separate A beta and A delta fibers from C fibres. The technique was verified using a pauci-fiber preparation. Applications of this new technique include the study of peripheral nerve and spinal cord injury in humans as monitored by evoked potentials. Selectively, repeatability, little temporal dispersion and no tissue damage are properties of this technique. (31 refs.)

104137 BAK instruments DIS-1 window spike discriminator. K.G.Buahin, W.Z.Rymer (Northwestern Univ., Medical School, Chicago, IL, USA).
J. Electrophysiol. Tech. (GB), vol.10, no.2, p.93-6 (1983).
The BAK Electronics Inc., Model DIS-1 window discriminator in a handy device that is used in electrophysiological experiments to separate single-unit spikes that exhibit unique temporal and amplitude characteristics from a recording of multi-unit extracellular activity. It is useful because it enables investigation of single-unit firing patterns without the need to further isolate the unit, a procedure which may be either inappropriate or impractical under many experimental conditions. The discriminator allows one to open a variable electronic window, bounded by time and amplitude, on a unique portion of the single-unit spike of interest. After the recording has passed through the discriminator all spikes not lying in the window are, in effect, filtered out of the output. The output of the discriminator, the acceptance pulse, is a TTL signal occurring essentially at the time at which the spike voltage satisfies the temporal and amplitude criteria. (no refs.)

104138 SELAVCO: a method to deal with trial-to-trial variability of evoked potentials. T.Gasser, J.Mocks, R.Verleger (Zentralinst. fur Seelische Gesundheit, Mannheim, Germany).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.6, p.717-23 (June 1983).
The possibility and the potential dangers of the inhomogeneity of potentials to repeated stimuli have been recognized for some time. The predominant method of averaging sweeps of brain activity time locked to the stimuli relies on the assumption of an invariant response. In this paper, a method is proposed for dealing more effectively with the variability of single potentials than does averaging. This method operates by weighted averaging and the weights are determined from the data after suitable filtering operations. SELAVCO is validated and compared to the average for real data and in a controlled design close to reality. (16 refs.)

104139 An improved microindentation technique to measure changes in properties of arterial intima during atherogenesis. B.S.Gow, W.D.Castle, M.J.Legg (Dept. of Physiology, Univ. of Sydney, Sydney, NSW, Australia).
J. Biomech. (GB), vol.16, no.6, p.451-8 (1983).
A fully automated instrument was developed that measured the amount and time-course of indentation of arterial intima by a spherical tipped probe 25 μm in diameter loaded routinely by forces of 10 μN. The relationship of depth of indentation to time was non-exponential but reached an apparent asymptotic value in about 6 s. Routine indentations were recorded 10 s after loading, the relationship of indentation and force being essentially linear between 0-100 μN. The instrument is an order of magnitude more sensitive than one previously described (Gow and Vaishnav, J. Appl. Physiol., vol.38, p.344-50, 1975) and produces indentations of 1-4 μm in the intima of rabbit thoracic aorta with a reproducibility of 1-2%. Preliminary usage of the new microindentor has shown increases in the compliance of the thoracic aorta intima in rabbits during cholesterol feeding. (13 refs.)

104140 The accuracy of formant frequency measurements: a comparison of spectrographic analysis and linear prediction. R.B.Monsen, A.M.Engebretson (Central Inst. for the Deaf, St. Louis, MO, USA).
J. Speech & Hear. Res. (USA), vol.26, no.1, p.89-97 (March 1983).
The accuracy of spectrographic techniques and of linear prediction analysis in measuring formant frequencies is compared. The first three formant frequencies of 90 synthetic speech tokens were measured by three experienced spectrographic readers and by linear prediction analysis. For fundamental frequencies between 100 and 300 Hz, both methods are accurate to within approximately ±60 Hz for both first and second formants. The third formant can be measured with the same degree of accuracy by linear prediction, but only to within ±110 Hz by spectrographic means. The accuracy of both methods decreases greatly when fundamental frequency is 350 Hz or greater. These limits of measurement appear to be within the range of the difference limens for formant frequencies. (25 refs.)

104141 Effects of practice and instructional set on the measurement of lingual vibrotactile thresholds. D.Fucci, L.H.Small, L.Petrosino (Ohio Univ., Athens, OH, USA).
J. Speech & Hear. Res. (USA), vol.26, no.2, p.289-93 (June 1983).
The effects on lingual vibrotactile thresholds of three different instructional sets and three different practice conditions were determined for 30 normal adult subjects. Results showed no measurable differences between thresholds obtained with the use of the three different instructional sets, but a high false alarm rate occurred for all conditions. When a subject was given practice at obtaining thresholds with a particular instructional set as a prerequisite to threshold data collection, false alarm responses disappeared. Lower (more sensitive) thresholds also were achieved when the practice condition used required the subject to provide three thresholds within 1 μ of each other before commencing with actual testing. (11 refs.)

104142 Electron microscopy of frozen hydrated sections of vitreous ice and vitrified biological samples. A.W.McDowall, J.-J.Chang, R.Freeman, J.Lepault, C.A.Walter, J.Dubochet (European Molecular Biology Lab., Heidelberg, Germany).
J. Microsc. (GB), vol.131, pt.1, p.1-9 (July 1983).
The preparation and high resolution observation of frozen hydrated thin sections has been studied by transmission electron microscopy (TEM and STEM) on model systems, including pure water, protein solutions, catalase crystals, myelin sheath and various tissues. The state of the ice is determined by electron diffraction. Mass measurement in the electron microscope is used to determine section thickness and control hydration. An adequate depth of vitrified material for sectioning can be obtained from many biological suspensions or untreated tissues. Frozen hydrated sections around 100 nm thick can be produced under optimal conditions from vitreous ice or from vitrified biological samples. Sectioning, transfer and observation in the electron microscope is feasible without alteration of the sample hydration or its initial vitrification. Biological structures can be preserved and observed down to 10 nm. Under favourable working conditions, specimen compression during sectioning and electron beam damage are the factors limiting high resolution observations. (31 refs.)

104143 Optimizing the cooling block for the quick freeze method. W.B.Bald (Dept. of Engng. Sci., Univ. of Oxford, Oxford, England).
J. Microsc. (GB), vol.131, pt.1, p.11-23 (July 1983).
It is important for future ultrastructural preservation studies to freeze biological specimens as rapidly as possible. Finite element numerical techniques has been used to compare different cooling block materials used in the quick freeze 'slamming' method. It is concluded that a pure silver block at an optimum initial temperature of about 15.6K will produce the quickest cooling and will give rates approximately 50% higher than if the block were initially cooled to 4.2K. A copper block will produce the fastest cooling rates when the block is initially at liquid nitrogen temperature of 77.3K provided the section being studied is taken no more than about 30 μm from the specimen-block interface. Composite metal blocks can further reduce the total specimen cooling time compared to a mono-block at the same initial temperature but the cooling rate near the interface will be slower. Future methods for specifying cooling rates within thin biological samples should be standardized and must be based on a combination of finite element numerical analysis and the measured temperature at the rear surface of the sample. Thermal contact resistance between cooling block and specimen and between specimen and the rear face temperature sensor must be minimal. (17 refs.)

104144 Correlative light, electron, and ion microscopy on a sngle histologic section. K.G.Kupke, J.P.Pickett, P.Ingram (Dept. of Pathology, Duke Univ., Durham, NC, USA), D.P.Griffis, R.W.Linton, J.D.Shelburne.
J. Microsc. (GB), vol.131, pt.1, p.RP1-2 (July 1983).
In order to best interpret the chemical images obtained using new microanalytical techniques such as ion microscopy (IM), it is advantageous to correlate them with the morphologic/chemical information provided by more conventional light microscopy (LM), secondary electron imaging (SEI), backscattered electron imaging (BEI), or electron probe microanalysis (EPMA). Accordingly the authors have devised a technique of specimen preparation which allows for the application of several different microanalytical techniques to a single histologic section mounted on the same substrate. The technique described offers the advantages of: (1) selecting specific areas within a section by LM for subsequent microanalysis; (2) facilitating the comparison of microanalytical methods in terms of sensitivity and spatial resolution, and (3) allowing for LM, SEI, BEI and EPMA both before and after IM yielding valuable information on differential sputtering effects (Farmer et al., 1981) and contaminants, two major potential sources of IM data misinterpretation. (4 refs.)

104145 A high-resolution staining method for examination of mammalian cell surfaces in the light microscope. S.Junker (Inst. of Human Genetics, Univ. of Aarhus, Aarhus, Denmark).
J. Microsc. (GB), vol.131, pt.2, p.235-9 (Aug. 1983).
A simple light-microscopic method for the examination of fine details on cell surfaces is described. When cell specimens on platinum-coated glass or plastic surfaces are stained with 3,3'-diaminobenzidine tetrahydrochloride and hydrogen peroxide, fine cytoplasmic processes that cannot be detected using conventional staining techniques for the light microscope are revealed. It is suggested the new technique be applied instead of the scanning electron microscope when the limited resolution of the light microscope is sufficient. (9 refs.)

104146 Automatic ultramicrotome advance system for routine histological investigations with the electron microscope. B.Wolf, A.Schwinde (Inst. fur Immunbiologie, Univ. Freiburg, Freiburg, Germany).
Microsc. Acta (Germany), vol.87, no.3, p.301-6 (May 1983). In German.
In modern ultramicrotomes the thermic advance system has been replaced by a mechanical one. Earlier, conventional DC-voltage motors were used, but recently the step motor has become popular. In connection with such motors, the application of digital control elements is facilitated, thus increasing precision significantly. A further step towards improving the precision of the advance system is the application of microprocessors as intelligent and interacting control elements. The microprocessor can not only process the output of sensors, but also perform the function of regulation. This paper describes a working concept whereby the advance system does not, as usual, work freely, but in connection with a sensor which measures the advance, and after a positive data comparison by the microprocessor, allows the cutting movement. The concept is not limited to ultramicrotomes but can also be applied to mechanical rotation microtomes. (8 refs.)

104147 A fluid exchange apparatus for the processing of biological specimens for electron microscopy. J.N.Brown (Dept. of Physiology, Univ. Medical School, Edinburgh, Scotland).
Microsc. Acta (Germany), vol.87, no.3, p.329-33 (May 1983).
A simple apparatus for the processing of biological specimens for electron microscopy is described. It comprises a fluid exchange chamber with associated reservoir. By carrying out all specimen processing from fixation to embedding in the exchange chamber and infiltrating the dehydrating and embedding mediums progressively, the handling and osmotic stresses associated with standard step processing are minimised. (24 refs.)

104148 Determination of ^{18}O trapping in X-irradiated amino acids by means of nuclear reactions. C.Wiezorek (Inst. fur Strahlenbiologie, Univ. Munster, Munster, Germany).
Radiat. Res. (USA), vol.95, no.1, p.15-23 (July 1983).
Nuclear reactions have been used for the quantitative study of X-irradiation-induced binding of the stable oxygen isotope ^{18}O by several amino acids in the dry state. The measurements demonstrate that the new method is a powerful tool for investigating radical yields. (9 refs.)

104149 In vivo one-dimensional imaging of phosphorus metabolites by phosphorus-31 nuclear magnetic resonance. J.C.Haselgrove, V.H.Subramanian, J.S.Leigh,Jr., L.Gyulai, B.Chance (Dept. of Biochem. & Biophys., Univ. of Pennsylvania, Philadelphia, PA, USA).
Science (USA), vol.220, no.4602, p.1170-3 (10 June 1983).
A phosphorus-31 nuclear magnetic resonance imaging technique has been used to obtain information on phosphorus metabolites from different spatial regions of tissues in vivo. The technique for selection of planes through the tissue is based on phase-encoding of spin echoes and was used to obtain one-dimensional discrimination of phosphorus-31 spectra from different parts of the tissue simultaneously. Specimens were resolved into 16 distinct slices and a signal-to-noise of about 20 to 1 was obtained in $^1/_2$ hour. Results are presented for phantoms, rat legs, and gerbil heads. (12 refs.)

104150 A pulsed-wire spirometer using sing-around method. T.Nemoto, T.Togawa (Inst. for Medical & Dental Engng., Tokyo Medical & Dental Univ., Tokyo, Japan).
Trans. Soc. Instrum. & Control Eng. (Japan), vol.19, no.4, p.314-18 (April 1983). In Japanese.
A pulsed-wire gas flowmeter using a sing-around system and a constant temperature heating method was developed for the spirometry with a wide range of flow rate. A wire located at the upstream is heated by a pulse current and travelled heated air sensed by the other wire. The sensed signal triggers the next pulse current so that the system can selfoscillate. The repetitive pulse

period is determined by the travelling time of heated air from the heated-wire to sensor-wire. The current of pulsed-wire is electronically controlled so that heating wire is kept at constant temperature. (7 refs.)

104151 An animal biological application of neutron radiography: study of rat bone tissue compared with standard radiography and histology. B.Graf, J.Le Gall, G.Renard, A.Laporte.
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.533-41
Bone tissue appears to be a suitable material for comparative study using radiography and neutrography. Osseous tissue is composed of a mineral phase and an organic phase. So, in order to obtain a sound basis for the interpretation of neutrographic documents, the authors have separated the two osseous phases and performed both radiographies and neutrographies on the same samples. Neutrography is complementary to radiography for the study of bone. The information obtained from these two techniques is different except when the structures studies are rich in both mineral and light elements. However, neutrography cannot be used in vivo, it must be reserved for biological purposes concerning animals or human specimens from autopsy or surgical excision. (18 refs.)

104152 Neutron radiography of osteopetrotic rat. B.Graf, G.Renard, J.Le Gall, A.Laporte.
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.543-53
The osteopetrotic disease is characterized by bone and cartilage tissue coexistence in the medullary space of long bones. The first description was given by H. Albers-Schonberg (1907) in the human race. The authors have studied 'congenital osteopetrosis' of 'op' rats. This disease appeared as a spontaneous mutation in Fatty/ORL and was found recessive and autosomal. This disease is suitable for neutrongraphical and radiographical studies because its appears, with optical examination, composed by two kinds of components: one is made up with calcium salts, radiopaque, the other is made up with glycoproteins and glucosaminoglycans substances neutropaque. Comparing radiography, neutrography and histology, the authors show the evolution of the 'osteopetrotic disease' and the healing of the ill rats by a single injection of bone marrow from normal animals according to G. Milhaud's protocol (1973). (8 refs.)

104153 Fast neutron imaging by cellulose nitrate foils [biological application]. E.Duhmke, L.Greim (Radiological Clinic, Univ. of Kiel, Kiel, Germany).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.565-71
Fast neutrons show sufficient penetration to test thick hydrogen containing objects. Neutron radiography can be done by track etch foil methods, which detects recoil nuclei especially protons. The imaging process has been studied in respect to optimal etching conditions, sensitivity and dose-density relations. A multifoil imaging system is proposed, which allows to lower the necessary neutron dose, suppresses artifacts and expands the attainable density range. With this system a good sharpness can be achieved; this has also been shown by comparison of the modulation transfer function with those of different X-ray imaging systems. (6 refs.)

104154 A neutron radiography technique for studying young roots growing in soil. R.G.Struss (Ames Lab., Iowa State Univ., Ames, IA, USA).
Neutron Radiography. Proceedings of the First World Conference, San Diego, CA, USA, 7-10 Dec. 1981 (Dordrecht, Netherlands: Reidel 1983), p.581-90
An indirect technique for taking neutron radiographs using indium collector foils has been used to study seed germination and root growth in soils. This paper describes the work done to develop this technique for in situ studies to replace destructive sampling techniques. Plants grown in loamy sand soil wetted to 9% volumetric water content in aluminum boxes of 2.5 and 5 cm thickness were photographed with this technique. An indium collector plate attached to the back of the box produced a transfer screen during exposure in the neutron beam which was subsequently placed in direct contact with photographic film to produce an image of the plant roots. The resulting indirect images were useful in measurements of root elongation, seed germination, compacted soil surface penetration, and rate of growth, with resolution of roots at about 0.3 mm size being obtained in low moisture soil conditions. Serial neutron radiographs of the same plant allowed sequential studies of root systems that had never been possible prior to development of this technique. (no refs.)

104155 Analysis of cardiac transmembrane action potentials with parallel microprocessors. J.M.Jenkins (Univ. of Michigan, Ann Arbor, MI, USA), D.-L.Klein, R.E.Ten Eick.
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.259-62
A dual microcomputer system has been developed for automating the analysis of cardiac transmembrane action potentials. This system consists of two microcomputers and supporting function modules which digitize, detect, analyze, and plot the transmembrane action potentials of a cardiac cell impaled with a microelectrode. The action potentials are digitized at two sampling rates for computer processing. A sampling rate of 10 kHz is used to obtain the rapid, initial upstroke, while a rate of 100 Hz is used to obtain the slower repolarization phase. The action potentials are characterized by graphic displays using the derived measurements. The system measures the resting potential, amplitude, $dV/dt_{\max}$ and time for 50%, 70% and 95% repolarization of the action potential. (4 refs.)

104156 A digital imaging of myocardial metabolism by multiwire proportional chamber: an alternative to autoradiography. P.Camici, R.Bellazzini, G.Coppini, G.Valli, D.Levantesi, M.G.Trivella, G.Pelosi, L.Taddei, M.Marzilli, A.L'Abbate (Univ. of Pisa, Pisa, Italy).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.263-5
A new digital imaging procedure for the study of tracer distribution in the experimental animal is proposed. Regional myocardial content of ^{3}H-deoxyglucose, a tracer of glucose metabolism, was assessed by a specially designed MultiWire Proportional Chamber (MWPC) that acts as a position sensitive radioactivity detector. The obtained digital map was processed by a computer procedure in order to obtain the tracer content in different regions and layers of the heart. (3 refs.)

Jenalumar—the fluorescence research microscope of the Jena-microscope series 250-CF .... See Entry 99172

Contemplations on fluorescence photomicrography .... See Entry 99176

Use of phosphorescent probes for studying model and biological membranes .... See Entry 103799

Normalization of ultrasonic scattering measurements to obtain average differential scattering cross sections for tissues .... See Entry 103942

Refractometry of fungi .... See Entry 103943

Fast neutron radiography in biology and medicine .... See Entry 104041

A method to record the circadian rhythm in a unicellular green algae under extraterrestrial conditions .... See Entry 104079

90.00 GEOPHYSICS, ASTRONOMY AND ASTROPHYSICS

91.00 SOLID EARTH GEOPHYSICS

91.10 GEODESY AND GRAVITY

(for relations of gravity observations to tectonics and isostasy, see 91.45 Physics of plate tectonics)

104157 Time and latitude results of observations made at Merate Observatory with the astrolabe for the year 1982. L.Buffoni, F.Carta, F.Chlistovsky, A.Manara, F.Mazzoleni (Osservatorio Astron. di Milano-Merate, Milano-Merate, Italy).
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.1, p.43-6 (July 1983).
Results of observations made with the astrolabe Danjon OPL no.32 are given. The results are in the FK4 system. (4 refs.)

104158 The geodesic inverse problem. B.R.Bowring.
Bull. Geod. (France), vol.57, no.2, p.109-20 (1983).
Various ways of solving the longitude equation of the inverse solution for the geodesic on the reference ellipsoid are examined, and a special development is given to deal with the nearly antipodal situation. (6 refs.)

104159 On filtering and compressing LAGEOS laser range data. E.G.Masters, A.Stolz, B.Hirsch (School of Surveying, Univ. of New South Wales, Kensington, Australia).
Bull. Geod. (France), vol.57, no.2, p.121-30 (1983).
A method of compressing LAGEOS laser range measurements into normal points is described. First, the raw range measurements are screened, on a pass-by-pass basis, by a filter which utilizes the fact that the range varies with time very nearly like a quadratic curve. Second, the time series of the filtered range data over each pass is divided into small segments, typically of 150 s duration. Third, each separate segment is modelled by a unique low-order Chebyshev polynomial, typically of order four. Fourth, the polynomial is interpolated at some instant, typically that corresponding to the mean time of the segment, to yield the normal point. Baseline measurements across Australia obtained from full rate data and from data compressed into 150 s normal points, agree to within the measurement error. These differences are mainly due to the effects of data distribution and pass geometry. Computer costs are substantially reduced. (10 refs.)

104160 Numerical calculation of covariances between area means. O.L.Colombo (Geodesy Dept., Tech. Univ. of Delft, Delft, Netherlands).
Bull. Geod. (France), vol.57, no.2, p.131-7 (1983).
When area means are given on a regular grid, their covariance functions, needed in least squares collocation to estimate quantities statistically related to the data, can be calculated as accurately as desired and very efficiently in the form of a Fourier series truncated at a suitably high frequency. (9 refs.)

104161 An efficient short-arc orbit computation. J.Kouba (Earth Phys. Branch, Dept. of Energy, Mines & Resources, Ottawa, Canada).
Bull. Geod. (France), vol.57, no.2, p.138-45 (1983).
Short-arc orbit computations by numerical or analytical integration of equations of motion traditionally utilized in geodetic and geodynamic satellite positioning are relatively involved and computationally expensive. However, short-arc orbits can be evaluated more efficiently by means of least squares polynomial approximations. Such orbit computations do not significantly increase the computation time when compared to widely used semi-short-arc techniques which utilize externally generated orbits. The sufficiently high-degree polynomial approximation of the second time derivatives $\ddot{x}$, $\ddot{y}$ and $\ddot{z}$ evaluated from a gravitational potential model at regular (two-minute) intervals and averaged initial conditions (position and velocity vectors at the beginning, the middle and the end of a pass) reproduces the US Defense Mapping Agency precise ephemeris of the Navy Navigation Satellites (NNSS) to about 5 cm RMS in each coordinate. To achieve this level of orbit shape resolution for NNSS satellites, the gravitational potential model should not be truncated at less than degree and order 10. (16 refs.)

104162 Lateral resection in three dimensions. B.R.Bowring.
Bull. Geod. (France), vol.57, no.2, p.195-7 (1983).
An equation is developed to obtain the azimuths to the known observed points in space, thus reducing the solution to one of intersection. (1 ref.)

104163 The introduction of the IAU 1980 nutation theory in the computation of the Earth Rotation Parameters by the Bureau International de l'Heure. N.Capitaine, M.Feissel (Bur. Internat. de l'Heure, Paris, France).
Bull. Geod. (France), vol.57, no.2, p.198-206 (1983).
The status of nutation theory in the computation of the Earth Rotation Parameters from the different observational techniques is reviewed. The impact on the combined solution of the Bureau International de l'Heure is evaluated. In view of the improvement brought by the IAU 1980 Nutation Theory, its introduction in the BIH publications, without waiting for the adoption by the astronomical ephemerides (1984 Jan. 1) is decided. (13 refs.)

104164 On the indirect influence of the planets on nutation. I. Effects of planetary perturbations in lunar orbit. J.Vondrak (Astron. Inst., Czechoslovak Acad. of Sci., Praha, Czechoslovakia).
Bull. Astron. Inst. Czech. (Czechoslovakia), vol.34, no.3, p.184-90 (June 1983).
The nutation terms produced by planetary perturbations in the lunar orbit are derived. All the perturbations greater than 0.01″ in angular position and 0.0001″ in the sine parallax of the Moon were considered. The total effect in nutation is found to be of the order of 10^{-4} seconds of arc thus being several times smaller than the direct influence of the planets, derived recently by the author. (8 refs.)

104165 The Indian Ocean gravity low: evidence for an isostatically uncompensated depression in the upper mantle. S.M.Ihnen, J.H.Whitcomb (Cooperative Inst. for Res. in Environmental Sci., Univ. of Colorado, Boulder, CO, USA).
Geophys. Res. Lett. (USA), vol.10, no.6, p.421-3 (June 1983).
The broad gravity low in the equatorial Indian Ocean south of Sri Lanka is the largest and most striking feature in the gravitational field. The most negative long-wavelength free-air gravity anomalies are found there and the sea surface (geoid) lies more than 100 meters below the best fitting ellipsoid. The authors propose a model of the lithosphere and upper mantle which accurately predicts the observed free-air gravity and geoid elevation. The crust south of India currently floats as much as 600 meters lower than would be expected if the region were isostatically compensated. This residual depression of the crust is apparently confirmed by the observations of ocean depth. An uncompensated depression is consistent with the downgoing arm of a convection cell, and also with the presence of a mechanical wake left in the upper mantle behind India as it traveled toward Asia. (16 refs.)

104166 Chandler wobble and frequency dependence of Q_μ of the Earth's mantle. S.M.Molodenskiy, V.N.Zharkov (O.Yu. Schmidt Inst. of Phys. of Earth, Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.4, p.245-54 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.4 (1982).
A rigorous derivation is given for the period of the Chandler wobble independent of any oscillation of the nonuniform liquid core. The contribution to the Chandler period due to the anelasticity of the Earth's mantle is examined. A hypothesis is studied according to which the anelasticity of the mantle determining the attenuation of small-amplitude oscillations may be described by transient creep. The question of the frequency dependence of the mechanical energy factor Q_μ of the mantle in the period range of from tens of seconds to a year is studied. (29 refs.)

104167 Fourier analogy in inverse problems of gravimetry for several 'petroleum' and 'planetary' density models. A.S.Margulis, V.M.Novoselitskiy (All Union Sci. Res. Inst. for Geological Petroleum Exploration, Min. of Geology, USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.4, p.289-97 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.4 (1982).
Density changes throughout an external gravity field in layers bounded by concentric spheres or horizontal planes are considered. (32 refs.)

104168 Regional deformation of the Earth model for the San Diego region, California. R.A.Snay, M.W.Cline, E.L.Timmerman (Nat. Ocean Survey, NOAA, Rockville, MD, USA).
J. Geophys. Res. (USA), vol.88, no.B6, p.5009-24 (10 June 1983).
A mathematical model for historical horizontal crustal deformation is presented for the southern California region that extends northward from Mexico for approximately 100 km to 33.5°N latitude. Model parameters are estimated from triangulation, trilateration, and astronomic azimuth data observed during the past century. Also geologic and seismic data indirectly participate in specifying the model. The model relates crustal deformation to the episodic movement experienced during large earthquakes ($M \geq 6$), secular slip rates on geologic and secular strain rates over large geographic areas. The episodic movement is modeled in accordance with the theory of dislocation in an elastic halfspace. For the secular motion the modeled region is partitioned into a mosaic of districts that are allowed to individually translate, rotate, and homogeneously deform as a linear function of time. (40 refs.)

104169 The multiple-frequency Chandler wobble. C.Pan (Hunter Geophys., Mountain View, CA, USA).
J. Phys. Earth (Japan), vol.30, no.5, p.389-419 (1982).
The problem of the excitation and damping of the Chandler wobble is reviewed and the conventional models analyzed. Using an axially near-symmetric and slightly triaxial Earth model, a solution of the Liouville equation reveals that the Chandler wobble has multiple frequency and is rather a quasi-permanent phenomenon in the Earth. After the introduction of the anelasticity of the mantle into the model, the Chandler wobble is found to be a combination of the Kelvin-Voigt and Maxwell oscillations with the former mechanism dominating the motion. The multiple-frequency model explains the Chandler amplitude and frequency variations as well as the persistence of the wobble beyond the damping relaxation time predicted by the single-frequency model. (64 refs.)

104170 Control surveys. J.G.Gergen, C.T.Whalen (Nat. Ocean Service, NOAA, Rockville, MD, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.523-8 (April 1983).
Reviews horizontal control, vertical control, and astronomical position determinations. (89 refs.)

104171 Gravimetry. L.E.Wilcox, D.M.Scheibe (Defense Mapping Agency Aerospace Center, St. Louis AFS, MO, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.537-43 (April 1983).
Reviews progress in United States gravimetry during the period 1979-82. A representative sampling of important literature published during the period is included. (38 refs.)

104172 Earth tides. C.C.Goad (Nat. Ocean Service, NOAA, Rockville, MD, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.544-6 (April 1983).
Reviews ocean tide models, Earth rotation, Love numbers, load deformation, tidal sensitive measurements, Green's functions, tiltmeter observations, absolute gravity meters, satellite orbital elements variation, laser ranging, altimetry, and very long baseline interferometry. (51 refs.)

104173 Geodetic theory. C.Jekeli (Terrestrial Sci. Div., Air Force Geophys. Lab., Hanscom AFB, Bedford, MA, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.547-53 (April 1983).
Reviews developments in least-squares and statistical techniques, geodetic networks and positioning, the geodetic boundary-value problem, gravity field determination using satellite techniques, error analyses, geopotential model, geodynamics and geodetic theory, reference frames, and data management, during the period 1979-82. (73 refs.)

104174 Status of the geopotential. F.J.Lerch (Geodynamics Branch, Goddard Space Flight Center, Greenbelt, MD, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.560-5 (April 1983).
Reviews progress made in modeling the geopotential field during the period 1979-1982. (73 refs.)

104175 Radio interferometry. W.E.Carter (Nat. Ocean Service, NOAA, Rockville, MD, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.565-8 (April 1983).
Reviews developments in very long baseline interferometry and plans for connected element interferometry. (81 refs.)

104176 Polar motion and Earth rotation. B.D.Tapley (Dept. of Aerospace Engng., Univ. of Texas, Austin, TX, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.569-73 (April 1983).
During the period from 1979 through 1982, polar motion and Earth rotation activity centered on the development of new observation techniques and the investigations of the relation between the observed motions and geophysical phenomena. The activity related to these developments, along with the theoretical and interpretative analyses which have been conducted, are summarized. (121 refs.)

104177 Satellite altimetry. J.G.Marsh (Geodynamics Branch, Goddard Space Flight Center, Greenbelt, MD, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.574-80 (April 1983).
Presents a summary of the geodetic applications of altimeter data, precision orbit determination analyses, the status of the instrumentation and the plans for future altimeter missions. (136 refs.)

104178 Satellite positioning. R.W.Hill (Naval Surface Weapons Center, Dahlgren, VA, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.581-4 (April 1983).
Reviews satellite Doppler positioning, the NAVSTAR Global Positioning System, and satellite laser positioning. (88 refs.)

Analytical description of the secular variations of the geomagnetic field and the rate of rotation of the Earth .... See Entry 104187

Constraint on deep mantle viscosity from Lageos acceleration data .... See Entry 104325

Rotational deformation of an elastic Earth .... See Entry 104328

Bathymetry estimates in the southern oceans from Seasat altimetry .... See Entry 104335

The accuracy of the low-degree geopotential: implications for ocean dynamics .... See Entry 104375

A new method for precise astro-azimuths .... See Entry 104579

The Airborne Laser Ranging System, its capabilities and applications .... See Entry 104580

Compact gravity inversion .... See Entry 104591

The frequency domain and the linear filtering of gravity and magnetic data .... See Entry 104608

New techniques [in geodesy] .... See Entry 104624

Tokyo Astronomical Observatory. Time and Latitude Bulletins [October-December 1982] .... See Entry 104706

91.25 GEOMAGNETISM AND PALAEOMAGNETISM; GEOELECTRICITY

104179 A practical method for the inversion of magnetotelluric data for a layered Earth. D.Rankin, F.Pascal (Dept. of Phys., Univ. of Alberta, Edmonton, Alberta, Canada).
Geophysics (USA), vol.48, no.6, p.736-44 (June 1983).
A numerical one-dimensional magnetotelluric inversion technique based on the Nabetani-Rankin algorithm for a layered Earth is presented and illustrated with a noise-free theoretical model and two examples with real field data. (9 refs.)

104180 A comparison of adjustment procedures for leveling aeromagnetic survey data. A.A.Green (Div. of Mineral Phys., CSIRO, North Ryde, NSW, Australia).
Geophysics (USA), vol.48, no.6, p.745-53 (June 1983).
Two techniques for leveling aeromagnetic survey data are compared. The first estimates a set of values for the magnetic intensity at each flight-line/tie-line intersection point. The procedure (a least-squares method) is equivalent to the older manual loop closure methods used for magnetic, gravimetric, and geodetic surveying. The second method involves the fitting of polynomials to the observed flight-line/tie-line intersection errors along each line in the survey. In the analysis of two surveys the least-squares method was found to be superior as a leveling procedure. (9 refs.)

104181 Werner deconvolution for automated magnetic interpretation and its refinement using Marquardt's inverse modeling. C.C.Ku, J.A.Sharp (Aero Service Div., Western Geophys. Co. of America, Houston, TX, USA).
Geophysics (USA), vol.48, no.6, p.754-74 (June 1983).
Presents a deconvolution for automated magnetic interpretation based on Werner's (1953) simplified thin-dike assumption which leads to the linearization of complex nonlinear magnetic problems. The usefulness of the method is expanded by the fact that the horizontal gradient of the total field caused by the edge of a thin interface body is equivalent to the total field from a thin dike. Statistical decision, numerical iteration, and a seven-point operator are used to improve approximations of susceptibility, dip, depth, and horizontal location of the source. (11 refs.)

104182 Use of the resistivity method in geological mapping-case histories from Raniganj Coalfield, India. R.K.Verma, T.K.Bandyopadhyay (Indian School of Mines, Dhanbad, Bihar, India).
Geophys. Prospect. (Netherlands), vol.31, no.3, p.490-507 (June 1983).
The effectiveness of the electrical resistivity method is studied using various configurations with different spacings over the Southern Boundary Fault in the northwestern part, and across a dolerite dyke named 'Salma dyke' in the central part, of the Raniganj Coalfield, India. The delineation of the fault and the dyke is made possible with this method under differential tropical weathering conditions. Geoelectric sections across the fault and the dyke are prepared on the basis of Schlumberger sounding results. In profiling, Wenner, two-electrode, half-Schlumberger and part of Al-Chalabi's (1969) configurations were applied over the Southern Boundary Fault. Across the dyke, alpha-, beta-, and gamma-Wenner, Schlumberger, half-Schlumberger and two-electrode configurations were employed. Azimuthal two-electrode sounding is also studied over the fault. (15 refs.)

104183 Electromagnetic sounding near a large square loop source of current. M.Poddar (Nat. Geophys. Res. Inst., Hyderabad, India).
Geophys. Prospect. (Netherlands), vol.31, no.3, p.508-23 (June 1983).
An electromagnetic sounding experiment with a large square loop as source was carried out on the dried-up bed of a water reservoir near the town of Dharmavaram in Andhra Pradesh. The sounding was performed in both geometric and parametric modes, and involved measurements of phase as well as amplitude of the vertical magnetic field inside and outside the loop. The six-frequency EM system used for the experiment appears to be a workable system for electromagnetic sounding. The results of the experiment more or less confirm the conclusions from theoretical modeling. (9 refs.)

104184 VLF survey of the weathered layer in southern India. M.Poddar, B.S.Rathor (Nat. Geophys. Res. Inst., Hyderabad, India).
Geophys. Prospect. (Netherlands), vol.31, no.3, p.524-37 (June 1983).
The electrical properties of the weathered layer were investigated by means of Geonics VLF-EM 16/16R equipment in two areas of the Andhra Pradesh State for groundwater prospecting. The resistivity and thickness of the weathered layer are found to be variable even over a small survey area. In the area underlain by Precambrian granite-gneiss, most of the recorded VLF-EM anomalies are caused by variations in the resistivity of the weathered layer. Changes in thickness are well reflected in the VLF-EMR curves. The second area is underlain by Cretaceous basalts and dolerites. Quantitative interpretation of the VLF-EMR data with a simple one-dimensional model yields considerable detail about the weathered layer. The field studies suggest that the VLF-EMR method can be used as a fast and inexpensive tool for mapping of the weathered layer in tropical regions with hard rock geology. (14 refs.)

104185 Spectral analysis of long-period variations of the magnetotelluric field on the southeast Siberian Plate. V.Yu.Semenov, V.A.Kuznetsov, B.A.Okulesskiy (Shirshov Inst. of Oceanology, Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.1, p.78-81 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.1 (1982).
Spectral analysis methods were used to develop an algorithm for processing data on long-period variations in the magnetotelluric field. A computer program developed from this algorithm was tested on measurements of the variations in the magnetotelluric field over the southeast Siberian Platform. Oriented and auxiliary impedances are derived. An effective apparent-resistance curve is plotted. (8 refs.)

104186 Electromagnetic investigations of secular variation anomalies in the Ural region. A.G.Krasnobayeva, V.A.Shapiro (Inst. of Geophys., Acad. of Sci., Sverdlovsk, USSR).
Geomagn. & Aeron. (USA), vol.22, no.1, p.82-7 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.1 (1982).
Calculations and studies of three secular variation anomalies in the Urals are presented. The Manchazh anomaly is caused by a rocky body of high residual magnetization. In the Butkino and Bashkir anomalies not more than 10% to 20% of the anomalous variation may be ascribed to field induction from an external source, and most of the variation is clearly related to current variations in the Earth. (10 refs.)

104187 Analytical description of the secular variations of the geomagnetic field and the rate of rotation of the Earth. S.I.Braginskiy (Inst. of Phys. of Earth, Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.1, p.88-94 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.1 (1982).
An analytical approximation of the data on the variations in the length of the day over a period of 10 years is derived in the form of a sum of the trend and a number of transient oscillations. In a similar form, with the same fundamental frequency of oscillation, an analytical approximation is derived for data on the variations of the Gaussian coefficients of the geomagnetic field for the 20th century. The role of field variations in the theory of geomagnetism is discussed. (34 refs.)

104188 Vertical component of the geoelectric field in high latitudes and magnetosphere processes. O.I.Bandilet, S.P.Chernysheva, V.M.Sheftel (Rostov Civil Engng. Inst., Rostov, USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.213-16 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
Variation of the vertical component of the geoelectric field (E_z) near the Earth's surface in the auroral and subauroral zones are presented. Space-time E_z distribution patterns are defined for high latitudes, the effect of magnetospheric substorms on E_z at high latitude is analyzed and its possible mechanisms discussed. (18 refs.)

104189 Structure of ELF electromagnetic fields in the Arctic Ocean. A.V.Gusev, A.P.Polykov, N.I.Uspenskiy, M.B.Yartsev (Arctic & Antarctic Inst., State Committee on Hydrometeorology USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.228-32 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
A study has been made of the natural ELF electromagnetic fields in the Arctic Ocean. The experimental apparatus, the experimental procedure, and the data analysis are described. The results confirm the hypothesis that these fields result primarily from the excitation of an Earth-ionosphere waveguide. The propagation characteristics of ELF electromagnetic waves in the ocean are derived and discussed. (7 refs.)

104190 Solar wind velocity and changes in the geomagnetic moment. Yu.D.Kalinin, T.S.Rozanova (L.V. Kirenskii Inst. of Phys., Acad. of Sci., Krasnoyarsk, USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.233-5 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
The average annual velocities of the solar wind are calculated for the years from 1930 through 1960 from the average annual values of the geomagnetic activity index and the regression equation found by Svalgaard. For the same years, the average annual data from 12 magnetic observatories at various points on the globe are used to calculate the geomagnetic moment M and, separately, its 'external' and 'external' parts (caused by factors respectively within the Earth and outside it). (8 refs.)

104191 Temporal variations in the anomalous magnetic field in the Fergana Valley in 1973-1979 and prediction of the Alay earthquake of 2 November 1978. V.A.Shapiro, K.N.Abdullabekov, M.Yu.Muminov, T.Kh.Khadzhiyev, E.B.Berdaliyev (Inst. of Geophys., Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.236-40 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
The changes in the anomalous magnetic field near the city of Andizhan which were used in the prediction of the Alay earthquake of 2 November 1978 ($M=7.0$) are discussed. The anomaly in the magnetic field coincided in time with an anomaly of the vertical motion of the Earth's crust. It is suggested that the source of the anomalous variation is a change in the electric current system in the lithosphere. (20 refs.)

104192 Screening properties of the mantle and extrapolation of the variation field to the core-mantle boundary. G.I.Kolomiytseva (Inst. of Terrestrial Magnetism, Ionosphere & Radio Wave Propagation, Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.241-4 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
The screening properties of a conducting mantle are studied. The phase lag and the amplitude damping are derived as functions of the period of the variations for various spatial harmonics. These results can be used to extrapolate the secular variation field, $F(T)$, to the core-mantle boundary with the help of the known coefficients in the expansion of the field $F(T)$ in spherical harmonics. (20 refs.)

104193 Devonian dikes from north central Newfoundland: a radiometric-paleomagnetic study. P.H.Reynolds (Dept. of Phys. & Geology, Dalhousie Univ., Halifax, Nova Scotia, Canada), G.S.Murthy.
Geophys. Res. Lett. (USA), vol.10, no.6, p.432-5 (June 1983).
$^{40}Ar/^{39}Ar$ age spectra have been obtained for biotites and hornblendes representing a suite of diabase dikes from the northern part of Newfoundland's Gander Zone. A primary apparent age of 375±10 Ma is suggested, a value probably very close to the age of intrusion. A number of the age spectra are discordant; this perhaps results from a disturbing 'event' ~180 Ma ago. Magnetic analysis of the dike swarm has yielded four paleopoles; three of these magnetizations appear to be carried by multi-domain magnetite, the other by hematite. If the magnetite magnetizations are primary, they possibly reflect a period of aberrant geomagnetic field behaviour at about the time given above. If the hematite magnetization is primary, the data can be interpreted in terms of the displaced terrain model of Kent and Opdyke,. (26 refs.)

104194 On magnetotelluric sounding of conducting layers in the Earth's crust and upper mantle. M.N.Berdichevskiy, V.I.Dmitriyev, I.S.Barashkov, N.A.Mershchikova, V.M.Kobzova (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.7 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.7, p.520-30 (1982).
The resolving capability of deep magnetotelluric (MT) sounding of local conducting layers in the Earth's crust and upper mantle is analyzed. It is shown that the crystalline rocks shield local conducting layers and that the resolving capability of the MT-sounding may be much lower than in a one-dimensional model. From this viewpoint, the most favorable for deep MT-sounding are highs on the basement, massifs containing effusive formations, and platforms with high-resistivity sedimentary covers. (20 refs.)

104195 Deep magnetotelluric profiling using the vertical component of geomagnetic variations. A.P.Bondarenko (S.I. Subbotin Inst. of Geophys., Acad. of Sci., Ukrainian SSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.7 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.7, p.531-7 (1982).
The results of testing a version of magnetotelluric profiling from S_q-variations on the basis of impedance determinations with a coefficient of the apparent horizontal conductivity inhomogeneity are presented. The results are compared with a seismological cross section and with the depth to a highly-conductive boundary in the mantle derived from geomagnetic profiling data. (16 refs.)

104196 The use of Walsh filters in geoelectric investigations. B.L.Pivovarov (Dept. of Geology, Moscow State Univ., Moscow, USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.7 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.7, p.538-43 (1982).
An examination is made of linear numerical systems whose frequency responses are Walsh functions. Modulated discrete sequences (MDS) are defined. The theorem of optimum Walsh filters coordinated with MDS is proved, and its consequences in relation to the problem of the suppression of regular electromagnetic noise are examined. The results of numerical simulation are given. (4 refs.)

104197 Electromagnetic geophysics and global tectonics. D.I.Gough (Inst. of Earth & Planetary Phys., Univ. of Alberta, Edmonton, Alberta, Canada).
J. Geophys. Res. (USA), vol.88, no.B4, p.3367-77 (10 April 1983). [received: Aug. 1983] (Anton L. Hales Symposium on 'Some Recent Advances in Geophysics', Dallas, TX, USA, 5-6 Oct. 1981).
In this review the author discusses conductivity-depth profiles obtained by four-electrode resistivity sounding of the continental lithosphere and magnetotelluric sounding of the oceanic lithosphere. Magnetometer arrays yield poor depth resolution but are very effective in discovery and mapping of highly conductive structures. Results from magnetometer arrays are discussed in greater detail both because the author's own work has been largely in this area and because some interesting ideas in global tectonics have arisen from this type of study. (40 refs.)

104198 Investigation of a Vine-Matthews magnetic lineation from a submersible: the source and character of marine magnetic anomalies. K.C.Macdonald, S.P.Miller, B.P.Luyendyk, T.M.Atwater (Dept. of Geological Sci. & Marine Sci. Inst., Univ. of California, Santa Barbara, CA, USA), L.Shure.
J. Geophys. Res. (USA), vol.88, no.B4, p.3403-18 (10 April 1983). [received: Aug. 1983]
Reports the first attempt to map directly the boundary of a Vine-Matthews magnetic stripe on the seafloor. The objectives are to study the processes of oceanic crustal accretion as recorded in the reversal transition zone and to investigate the formation of the magnetic source of Vine-Matthews magnetic anomalies. The deep-tow and ALVIN-based magnetic studies focus on the Matuyama/Brunhes reversal transition on the flanks of the East Pacific Rise near 21°N. While the sea level magnetic anomalies are less than average in clarity for the East Pacific Rise, a 'three-dimensional' inversion of deep-tow data reveals a sharp, strike-linear polarity transition less than 1.8 km wide. The measurements show that nearly every magnetic target has the correct polarity. The mechanisms responsible responsible for the formation of new oceanic crust at mid-ocean ridges is discussed in the light of these new observations. (77 refs.)

104199 Paleomagnetism of a polarity transition in the Lower (?) Triassic Chugwater Formation, Wyoming. E.Herrero-Bervera, C.E.Helsley (Hawaii Inst. of Geophys., Univ. of Hawaii, Honolulu, HI, USA).
J. Geophys. Res. (USA), vol.88, no.B4, p.3506-22 (10 April 1983). [received: Aug. 1983]
A total of 156 oriented specimens, taken at stratigraphic intervals of 3 to 20 cm, have been collected from the Red Peak Member of the Chugwater Formation at three localities approximately 25 km southeast of Dubois, Wyoming. The stratigraphic interval containing the polarity transition in the remanent magnetic field is about 1.0 m. The section sampled is divided into five intensity periods: two periods recording the dipolar field, one recording a dipolar field of decreasing intensity, one recording a dipolar field of increasing intensity, and a period of low intensity recording the field present during the 180° directional swing. A virtual geomagnetic pole path obtained for a N→R polarity transition makes a fairly smooth transit, with the path confined to a sector of longitude between 85°W and 110°E. The reversal's onset is first indicated by a slow movement of the VGP across northern latitudes. (55 refs.)

104200 Paleomagnetism of Mesozoic and Tertiary rocks from East El Oweinat area, southwest, Egypt. A.Gouda Hussain, Y.Aziz (Helwan Inst. of Astron. & Geophys., Helwan, Cairo, Egypt).
J. Geophys. Res. (USA), vol.88, no.B4, p.3523-9 (10 April 1983). [received: Aug. 1983]
Ten sites from alkali syenite at East El Oweinat (23.2°N, 29.5°E) yield a stable mean direction of magnetization resulting in a pole at 67.8°N. 268.8°E with $A_{95}=8.6°$. This pole position agrees with the other Upper Cretaceous pole positions of Africa. From seven sites from Upper Cretaceous Nubian

sandstone at East El Oweinat a mean direction was obtained. The paleopole positions of East El Oweinat rocks confirm the apparent polar wander path of Africa established in previous papers. (19 refs.)

104201 On the theory of electromagnetic induction in the Earth by ocean currents. A.D.Chave (Inst. of Geophys. & Planetary Phys., Scripps Inst. of Oceanography, Univ. of California, La Jolla, CA, USA).
J. Geophys. Res. (USA), vol.88, no.B4, p.3531-42 (10 April 1983). [received: Aug. 1983]
The theory of electromagnetic induction is extended to the case where the driving electric currents must be considered explicitly. Differential equations for independent poloidal magnetic (PM) and toroidal magnetic (TM) modes are derived directly from the governing quasistatic form of the Maxwell equations. They are applied to induction by motional source fields in the ocean by deriving Green functions for the two modes in a constant depth ocean. PM and TM modes are shown to behave in very different ways as a function both of the ocean velocity field dynamics and of the electrical conductivity structure of the Earth. (25 refs.)

104202 Geomagnetic anomalies over the Fossa Magna region in central Japan. Y.Ishikawa, T.Yukutake (Earthquake Res. Inst., Univ. of Tokyo, Tokyo, Japan).
J. Geomagn. & Geoelectr. (Japan), vol.34, no.10, p.551-70 (1982).
Total intensity data acquired by aeromagnetic surveys are decomposed into vector components, following a procedure proposed by Lourenco and Morrison (1973). It is revealed that the Fossa Magna is a magnetic region. Intense magnetic anomalies are situated inside the region, and no conspicuous anomalies are outside. The distributions are discussed together with their origins. The boundaries of the Fossa Magna correspond to the boundaries of the magnetic region. (23 refs.)

104203 An electromagnetic scale model study of the Rheingraben anomaly. V.Ramaswamy (Oil & Natural Gas Comm., Nazira, India), H.W.Dosso, R.Winter.
J. Geomagn. & Geoelectr. (Japan), vol.35, no.1, p.17-27 (1983).
The behaviour of time-varying geomagnetic fields in the Rheinegraben region is investigated using a laboratory scale model. The two dimensional geophysical model proposed by Winter (1973, 1974), which consists of a thin sedimentary layer with nonuniform conductivity and a series of subsurface layers, is modelled in the laboratory. The study indicates good agreement between the scale model results and the field station observations. The model results have further established that the behavior of the surface geomagnetic fields observed in the Rhinegraben region is strongly influenced both by the near-surface sedimentary layer as well as by a highly conducting layer in the upper mantle. (15 refs.)

104204 Magnetic anomalies as a reference for ground-speed and map-matching navigation. C.Tyren (Lund Inst. of Technol., Lund, Sweden).
J. Navig. (GB), vol.35, no.2, p.242-54 (May 1982). [received: July 1983]
The Earth's magnetic field provides a directional reference of almost world-wide usable coverage. The author examines the use of the magnetic field for ground referenced motion and position measurements. (3 refs.)

104205 Detailed geomagnetic studies of the rift zone in the south of the Red Sea. A.A.Shreyder, V.I.Trukhin, V.A.Sychev, N.A.Rimskiy-Korsakov (Shirshov Inst. of Oceanology, Acad. of Sci., Moscow, USSR).
Oceanology (USA), vol.22, no.3, p.325-30 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.3 (1982).
Detailed geomagnetic and geomorphological studies, carried out by the R/V Akvanavt, coupled with data obtained by side-scanning sonar and high-frequency profiles from the towed Zvuk-4 vehicle, plus the results of visual observations of the sea bottom from the Pisces submersible, have shown that the spreading axis is divided into segments, whose strike (330°) differs from the overall strike (310°) of the axial magnetic anomaly. In the study area, the segments are about 1 km long, and the transform displacements are 0.5 km. Calculations on a model have shown that the spreading is asymmetric: during the Brunhes epoch, the accretion rate of the African Plate was 6 mm/yr, and that of the Arabian Plate, 7 mm/yr. Earlier, it has been 9 and 11 mm/yr, respectively. (10 refs.)

104206 The magnetic characteristics of the oceanic crust in the Heezen Fracture Zone. T.I.Lin'kova, G.L.Kashinets, A.M.Gorodnitskiy, M.I.Raykevich (Shirshov Inst. of Oceanology, Acad. of Sci., Moscow, USSR).
Oceanology (USA), vol.22, no.3, p.331-6 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.3 (1982).
Petrographic and magnetic studies were carried out on samples of crustal rocks from the Heezen (Eltanin) Fracture Zone in the southeastern Pacific. The data obtained showed the presence of magnetically active layers and allowed their comparison with observed magnetic anomalies. The positive anomaly above the uplifted southern margin of the zone is the result of superposition of fields, where the magnetically-active layers consist (from the top down) of basalts, dolerites, ultramafics, and metamorphic rocks. The metamorphic rocks exhibit a large induced magnetization which may be the cause of the observed magnetic anomalies. (5 refs.)

104207 Acquisition of long wavelength magnetic anomalies pre-dates continental drift. A.Galdeano (Inst. de Phys. du Globe, Univ. Paris, Paris, France).
Phys. Earth & Planet. Inter. (Netherlands), vol.32, no.4, p.289-92 (July 1983).
Using the low altitude MAGSAT satellite data, NASA recently published a new global magnetic map of anomalies. Using this new accurate map and paleomagnetic reconstruction of Gondwanaland, it is pointed out that long wavelength anomalies were continuous in continents that are presently separated. Thus, continental drift would not significantly affect the geometry of these deep-source anomalies. Accordingly, the magnetization of the rocks responsible for these anomalies should mainly be induced. (19 refs.)

104208 Electromagnetic fields induced in the world's oceans and the spatial distribution of electrical conductivity functions. E.B.Fainberg, B.Sh.Singer, A.V.Kuvshinov (Inst. of Terrestrial Magnetism, Ionosphere & Radio Wave Propagation, Acad. of Sci., Moscow, USSR).
Phys. Earth & Planet. Inter. (Netherlands), vol.32, no.4, p.293-300 (July 1983).
The results of numerical simulation of electromagnetic fields induced in the world's oceans by solar daily variations are discussed. Some examples of apparent resistivity curves simulated for continental and ocean regions are demonstrated. (14 refs.)

104209 A preliminary geoelectrical model of the Karelian megablock of the Baltic shield. P.Kaikkonen (Dept. of Geophys., Univ. of Oulu, Oulu, Finland), L.L.Vanyan, S.E.Hjelt, A.P.Shilovsky, K.Pajunpaa, P.P.Shilovsky.
Phys. Earth & Planet. Inter. (Netherlands), vol.32, no.4, p.301-5 (July 1983).
Three groups of electromagnetic data have been considered in order to construct a preliminary geoelectrical depth model of the old basement of the Baltic shield: (i) audiomagnetotelluric data in the period range 1/3700-1/8 s; (ii) magnetotelluric data in the period range 25-1000 s; and (iii) global magnetovariation-sounding data in the period range >6 h. These data sets fit together on a common apparent-resistivity curve, indicating the existence of a unified geoelectrical model. This model does not support the existence of conducting crustal or asthenospheric layers. (16 refs.)

104210 Induction arrows for a buried conducting plate. W.Nienaber, D.Hebert, H.W.Dosso (Dept. of Phys., Univ. of Victoria, Victoria, British Columbia, Canada).
Phys. Earth & Planet. Inter. (Netherlands), vol.32, no.4, p.306-11 (July 1983).
A scaled electromagnetic analogue model is used to study the behaviour of single station induction arrows over a conducting plate embedded in a homogeneous poorly conducting medium. For a profile crossing the edge of the conducting plate, the in-phase arrow, for all locations, points towards the bulk of the good conductor while the quadrature arrow reverses direction directly over the edge, consistently pointing towards the edge. The results also show that both the in-phase and quadrature arrow lengths are reduced with increasing conductor thickness and depth of burial. The model results are applied to examples of a uniform depth ocean and a conducting sill embedded in a poorly conducting Earth. (15 refs.)

104211 Main field and recent secular variation. L.R.Alldredge (US Geological Survey, Denver, CO, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.599-603 (April 1983).
Reviews data sources, MAGSAT, main field representations, secular variation sources, and studies of anomalies in the period 1979-82. (53 refs.)

104212 Archaeo- and paleosecular variation, and long-term asymmetries of the geomagnetic field. C.E.Barton (Graduate School of Oceanography, Univ. of Rhode Island, Narragansett, RI, USA), R.T.Merrill.
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.603-14 (April 1983).
Summarizes progress made during the years 1979-82 in (i) obtaining records of the geomagnetic secular variation using paleomagnetic techniques, (ii) analysis and modelling of the secular variation, and (iii) the study of asymmetries in the time-averaged field: seen both as departures from the geocentric axial dipole model, and as statistical differences between polarity states. (160 refs.)

104213 Geomagnetic reversals and excursions: their paleomagnetic record and implications for the geodynamo. K.A.Hoffman (Phys. Dept., California Polytech. State Univ., San Luis Obispo, CA, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.614-20 (April 1983).
Reviews palaeomagnetic transition records, field intensities during reversals, reversal duration, transition field geometries, testable models, sources of the transition field, palaeomagnetic excursions, reversals—excursions relationships and dynamo implications. (59 refs.)

104214 Magnetic polarity stratigraphy. L.S.Chan, W.Alvarez (Dept. of Geology & Geophys., Univ. of California, Berkeley, CA, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.620-6 (April 1983).
Reviews studies of pelagic and other deep-sea sediments, continental sediments, magnetostratigraphic nomenclature, and the polarity time scale. (132 refs.)

104215 Geomagnetism of Earth's core. E.R.Benton (Dept. of Astro-Geophys., Univ. of Colorado, Boulder, CO, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.627-33 (April 1983).
Reviews major highlights in the 1979-82 period: the successful completion of the first global vector magnetic satellite survey of Earth (by MAGSAT); a wealth of important work on the present physical, compositional, thermodynamic and energetic state of the outer core as well as its evolution over geological time; and a revival of interest in the direct extraction from magnetic measurements of the fluid dynamic motions at the top of the core. (109 refs.)

104216 Magnetic anomalies. C.G.A.Harrison (Rosenstiel School of Marine & Atmospheric Sci., Univ. of Miami, Miami, FL, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.634-43 (April 1983).
Reviews MAGSAT results, and studies of core magnetic field, oceanic basins, and magnetic anomalies in the United States, and magnetic modelling in the period 1979-82. (230 refs.)

104217 Paleomagnetism and the motion of large and small plates. M.O.McWilliams (Geophys. Dept., Stanford Univ., Stanford, CA, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.643-51 (April 1983).
Discusses three major aspects of paleomagnetic research important to the 1978-1982 quadrennial: (1) refinement and application of Cenozoic/Mesozoic apparent polar wander paths (APWP) for the major plates, (2) delineation, displacement, history and assemblage of some of the better-known terranes which comprise the marginal domains of some continents, and (3) development and interpretation of Paleozoic and Precambrian reference APWP. (234 refs.)

104218 Electromagnetic induction studies. J.F.Hermance (Dept. of Geological Sci., Brown Univ., Providence, RI, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.652-65 (April 1983).
Reviews development involving electromagnetic induction studies of the lithosphere and asthenosphere. Activities during the period 1979-82 are emphasized, particularly those of US and Canadian workers. (350 refs.)

Error analysis for the determination of tectonic rotation from paleomagnetic data .... See Entry 104323

A model for the high-frequency electrical response of wet rocks .... See Entry 104340

Magnetic properties of three segments of the Mid-Atlantic Ridge at 37°N: FAMOUS, Narrowgate, and AMAR: AMAR 2 .... See Entry 104350

A model study of the transient electromagnetic coincident loop technique .... See Entry 104596

Sea floor measurement of geomagnetic field using newly developed ocean bottom magnetometers .... See Entry 104603

The frequency domain and the linear filtering of gravity and magnetic data .... See Entry 104608

Generalised study of the suppression principle and its associate equivalence for the three-layer case. Detectability of a stratum by the VES method .... See Entry 104620

Note on the detectability of a layer by the VES method .... See Entry 104622

Electrojet boundaries and electron injection boundaries .... See Entry 104658

Study of the statistical properties of the relationship between the interplanetary and geomagnetic fields by means of multiple-coherence functions .... See Entry 104700

Magnetic fields in the cosmos .... See Entry 104732

91.30 SEISMOLOGY

104219 Earthquake data analysis: an example from Sweden. M.Bath.
Earth-Sci. Rev. (Netherlands), vol.19, no.3, p.181-303 (June 1983).
Methods and results of earthquake data analysis are illustrated by the seismicity of Sweden in the period 1951-1976, summarizing a comprehensive research project for the past five years. Starting from the regional structural properties, methods are given for the evaluation of instrumental and macroseismic observations, including error analysis and source identification. The resulting earthquake distribution is investigated in relation to space (various types of seismicity mapping), time (periodicities) and magnitude (frequency-magnitude and energy-magnitude relations). (149 refs.)

104220 A specific barrier model for the quantitative description of inhomogeneous faulting and the prediction of strong ground motion. I. Description of the model. A.S.Papageorgiou, K.Aki (MIT, Cambridge, MA, USA).
Bull. Seismol. Soc. Am. (USA), vol.73, no.3, p.693-722 (June 1983).
Constructs an earthquake source model which provides a complete description of acceleration power spectra of direct body waves. The model is a specific form of the barrier model proposed by Aki et al. (1977). According to this specific barrier model, the fault surface is visualized as composed of an aggregate of circular cracks which represent areas of localized slip, and the strong motion is assumed to be generated by the stationary occurrence of these localized ruptures as the rupture front propagates. The acceleration power spectra of direct S waves are described by their peak value and an effective bandwidth. From these spectra and an estimate of the duration of faulting, measures of strong motion intensity such as r.m.s. and maximum acceleration can be inferred. (49 refs.)

104221 Numerical evaluation of near-field, high-frequency radiation from quasi-dynamic circular faults. M.Campillo (Lab. de Geophys. Interne, IRIGM, Grenoble, France).
Bull. Seismol. Soc. Am. (USA), vol.73, no.3, p.723-34 (June 1983).
Computes the near-field, high-frequency radiation from a circular crack expanding with constant rupture velocity and discusses the characteristics of the stopping phases. The author then introduces rupture velocity jumps in the fracture process. The computed accelerations show the dominant role played by the rupture front kinematics. The high acceleration pulses are associated with sudden changes of the rupture velocity. For a sudden jump (or a sudden stop), there is no theoretical high-frequency limit to the spectral density of acceleration. In order to account for $f_{\max}$, the author introduces a smooth deceleration of the rupture front over a time t′ in place of a sudden stop. (18 refs.)

104222 Three-dimensional ray tracing and the method of principal curvature for geometric spreading. Jia-Ju Lee, C.A.Langston (Dept. of Geosci., Pennsylvania State Univ., University Park, PA, USA).
Bull. Seismol. Soc. Am. (USA), vol.73, no.3, p.765-80 (June 1983).
A three-dimensional ray method is used to compute three components of ground motion for complex structures involving curved boundaries. The method of principal curvature is developed to compute geometrical spreading of rays. This method employs phase matching at model interfaces and analysis of the wave front surface metric as the ray propagates throughout the model. Results computed for a two-dimensional canonical basin model with a plane *SH*-wave source are compared. Relaxing the restriction that the incident wave be perpendicular to the basin symmetry axis gives rise to large amplitude vertical and radial motions for incident *SH* waves and large tangential motions for incident *P* waves. (18 refs.)

104223 Spatial attenuation of the *Lg* wave in the central United States. J.J.Dwyer, R.B.Herrmann, O.W.Nuttli (Dept. of Earth & Atmospheric Sci., Saint Louis Univ., Saint Louis, MO, USA).
Bull. Seismol. Soc. Am. (USA), vol.73, no.3, p.781-96 (June 1983).
The spatial attenuation of the *Lg* wave in the central United States is studied in the time domain in the frequency range of 1 to 10 Hz. Bandpassed microearthquake data are used to estimate source spectrum shapes and seismic moments. Incorporating these results with those of Street et al. (1975), the seismic moment-magnitude scaling for the central United States is found. (17 refs.)

104224 Deep intraplate seismicity in the western Sierra Nevada, central California. I.G.Wong, W.U.Savage (Woodward-Clyde Consultants, Walnut Creek, CA, USA).
Bull. Seismol. Soc. Am. (USA), vol.73, no.3, p.797-812 (June 1983).
A microearthquake monitoring program was conducted from 1976 to 1979 in the eastern San Joaquin Valley and Sierran foothills of central California. This program revealed one of the deepest occurrences of intraplate earthquakes observed in the conterminous United States. Earthquakes in the M_L range of approximately 0 to 3.2 were confined to the lower crust of the Sierran block at depths from 12 to 38 km. The distribution of epicenters was diffuse and widespread with some clustering in space and time. Two particularly active areas that were consistent with the historical seismicity record were recognized: an area 15 km south of the town of Madera and an area 15 km south of Mariposa. This occurrence of deep seismicity does not appear to extend farther north along the foothills than Jamestown, although two deep events have been observed near Oroville. Focal mechanisms of these deep crustal earthquakes are discussed. (25 refs.)

104225 Rampart seismic zone of central Alaska. P.Yi-Fa Huang, N.N.Biswas (Geophys. Inst., Univ. of Alaska, Fairbanks, AK, USA).
Bull. Seismol. Soc. Am. (USA), vol.73, no.3, p.813-29 (June 1983).
Describes the characteristics of the Rampart seismic zone by means of the aftershock sequence of the Rampart earthquake ($M_L=6.8$) which occurred in central Alaska on 29 October 1968. The magnitudes of the aftershocks ranged from about 1.6 to 4.4 which yielded a *b* value of 0.96 ± 0.09. The locations of the aftershocks outline a NNE-SSW trending aftershock zone about 50 km long which coincides with the offset of the Kaltag fault from the Victoria Creek fault. Fault plane solutions for a group of selected aftershocks, which occurred over a period of 22 days after the main shock, show simultaneous occurrences of strike-slip and normal faults. A comparison of the trends in seismicity between the neighboring areas is discussed. (21 refs.)

104226 Maximum likelihood estimation of *b* values for magnitude grouped data. B.Bender (US Geological Survey, Denver Federal Center, Denver, CO, USA).
Bull. Seismol. Soc. Am. (USA), vol.73, no.3, p.831-51 (June 1983).
The *b* value estimated by fitting a set of observed earthquake magnitudes to the magnitude-frequency relationship, $\log N(m)=a-bm$, where $N(m)$ = number of earthquakes exceeding magnitude *m*, is correlated with the fitting technique used. A simple form of the grouped data formula is derived and shows the role of interval size and maximum magnitude on the *b* value obtained. The author shows how, given a population value of *b*, to calculate the distribution of the estimated *b* values. The author also derives an a posteriori distribution for the population *b* value, given the magnitudes of an observed set of earthquakes. The distribution of *b* values fitted by various techniques is illustrated. (8 refs.)

104227 A statistical model of the earthquake process. J.Lomnitz-Adler (Inst. de Fisica, Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
Bull. Seismol. Soc. Am. (USA), vol.73, no.3, p.853-62 (June 1983).
A model is presented for the simulation of the statistical features of the earthquake process. An analytical solution is given for a simple case, and a numerical calculation of spatial and stress drop frequency distribution has been carried out. Extensions of the model are discussed. (6 refs.)

104228 Dynamic analysis of a slope failure from the 6 August 1979 Coyote Lake, California, earthquake. R.C.Wilson, D.K.Keefer (US Geological Survey, Menlo Park, CA, USA).
Bull. Seismol. Soc. Am. (USA), vol.73, no.3, p.863-77 (June 1983).
The Coyote Lake, California, earthquake of 6 August 1979 ($M_L=5.7$) provided a rare opportunity to perform a dynamic numerical analysis of a seismically induced slope failure using actual strong-motion records. The earthquake displaced a preexisting slump on the northeast shore of Lake Anderson and formed a fissure 20 m long; offsets of 9 mm vertically and 18 mm horizontally were measured across the fissure. The slump is 9 km northwest of the located epicenter but within 100 m of the mapped trace of the Calaveras fault. Two strong-motion records were written in the vicinity of the slump: Coyote Creek, 5 km to the southeast, and Gilroy #6, 15 km to the southeast. These records combined with field measurements of the slope, estimates of the material properties, and a dynamic numerical model based on the Newmark (1975) analysis of seismic slope stability are used to calculate a predicted displacement for the landslide. (14 refs.)

104229 Partial derivative of Love numbers. S.Okubo (Earthquake Res. Inst., Univ. of Tokyo, Tokyo, Japan), M.Saito.
Bull. Geod. (France), vol.57, no.2, p.167-79 (1983).
Presents a simple formula for the partial derivatives of Love numbers with respect to density, bulk modulus and rigidity without using the Adams-Williamson condition in the liquid core. Partials of the second degree Love numbers are computed for model 1066 A. Love numbers prove to be either completely or virtually independent of the elastic profile within the whole core. Delta-function-like changes occur in Love numbers when the density of the top and bottom layers of the outer core are perturbed. (6 refs.)

104230 Measures of strong ground motion derived from a stochastic source model. E.Faccioli (Dept. of Structural Engng., Politecn. di Milano, Milano, Italy).
Int. J. Soil Dyn. & Earthquake Eng. (GB), vol.2, no.3, p.135-49 (July 1983).
Taking the seismic spectrum of a 'statistical' source model as the point of departure, the author arrives at simple expressions for strong miotion measures of engineering significance. Introducing inelastic attenuation through a frequency dependent *Q*-factor, the following relation is obtained for root-mean-square acceleration $\bar{a}$: $\bar{a}\simeq (M_0/4\pi\partial\beta^3)(\exp(-qR)/R)(k_T{}^{-1}/T_r)^{0.5} k_T{}^3[D_a(\Theta)]^{0.5}$ where M_0 is seismic moment, β is shear-wave velocity, R is distance, $k_T{}^{-1}$ is the correlation time of the model, q is an attenuation parameter, T_r is the rupture duration, and $D_a(\theta)$ is a directivity factor. The basic parameter $K_T{}^{-1}$ is estimated by regressing the Arias intensities of representative accelerograms from Italy and Yugoslavia through the analytical expression derived herein. The regression analysis shows that (a) $k_T{}^{-1}$ scales as $M_0{}^{0.26}$; (b) the ratio $k_T{}^{-1}/T_r$ is virtually independent of M_0 so that $\bar{a}\propto M_0{}^{0.23}$, and (c) the fit is improved when directivity is accounted for. (65 refs.)

104231 Characterization of inclusion through surface strong ground motion. M.Dravinski (Dept. of Mech. Engng., Univ. of Southern California, Los Angeles, CA, USA).
Int. J. Soil Dyn. & Earthquake Eng. (GB), vol.2, no.3, p.150-5 (July 1983).
Steady-state wave motion in a half-space with an elastic inclusion of arbitrary shape subjected to a surface line load is investigated. Material of the half-space and the inclusion is assumed to be linearly elastic, homogeneous, and isotropic. Displacement field is evaluated throughout the elastic media by using a boundary integral method so that the continuity conditions between the half space and the inclusion are satisfied in the mean square-sense. Surface displacement results are presented for an elliptic inclusion of arbitrary orientation. A wide range of parameters in the problem is considered. (15 refs.)

104232 Dynamic interaction of a propagation crack with an oblique fault. P.S.Theocaris, H.G.Georgiadis (Dept. of Theoretical & Appl. Mech., Nat. Tech. Univ. of Athens, Athens, Greece).
Int. J. Soil Dyn. & Earthquake Eng. (GB), vol.2, no.3, p.s161-70 (July 1983).
The behaviour of a fast running crack against an internal oblique fault in a brittle material (polymethylmethacrylate) was investigated by the use of high-speed photography and caustics. This problem is significant in rock mechanics, where the whole failure of the rock mass is often due to such dynamic interaction phenomena during earthquake activities. Interesting effects were disclosed when the rapidly moving crack was approaching the internal fault. The non-homogeneous stress field, which was created by the internal slant crack, forced the main propagating crack to a curved path and, simultaneously, to a deceleration of its velocity and eventually its arrest, as well as the variation of the only effective K_I-stress intensity factor along almost all the field of propagation of the crack. The purpose of this paper is to investigate the conditions which govern the development of such phenomena. (15 refs.)

104233 Mechanism of deformation during cyclic undrained loading of saturated sands. Y.P.Vaid, J.C.Chern (Dept. of Civil Engng., Univ. of British Columbia, Vancouver, Canada).
Int. J. Soil Dyn. & Earthquake Eng. (GB), vol.2, no.3, p.171-7 (July 1983).
Laboratory cyclic loading tests have provided most of the present understanding of the response to saturated sands under earthquake loading. In many cases, however, the interest has centered on relating the resistance to liquefaction to the number of cycles of loading. Few attempts have been made to examine in detail the response within cycles of loading. Such an examination is essential for a fundamental understanding of the processes leading to pore-water pressure and strain development of liquefaction. To satisfy the need for practical applications, a close simulation of the stress condition on soil elements in the field, both prior to and during an earthquake, has been emphasized in all cyclic loading studies. Thus, cyclic triaxial tests on isotropically consolidated samples or cyclic simple shear tests on one-dimensionally consolidated samples have been used to simulate stress conditions below level ground. (13 refs.)

104234 Microseisms in geothermal field exploration. I. M.Ohmi, K.Kaneko, M.Inoue, K.Masunaga (Kumamoto Univ., Kyushu, Japan).
Tech. Rep. Kumamoto Univ. (Japan), vol.31, no.3, p.91-6 (Nov. 1982). In Japanese.
The area around geothermal fields in Kyushu, Japan, was surveyed for microseisms. One to 30 Hz band pick-ups with vertical, north-south, and east-west sensors feeding into an amplifier, data recorder, digital memory and

microcomputer were used. Analysis of the data to eliminate man-made and natural sources of microseisms is described. Examples of this analysis on the data obtained are shown. (3 refs.) *M.O.*

104235 Reflection of spherical seismic waves in elastic layered media. P.M.Krail (Res. Center Annex, Getty Oil Co., Houston, TX, USA), H.Brysk.
Geophysics (USA), vol.48, no.6, p.655-64 (June 1983).
The solution of the elastic wave equation for a plane wave incident on a plane interface has been known since the turn of the century. For reflections from reasonably shallow beds, however, it is necessary to treat the incident wave as spherical rather than plane. The formalism for expressing spherical wavefronts as contour integrals over plane waves goes back to Sommerfield (1909) and Weyl (1919). Brekhovskikh (1960) performed a steepest descent evaluation of the integrals to attain analytic results in the acoustic case. The authors have extended their approach to elastic waves to obtain spherical-wave Zoeppritz coefficients. (15 refs.)

104236 Generalized linear inversion of reflection seismic data. D.A.Cooke, W.A.Schneider (Colorado School of Mines, Golden, CO, USA).
Geophysics (USA), vol.48, no.6, p.665-76 (June 1983).
Generalized linear inversion is applied to synthetic and real seismic data sets with the objective of obtaining an impedance profile as a function of time. The impedances solved for are parameterized in a manner that describes the unknown Earth using fewer variables than previous seismic generalized linear inversion techniques. The method of generalized linear inversion is designed to improve on the shortcomings of recursive inversion with respect to relative and absolute scale of the impedance results, resolution of impedance boundaries, and distortion from residual wavelet effects. (11 refs.)

104237 Migration with the full acoustic wave equation. D.D.Kosloff, E.Baysal (Seismic Acoustics Lab., Univ. of Houston, Houston, TX, USA).
Geophysics (USA), vol.48, no.6, p.677-87 (June 1983).
Conventional finite-difference migration has relied on one-way wave equations which allow energy to propagate only downward. Although generally reliable, such equations may not give accurate migration when the structures have strong lateral velocity variations or step dips. An alternative approach based on the full acoustic wave equation is examined. The migration algorithm developed from this equation was tested against synthetic data and against physical model data. The results indicated that such a scheme gives accurate migration for complicated structures. (9 refs.)

104238 Seismic shear-wave observations in a physical model experiment. R.H.Tatham, D.V.Goolsbee, W.F.Massell (Petty-Ray Geophys., Houston, TX, USA), H.R.Nelson.
Geophysics (USA), vol.48, no.6, p.688-701 (June 1983).
The observation and common-depth-point (CDP) processing of mode-converted shear waves is demonstrated for real data collected in a physical model experiment. Data were collected in both an end-on-CDP model, with offsets from 1000 ft to 20000 ft, and a variety of walk-away experiments with scaled ranges from 1000 ft to 31000 ft. Processing and analysis of the data confirm the existence of mode-converted shear-wave reflections in a modeled marine environment. (7 refs.)

104239 Continuously time-variable recursive digital band-pass filters for seismic signal processing. R.A.Stein, N.R.Bartley (Dept. of Electrical Engng., Univ. of Calgary, Calgary, Alberta, Canada).
Geophysics (USA), vol.48, no.6, p.702-13 (June 1983).
A design technique is described for continuously time-variable recursive digital band-pass filters for seismic signal processing. Two types of band-pass filters are considered: a cascade of a low-pass and a high-pass filter, and a direct band-pass filter, with all filters being derived from a continuous unit-bandwidth Butterworth low-pass prototype. Data are given for determining the length of the interpolation interval to meet prescribed worst case magnitude and frequency error criteria. (13 refs.)

104240 Migration by extrapolation of time-dependent boundary values. G.A.McMechan (Pacific Geosci. Center, Dept. of Energy, Mines & Resources, Sidney, BC, Canada).
Geophys. Prospect. (Netherlands), vol.31, no.3, p.413-20 (June 1983).
Migration of an observed zero-offset wavefield can be performed as the solution of a boundary value problem in which the data are extrapolated backward in time. This concept is implemented through a finite-difference solution of the two-dimensional acoustic wave equation. All depths are imaged simultaneously at time 0 (the imaging condition), and all dips (right up to vertical) are correctly migrated. Numerical examples illustrate this technique in both constant and variable velocity media. (13 refs.)

104241 Radiation and receiver pattern of shear and compressional waves as a function of Poisson's ratio. S.Kahler, R.Meissner (Inst. fur Geophys., Univ. Kiel, Kiel, Germany).
Geophys. Prospect. (Netherlands), vol.31, no.3, p.421-35 (June 1983).
Shear (=S) wave studies and compressional (=P) wave surveys have revealed that S-wave velocities are much more variable than P-wave velocities. This strongly affects Poisson's ratio σ, especially in young sediments. It is shown that σ has a great influence on the directivity pattern. For their calculation, well-known surface boundary conditions and White's statement of the reciprocity relation (White 1965) are used. They also form the basis for the combination of source and receiver patterns essential for practical field work. The various combinations of horizontally and vertically arranged sources and receivers are investigated. (8 refs.)

104242 Wavefront divergence, multiples, and converted waves in synthetic seismograms. F.Hron, J.D.Covey (Amoco Production Co., Tulsa, OK, USA).
Geophys. Prospect. (Netherlands), vol.31, no.3, p.436-56 (June 1983).
Synthetic seismograms can be very useful in aiding understanding of wave propagation through models of real media, verification of geologic models derived from interpretation of field seismic data, and understanding the nature and complexity of wave phenomena. Various needs for computation are discussed. Various seismograms, computed via asymptotic ray theory and an automatic ray generation scheme, are presented for a highly simplified North Sea velocity structure. (27 refs.)

104243 Absorption-dispersion relations for Love channel waves. M.Dobroka, T.Ormos (Dept. of Geophys., Tech. Univ. for Heavy Industry, Egyetemvaros, Hungary).
Geofiz. Koeslemenyek (Hungary), vol.29, no.2, p.117-27 (June 1983).
Starting from the rheological equations of the Poynting-Thomson model, dispersion relations are derived for horizontally-polarised Love waves travelling in a stratum bounded by two different semi-infinite media. Numerical solutions to the complex dispersion relation and absorption-dispersion curves are also given in three special cases. (5 refs.)

104244 Preliminary results of numerical modelling of 'seam-waves'. A.Bodoky (Computer & Automation Inst., Hungarian Acad. of Sci., Budapest, Hungary), T.Bodoky.
Geofiz. Koeslemenyek (Hungary), vol.29, no.2, p.129-40 (June 1983).
Suggests a numerical modelling scheme for elastic waves channelled through coal seams. The numerical modelling is based on the finite difference solution of the elastic wave equation. Boundary conditions are satisfied by the explicit approximation technique. Input motions given for the consecutive time instants supply the initial condition. Snapshots of the motion and seismograms are computed and some examples are provided to illustrate the potential of finite difference modelling. (14 refs.)

104245 Influence of charge depth on the frequency content of seismic waves. H.Rische (Sektion Phys., Karl-Marx-Univ., Leipzig, Germany).
Geofiz. Koeslemenyek (Hungary), vol.29, no.2, p.163-71 (June 1983).
In experiments aimed at broadening the frequency pass-band of shot generated seismic waves the charge depth was hardly considered hitherto. By means of field data it is demonstrated that by decreasing the charge depth essentially higher frequencies and hence considerable signal compression can be achieved. This effect may favourably be applied in shallow seismic surveys using P-waves. (7 refs.)

104246 Contemporary seismicity of the Pamirs and diagrams of the seismogenic zones of the territory. R.S.Mikhaylova (Inst. of Earthquake Resistant Construction & Seismology, Acad. of Sci., Tadzhik SSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.7 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli,* vol.18, no.7, p.486-90 (1982).
An analysis of the crustal seismicity of the Pamirs is presented which indicates the existence of a seismogenic zone of near-north-south trend. (14 refs.)

104247 The seismic cross section and strength of the lithosphere of Iceland. S.S.Demin (Schmidt Inst. of Earth Phys., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.7 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli,* vol.18, no.7, p.491-5 (1982).
A mechanical analysis is made of a seismic model of the deep structure of Iceland. The model is characterized by a thin suboceanic crust underlaid by an anomalous, partially molten mantle. Tangential stresses created by inhomogeneities of the external relief and by density inhomogeneities in the crust are estimated. The estimates obtained for the Vatnajokull glacial shield are analyzed. (28 refs.)

104248 The effect of the length of a shear fracture on the nature of the radiation [earthquake focus]. S.A.Strizhkov, A.A.Pavlov (Schmidt Inst. of Earth Phys., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.7 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli,* vol.18, no.7, p.496-501 (1982).
The results of experimental studies of the rupture rate and the nature of the radiation of prepared fractures of shear type as a function of their length are presented. With an increase in the length of the fractures the rupture rate increases. The radiation pattern when this rate attains a supersonic velocity becomes symmetrical with respect to the fracture plane, and the greater part of the energy is radiated in the rupture direction. (9 refs.)

104249 An experiment in systematic study of global seismicity: centroid-moment tensor solutions for 201 moderate and large earthquakes of 1981. A.M.Dziewonski, J.H.Woodhouse (Dept. of Geological Sci., Harvard Univ., Cambridge, MA, USA).
J. Geophys. Res. (USA), vol.88, no.B4, p.3247-71 (10 April 1983). [received: Aug. 1983] (Anton L. Hales Symposium on 'Some Recent Advances in Geophysics', Dallas, TX, USA, 5-6 Oct. 1981).
Data from the Global Digital Seismograph Network were used to obtain 'centroid-moment tensor' solutions using the method of Dziewonski et al. (1981). Results were obtained for 201 earthquakes ranging in seismic moment from 7×10^{23} to 3×10^{27} dyne-cm. The wide dynamic range of the SRO/ASRO stations the same algorithm to be used to investigate series of events among which the smallest and the largest may differ in moment by a factor as large as 1000. Among the events studied is a particularly interesting series, in January 1981, off the island of Honshu. The source mechanisms of all these earthquakes are discussed. (36 refs.)

104250 Total-moment spectra of fourteen large earthquakes. P.G.Silver, T.H.Jordan (Geological Res. Div., Scripps Inst. of Oceanography, La Jolla, CA, USA).
J. Geophys. Res. (USA), vol.88, no.B4, p.3273-93 (10 April 1983). [received: Aug. 1983] (Anton L. Hales Symposium on 'Some Recent Advances in Geophysics', Dallas, TX, USA, 5-6 Oct. 1981).
Total-moment spectra $M_T(\omega)=\|M(\omega)\|\sqrt{2}$, where M is the moment rate tensor, are computed for 14 large earthquakes recorded by the International Deployment of Accelerometers (IDA) network using the scalar-moment retrieval method proposed by Silver and Jordan [1982]. For each event we obtain estimates of M_T averaged over the 10 disjunct, 1-mHz intervals in the low-frequency and 1-11 mHz; typical IDA record sets from events with $M_T \gtrsim 0.2$ A (1 A$=10^{27}$ dyne.cm) yield standard errors on the 1-mHz averages that are generally less than 20%. Our multiple-band estimates of M_T are usually consistent with comparable single-band values found by other investigators. From the total-moment spectra we derive the zero-frequency (static) moment $M_T{}^0 \equiv M_T(0)$ and the characteristic source duration $\tau_c \equiv 2\ (\mathrm{Var}\ [f(t)])^{1/2}$, where $f(t)$ is the time function of the moment rate tensor, assumed to be the same for all components. (60 refs.)

104251 Travel times and station corrections for P waves at teleseismic distances. A.M.Dziewonski (Dept. of Geological Sci., Harvard Univ., Cambridge, MA, USA), D.L.Anderson.
J. Geophys. Res. (USA), vol.88, no.B4, p.3295-314 (10 April 1983). [received: Aug. 1983] (Anton L. Hales Symposium on 'Some Recent Advances in Geophysics', Dallas, TX, USA, 5-6 Oct. 1981).
Approximately 3300 shallow focus earthquakes and 1000 seismic stations have been used in a study of P wave travel times and station residuals, including azimuthal effects. The events were selected from a catalog containing 160000 earthquakes, and those having uniform distance and azimuthal coverage were systematically relocated and used to refine P wave travel times and station corrections. Station corrections are provided for 994 seismic stations. The station corrections involve three terms: the static effect and two cosine terms with appropriate phase shifts. They exhibit general consistency over broad geographic areas and, where coverage is dense, often show abrupt changes from one geological province to another. The cos 2θ terms appear to be due to upper mantle anisotropy, and they correlate with the stress direction in the crust. (26 refs.)

104252 Multimode Rayleigh wave attenuation and Q_β in the crust of the Barents shelf. A.Kijko, B.J.Mitchell (Dept. of Earth & Atmospheric Sci., Saint Louis Univ., St. Louis, MO, USA).
J. Geophys. Res. (USA), vol.88, no.B4, p.3315-28 (10 April 1983). [received: Aug. 1983] (Anton L. Hales Symposium on 'Some Recent Advances in Geophysics', Dallas, TX, USA, 5-6 Oct. 1981).
The multimode method of Cheng and Mitchell [1081] is used to study the attenuation properties of the crust throughout the Barents shelf. The sensitivity of the spectra to various source factors and to propagation factors which might characterize a shelf region are thoroughly studied. For plane-layered models, the method is very sensitive to Q_β in the upper crust and to Q_β of sedimentary layers if those layers are thick and highly attenuating. The fundamental mode, but not the higher mode, spectra for one path across the

Barents shelf are, apparently, distorted at short periods by lateral heterogeneities along the travel path. Simple two-layer, trial-and-error inversions yield a model of the Barents shelf with an upper crustal Q_β value of about 80. Three-layer inversions with a sedimentary layer, however, yield an upper crustal Q_β of about 250, if the sediments are 1 km thick and are characterized by Q_β values of 40. Seismic velocity models are presented. (30 refs.)

104253 COCORP and the continental crust. J.Oliver, F.Cook, L.Brown (Dept. of Geological Sci., Cornell Univ., Ithaca, NY, USA).
J. Geophys. Res. (USA), vol.88, no.B4, p.3329-47 (10 April 1983). [received: Aug. 1983] (Anton L. Hales Symposium on 'Some Recent Advances in Geophysics', Dallas, TX, USA, 5-6 Oct. 1981).
Seismic reflection profiling data from the COCORP project, coupled with other kinds of geophysical and geological observations, suggest some fresh perspectives on the crust. For example, there is evidence for great differences within the basement at a single site and from one COCORP site to another. A simple layered model is surely not an adequate representation of the crust in most areas. There is, however, the puzzling and rather common occurrence of limited zones of parallel, though not always flat, layered features at various depths in certain parts of the crust. Are the corresponding rocks metasedimentary? Or igneous? Or both? There are transparent zones from which little or no coherent reflected seismic energy is detected. Are the corresponding rocks intrusions? Or highly deformed metasediments? The authors answer these and other questions in this speculative paper. (42 refs.)

104254 Changes in compressional and shear wave velocities and dynamic moduli during operation of a hot dry rock geothermal system. C.F.Pearson (Earth & Space Sci. Div., Los Alamos Nat. Lab., Los Alamos, NM, USA), M.C.Fehler, J.N.Albright.
J. Geophys. Res. (USA), vol.88, no.B4, p.3468-75 (10 April 1983). [received: Aug. 1983]
Compressional and shear wave velocities measured during cross well seismic surveys are found to decrease during operation of a hot dry rock geothermal system. This relative *P* and *S* wave velocity decrease is very close to values predicted by O'Connell and Budiansky (1974), who modeled velocities in rocks containing fluid-saturated and dry cracks. Because the author's data fit their model quite well, attribute the velocity decrease to an increased density of fluid-filled fractures in the reservoir. Fracture density parameters of O'Connell and Budiansky range as high as 0.365 near the main heat transfer areas of the geothermal reservoir. The dynamic shear and Young's modulus are significantly lower near the principal heat transfer surfaces, but the bulk modulus is largely unaffected. These observations suggest that the velocity differences are caused by fully saturated fractures. (26 refs.)

104255 Kinematic analysis of strong motion *P* and *SV* waves from the Sterling event. C.A.Langston (Dept. of Geosci., Pennsylvania State Univ., University Park, PA, USA).
J. Geophys. Res. (USA), vol.88, no.B4, p.3486-97 (10 April 1983). [received: Aug. 1983]
P and *SV* velocity waveforms from the Sterling explosion of December 3, 1966, are analyzed from a point of view often taken in earthquake source studies. The detonation occurred in the cavity excavated by the Salmon explosion within the Tatum salt dome, Mississippi. Velocity recordings taken from nearby borehole strong motion instruments show the occurrence of significant *SV* energy. Kinematic source models are constructed by considering constraints afforded by the preshot cavity, condition of the surrounding material, and aspects of the *P* and *SV* waveforms such as wave polarity and duration. Waveforms for these models are computed and compared directly with the data. (21 refs.)

104256 Present seismic evidence for a boundary layer at the base of the mantle. D.J.Doornbos (Norges Teknisk Naturvitanskapelige Forsknungsrad, Norwegian Seismic Array, Kjeller, Norway).
J. Geophys. Res. (USA), vol.88, no.B4, p.3498-505 (10 April 1983). [received: Aug. 1983]
To improve the global coverage needed in investigating the observational consequences of boundary layer models, the existing data set has been extended with long-period diffracted *P* and *SH* from the SRO network, and short-period diffracted *P* from the NORSAR array. It was found that on average, the amplitude decay of diffracted *SH* is relatively small, in accordance with the majority of previously published WWSSN data, and consistent with the observed weakness in dispersion of this phase. These results, in combination with the apparent absence of anomalously high $dT/d\Delta$, can be explained by a relatively thin ($\leq$100 km) low-velocity zone at the base of the mantle. Long-period diffracted *P* wave data probably lack the required resolution for detecting a relatively thin transition zone. The existence of such a zone is discussed. (26 refs.)

104257 Focal depths of intracontinental and intraplate earthquakes and their implications for the thermal and mechanical properties of the lithosphere. Wang-Ping Chen (Dept. of Geology, Univ. of Illinois, Urbana, IL, USA), P.Molnar.
J. Geophys. Res. (USA), vol.88, no.B5, p.4183-214 (10 May 1983).
Investigates the distribution of focal depths for earthquakes that do not appear to be associated with zones of recent subduction, using both new results from analyses of individual events recorded at teleseismic distances and published data for both microearthquakes and larger events. The deepest events in oceanic regions occur in old lithosphere, and excluding earthquakes in active mountain belts, the deepest crustal events occur in old cratons. Therefore, the temperature at the source region is likely to be an important factor determining whether deformation occurs seismically or not. From estimates of the temperature at depths of the deepest events, it is concluded that those limiting temperatures are about 250°-450°C and 600°-800°C for crustal and mantle materials, respectively. Both the upper crustal and the mantle seismic regions correspond to zones of relatively high strength and they are separated by a zone of lower strength in the lower crust where aseismic, ductile deformation predominates. (200 refs.)

104258 Triple seismic zone and the regional variation of seismicity along the northern Honshu arc. H.Kawakatsu, T.Seno (Dept. of Geophys., Stanford Univ., Stanford, CA, USA).
J. Geophys. Res. (USA), vol.88, no.B5, p.4215-30 (10 May 1983).
The regional variation of seismicity along the northern Honshu arc, Japan, is studied using accurate focal depths and focal mechanism types. The types of the focal mechanisms of 184 events were determined using P wave first motion data. Based on historical seismicity of great and large earthquakes, the authors divide the zone of thrust type earthquakes at the plate interface into two regions: the shallow thrust zone (0-40 km), where great earthquakes ($M_s \sim 8.0$) occur, and the deep thrust zone (40-60 km), where large earthquakes ($M_s \sim 7.4$) occur. The activity of great or large earthquakes shows a variation along the arc. (51 refs.)

104259 Preseismic rupture progression and great earthquake instabilities at plate boundaries. V.C.Li (Dept. of Civil Engng., MIT, Cambridge, MA, USA), J.R.Rice.
J. Geophys. Res. (USA), vol.88, no.B5, p.4231-46 (10 May 1983).
A procedure is presented for modeling the initially quasi-static upward progression of a zone of slip from some depth in the lithosphere toward the Earth's surface, along a transform plate margin, culminating in a great crustal earthquake. Stress transmission in the lithosphere is analyzed with a generalized Elsasser model, in which elastic lithospheric plates undergo plane stress deformation and are coupled by an elementary foundation model to a Maxwellian viscoelastic asthenosphere. Upward progression of rupture over a finite length of plate boundary, corresponding to a seismic gap along strike, is analyzed by a method based on the 'line-spring' concept, whereby a two-dimensional antiplane analysis of the upward progression provides the relation between lithospheric thickness-averaged stress and slip used as a boundary condition in the generalized Elsasser plate model. The formulation results in a nonlinear integral equation for the rupture progression as a function of time and distance along strike. A simpler approximate single degree of freedom analysis procedure is described and shown to lead to instability results that can be formulated in terms of the slip-softening slope at the boundary falling below the elastic unloading stiffness of the surroundings. (35 refs.)

104260 Local seismicity preceding the March 14, 1979, Petatlan, Mexico earthquake ($Ms=7.6$). V.Hsu, J.F.Gettrust, C.E.Helsley, E.Berg (Hawaii Inst. of Geophys., Univ. of Hawaii, Honolulu, HI, USA).
J. Geophys. Res. (USA), vol.88, no.B5, p.4247-62 (10 May 1983).
Local seismicity surrounding the epicenter of the March 14, 1979, Petatlan, Mexico earthquake was monitored from 6 weeks before to 4 weeks after the main shock. Prior to the main shock, the recorded local seismic activity was shallow and restricted within the continental plate above the Benioff zone. The relocated main shock hypocenter also lay above the Benioff zone, suggesting an initial failure within the continental lithosphere. Four zones can be recognized that showed relatively higher seismic activity than the background. A possible connection is inferred between the observed earthquake migration pattern and the subduction of a fracture zone because the 200-km segment that includes the aftershock zones of the Petatlan earthquake and the three preceding moderate earthquakes matches the intersection of the southeastern limb of the Orozco Fracture Zone and the Middle America Trench. (29 refs.)

104261 Seismic rupture patterns in Oaxaca, Mexico. F.Tajima, K.C.McNally (Seismological Lab., California Inst. of Technol., Pasadena, CA, USA).
J. Geophys. Res. (USA), vol.88, no.B5, p.4263-75 (10 May 1983).
The spatio-temporal patterns of seismic activity for events with body wave magnitude $m_b \geq 4.0$ are investigated for the three most recent large earthquakes in the Oaxaca region of southern Mexico (August 23, 1965, $M_s=7.6$, $M_w=7.5$; August 2, 1968, $M_5=7.1$, $M_w=7.3$; November 29, 1978, $M_w=7.8$, $M_w=7.6$). A master catalogue of earthquakes is compiled for the analyses. The events are then relocated with the Joint Hypocenter Determination (JHD) method. At this magnitude threshold it was found that the aftershock zone of the 1965 earthquake was seismically quiescent for at least 20 months prior to the main event; the 1968 earthquake was preceded by 1 year of foreshock type activity clustered in the aftershock zone; the 1978 earthquake was preceded by 43 months of quiescence and one event ($m_b=4.7$) within the aftershock zone 4 months prior to the mainshock. A segment of the subduction zone in Oaxaca remains unbroken by these earthquakes. (16 refs.)

104262 Breaking of a single asperity: rupture process and seismic radiation. S.Das (Lamont-Doherty Geological Obs., Columbia Univ., Palisades, NY, USA), B.V.Kostrov.
J. Geophys. Res. (USA), vol.88, no.B5, p.4277-88 (10 May 1983).
The problem of spontaneous shear rupture of a single circular asperity on an infinite fault plane is studied. Initially, the fault plane is broken everywhere except at a circular asperity. An applied displacement at infinity results in a stress concentration along the bounding edge of the asperity. The frictional stress on the broken part of the fault plane is taken to be a constant. Once a point on the asperity breaks, the stress there drops to the same value as on the 'main' fault surface. The rupture is started by relaxing the shear stress at a point on the asperity edge and is then allowed to propagate spontaneously, using a critical stress level fracture criterion. The rupture process is calculated numerically. It is found that for asperities of constant strength, the rupture first propagates around the edge of the asperity and then inward, a phenomenon best described by the well-known term of classic military maneuver: 'the double encircling pincer movement'. (21 refs.)

104263 Spectral characteristics of high-frequency P_n, S_n phases in the Western Pacific. D.A.Walker, C.S.McCreery (Hawaii Inst. of Geophys., Honolulu, HI, USA), G.H.Sutton.
J. Geophys. Res. (USA), vol.88, no.B5, p.4289-98 (10 May 1983).
Pn and Sn phases from 25 selected earthquakes recorded since July of 1979 on ocean bottom hydrophones near Wake Island are used to complement and extend prior investigations of high-frequency Pn, Sn spectra in the Western Pacific. At a distance of about 18° ($\simeq$2000 km), frequencies for Pn and Sn are as high as 30 and 35 Hz, respectively; at a distance of about 30° ($\simeq$3300 km), as high as 15 and 20 Hz, respectively. Pn phases lose their high-frequency energy more rapidly than Sn phases do, yet Pn wavetrains are much longer than Sn wavetrains. Pn wavetrains of longer duration, more energy, and higher frequencies are found for travel paths primarily in the Northwestern Pacific Basin than for travel paths across the transition zone from the shallow Ontong-Java Plateau to the deep Northwestern Pacific Basin. Sn phases are extremely weak or absent for travel paths crossing this transition zone from the shallower Ontong-Java Plateau to the deeper Northwestern Pacific Basin. (17 refs.)

104264 The inverse problem of a spherically symmetric fluid Earth. S.Coen (Dept. of Materials Sci. & Mineral Engng., Univ. of California, Berkeley, CA, USA).
J. Geophys. Res. (USA), vol.88, no.B5, p.4299-303 (10 May 1983).
It is shown that the density and bulk modulus profiles of a spherically symmetric fluid Earth model are uniquely determined from the surface particle acceleration and pressure at two arbitrary frequencies. The excitation is a harmonically oscillating point source which is located on the surface of the Earth. (12 refs.)

104265 Shear and compression wave measurements in shocked polycrystalline Al_2O_3. Y.M.Gupta (SRI Internat., Menlo Park, CA, USA).
J. Geophys. Res. (USA), vol.88, no.B5, p.4304-12 (10 May 1983).
Experimental techniques have been developed to study the propagation of large-amplitude, one-dimensional shear and compression waves in shocked solids of geophysical interest. Shear wave velocities and amplitudes can be directly measured along with the usual measurements on longitudinal waves. Experimental measurements to 90 kbar compressive shock stresses are reported in Al_2O_3. Within experimental scatter ($\pm$2%), the shear wave velocity data are in good agreement with the extrapolation of the ultrasonic

measurements. The experimental developments reported are expected to be important to high pressure geophysics applications because they provide a direct measure of the shear modulus in the shocked state. The shear modulus is not only a more sensitive indicator of the solid state than the longitudinal modulus but in conjunction with the longitudinal wave data can provide the mean stress-volume relations for comparison with static data. (21 refs.)

104266 A study of the importance of nonlinearity in the inversion of earthquake arrival time data for velocity structure. G.L.Pavlis, J.R.Booker (Univ. of Washington, Seattle, WA, USA).
J. Geophys. Res. (USA), vol.88, no.B6, p.5047-55 (10 June 1983).
All techniques that currently exist to invert arrival time data from earthquake sources for velocity structure rest on a local linearization of the nonlinear equations relating these data to the velocity model. The authors have studied the limitations imposed by this approximation using synthetic data in which a one dimensional velocity model is the only variable. This problem is found to be sufficiently nonlinear that some iterative scheme is generally required to obtain results that are quantitatively correct. Convergence to a solution linearly close to the truth is fairly readily achieved whenever the resolution of the data is sufficient to resolve the structure of the true velocity model. Convergence to solutions that are not linearly close where found to occur, however, when the true velocity model contained significant unresolvable structure. (13 refs.)

104267 Teleseismic detection in the Aleutian Island Arc. R.E.Habermann (Univ. of Colorado, Boulder, CO, USA).
J. Geophys. Res. (USA), vol.88, no.B6, p.5056-64 (10 June 1983).
Recently it has become apparent that teleseismic detection of earthquakes has decreased substantially in many regions of the world. The major decrease was related to the closure of the VELA arrays in the United States during the late 1960's. In this paper the effect of the closure of these arrays on the reporting of events in the Aleutian Island Arc is examined. In the Aleutians, the detection history is complicated by the short-term installation of a local network on and near Amchitka Island during the early 1970's. The temporal coincidence of the installation of this network and the closure of the VELA arrays delayed the detection decrease in the central Aleutians until the Amchitka network was closed in early 1973. (10 refs.)

104268 A seismic risk evaluation in Korea. S.G.Kim (Dept. of Phys., Hanyang Univ., Seoul, Korea), S.J.Kim.
J. Phys. Earth (Japan), vol.30, no.5, p.441-50 (1982).
A seismic risk map of Korea is constructed using the modified first asymptotic distribution of the extreme value theory (Kim, 1981). The seismic data of historical earthquakes (1405-1905) and instrumentally recorded earthquakes (1906-1981) are obtained from the ancient Korean documents and seismograph stations, respectively. Maximum potential earthquakes that are expected to occur with a 10% exceeding probability within 30 years are estimated in 6 seismic provinces of the Korean Peninsula. Maximum ground accelerations or particle velocities for all points on a grid are computed. (18 refs.)

104269 Moment and duration of shallow earthquakes from Love-wave modelling for regional distances. W.Brustle, G.Muller (Inst. of Meteorology & Geophys., Frankfurt, Germany).
Phys. Earth & Planet. Inter. (Netherlands), vol.32, no.4, p.312-24 (July 1983).
Love waves from five earthquakes in southwest Germany, Italy, Yugoslavia, Greece and Algeria, as recorded at the broadband Grafenberg array in eastern Bavaria, are modelled in detail using an extended reflectivity method. The focal mechanisms are taken from the literature or determined from long-period WWNSS data. The theoretical double-couple moment function used for modelling increases smoothly during the risetime T from zero to the seismic moment M_0. T and M_0 are determined by matching the observed and theoretical Love-wave seismograms in the long-period WWNSS frequency band. T is approximately equal to the rupture duration; values from 1.4 to 20 s are found. The present results show that accurate Love-wave modelling for a single station at regional distance from an epicentre is a reliable method for estimation of seismic moment and rupture duration. (21 refs.)

104270 Extreme value distribution of earthquake magnitude. Zi Jun Gan (Inst. of Oceanology, Acad. Sinica, Shandong, China), C.C.Tung.
Phys. Earth & Planet. Inter. (Netherlands), vol.32, no.4, p.325-30 (July 1983).
Probability distribution of maximum earthquake magnitude is first derived for an unspecified probability distribution of earthquake magnitude. A model for energy release of large earthquakes, similar to that of Adler-Lomnitz and Lomnitz, is introduced from which the probability distribution of earthquake magnitude is obtained. An extensive set of world data for shallow earthquakes, covering the period from 1904 to 1980, is used to determine the parameters of the probability distribution of maximum earthquake magnitude. Because of the special form of probability distribution of earthquake magnitude, a simple iterative scheme is devised to facilitate the estimation of these parameters by the method of least-squares. The agreement between the empirical and derived probability distributions of maximum earthquake magnitude is excellent. (9 refs.)

104271 Synthetic P-wave seismograms for the Kinnaur (Himachal Pradesh, India) earthquake of January 19, 1975. A.R.Banghar (Neutron Phys. Div., Bhabha Atomic Res. Centre, Trombay, Bombay, India).
Phys. Earth & Planet. Inter. (Netherlands), vol.32, no.4, p.331-41 (July 1983).
Long-period P-wave seismograms are computed for the Kinnaur earthquake of January 19, 1975, using a bilateral-bidirectional propagating rectangular fault model. Comparison of computed and observed P-wave seismograms shows good agreement. Hence, it is inferred that a bilateral-bidirectional fault is a suitable model for this earthquake. (31 refs.)

104272 A new approach for studying microseism data and coda wave analysis. M.H.Sarachaga (Catedra de Geofisica, Univ. Complutense, Madrid, Spain), J.M.Rodriguez.
Rev. Geofis. (Spain), vol.38, no.2, p.167-78 (1982). In Spanish.
Microseismicity studies are an interesting and useful tool in order to determine the activity of a fault or to improve the knowledge of the general seismicity of a specific area. Unfortunately, the possibilities of the microseismicity data are strongly diminished when data are, as is usual in Spain, paper recorded. A new method, based on coda wave analysis and specially designed for dealing with this problem is presented. This method allows one to evaluate the quality factor Q and the $M_L - M_0$ relations for each analyzed area. Its theoretical background and its application to the regions of Arette (French Central Pyrenees), Lorca (South-east of Spain) and Granada, are also described. (26 refs.)

104273 Historical development of seismic catalogues for Spain. D.Munoz, A.Udias (Catedra de Geofisica, Univ. Complutense, Madrid, Spain).
Rev. Geofis. (Spain), vol.38, no.2, p.189-93 (1982). In Spanish.
Since the publication of the first lists of earthquakes in XVII century, interest on these studies grew and gave rise to seismic catalogues. These catalogues started to be published in a standard fashion after Perrey's work in 1847. In the present work national and regional seismic catalogues of Spain, as well as other more general lists with information on Spanish earthquakes are presented. (26 refs.)

104274 Inversion and deconvolution: foreplay and interplay. J.M.Mendel (Dept. of Electrical Engng., Univ. of Southern California, Los Angeles, CA, USA).
1983 IEEE International Symposium on Circuits and Systems, Newport Beach, CA, USA, 2-4 May 1983 (New York, USA: IEEE 1983), p.940-8 vol.2
Geo-optimal deconvolution is a procedure that interweaves maximum-likelihood deconvolution and maximum-likelihood normal incidence inversion so as to capture the strong points of both procedures. It is also known as model-based deconvolution and represents the first effort, to the best of our knowledge, to combine deconvolution and inversion. This is possible because our maximum-likelihood deconvolution and maximum-likelihood normal incidence inversion solutions are each optimal in a maximum-likelihood sense, and because of the invariance principle of maximum-likelihood estimation, that, functions of maximum-likelihood estimates are, themselves, maximum-likelihood estimates. The paper describes ML NI inversion, maximum-likelihood deconvolution (MLD) and normal incidence geo-optimal deconvolution (NIGOD). (34 refs.)

Anton L. Hales Symposium on 'Some Recent Advances in Geophysics' ....See Entry 98630

Third Symposium on Recent Crustal Movements and Phenomena Associated with Earthquakes and Volcanism ....See Entry 98643

Temporal variations in the anomalous magnetic field in the Fergana Valley in 1973-1979 and prediction of the Alay earthquake of 2 November 1978 ....See Entry 104191

A 550 km long Moho traverse in the Tyrrhenian Sea from OBS recorded P_N waves ....See Entry 104286

Crustal structure in Izu Peninsula, central Japan, as derived from explosion seismic observations. I. Mishima-Shimoda profile ....See Entry 104295

Microearthquake activity in the West Philippine Basin and northern Ryukyu Trench region as observed by ocean bottom seismometers at the Amami Plateau ....See Entry 104297

Density profile and modern crustal and uppermost mantle geotherm of the Voronezh crystalline massif ....See Entry 104301

Observations of volcanic tremor at Mount St. Helens Volcano ....See Entry 104305

Measurements of frictional heating in granite ....See Entry 104348

Continuous measurement of radon emanations from soil and groundwaters in southern France (Alpes Maritimes). Preliminary results ....See Entry 104576

Simplified estimation of seismic moment from seismograms ..See Entry 104578

Electronic acceleration-sensitive geophone for seismic prospecting ....See Entry 104593

Practical application and preliminary interpretation techniques of in-seam seismology ....See Entry 104594

Construction of M_{max} earthquake maps based on a method of approximating spaced expert estimates ....See Entry 104598

Numerical inversion method for application to the interpretation of seismic profiles ....See Entry 104623

The dynamic least square algorithm and its application to the location of seismic events ....See Entry 104632

91.35 EARTH'S INTERIOR STRUCTURE AND PROPERTIES

104275 Geochemistry, mineralogy and petrogenesis of lavas erupted along the Southwest Indian Ridge between the Bouvet triple junction and 11 degrees east. A.P.Le Roex (Depts. of Geology & Geochem., Univ. of Cape Town, Rondebosch, S Africa), H.J.B.Dick, A.J.Erlank, A.M.Reid, F.A.Frey, S.R.Hart.
J. Petrol. (GB), vol.24, no.3, p.267-318 (Aug. 1983).
Basaltic lavas from fracture zones and ridge segments have been systematically sampled along the Southwest Indian Ridge from the Bouvet triple junction to 11°E. Detailed studies of the major and trace element and isotopic variations in these lavas serve to distinguish three compositional groupings which occur throughout this region. (57 refs.)

104276 Geothermic lineaments in Morocco. L.Bahi (Ecole Mohammadia, Rabat, Morocco), N.El Yamine, J.-J.Risler.
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.14, p.1087-92 (18 April 1983). In French.
One, perhaps two, lineaments of high heat flow have been identified in Morocco, following geological and geophysical criteria: fracture patterns, seismic zones, gravity and thermal springs and direct heat-flow measurements. These lineaments are of interest for the exploitation of geothermal energy in Morocco. (16 refs.)

104277 Stratigraphy and paleobiogeography of Upper Senonian rudistid reefs from southeastern Sicily. Relationships with submarine volcanism. G.Camoin, J.Philip (Univ. de Provence, Marseille, France), M.-C.Bernet-Rellande.
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.14, p.1093-6 (18 April 1983). In French.
Upper Senonian rudistid reefs from the Iblean Domain (southeastern Sicily) are the subject of a stratigraphic study. Their regional evolution is described with respect to local volcanism acting over the Iblean margin during the Upper Senonian. Paleogeographic conclusions through rudistid evolution help in understanding the relationships between African and Apulian margins near the end of the Cretaceous. (27 refs.)

104278 Radiometric data (^{40}K-^{40}Ar) on K-minerals from Triassic of the 'Zone des Nappes' in Northern Tunisia. Cretaceous and Tertiary thermal events. H.Bellon, V.Perthuisot (Dept. des Sci. de la Terre, Univ. de Brest, Brest, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.19, p.1539-44 (30 May 1983). In French.
Radiometric ages confirm the existence of a drastic thermal event in the Eastern Maghreb during the Middle Cretaceous and the synchronism between heating phases and magmatic phases during the Tertiary. (16 refs.)

104279 The 'Cicatrice de Preit': a major structural discontinuity in the internal Brianconnais zone between Acceglio and the Argentera Massif (Southern Cottic Alps). R.Lefevre (Lab. de Geodynamique Interne, Univ. Paris-XII, Creteil, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.19, p.1551-4 (30 May 1983). In French.
South of the Maira and NE of the Argentera Massif, the internal Brianconnais, Ultrabrianconnais and Piemontais Nappes of the Acceglio, Roure, and Ceillac Bands are truncated obliquely by a fault belonging to the N110° sinistral strike-slip fault zone of the 'Couloir de la Stura'. Prior to the movement along this fault the Brianconnais and Ultrabrianconnais rocks of the Cottic Alps were probably much less distant from those of the Ligurian Alps than they are today. (20 refs.)

104280 Fault tectonics and Cenozoic stress fields in the Hungarian central mountains: mechanisms and chronology of the extension in the Pannonian basin (Hungary). F.Bergerat, J.Geyssant, C.Lepvrier (Dept. de Geotectonique, Univ. Pierre-et-Marie-Curie, Paris, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.19, p.1555-8 (30 May 1983). In French.
A fault analysis in the Hungarian central mountains enables one to distinguish four main tectonic events during the Tertiary. This succession reflects the complexity of deformations in the Pannonian basin: East-West compression with westward movement of moesian block, North-South and East-West multi-directional extension due to southward subduction of the substratum of carpathian flyschs, and finally North-South compression with conjugate strike-slip faults. (6 refs.)

104281 Huahine Island: three successive volcanoes (Society Archipelago, Polynesia). R.Brousse, C.Macherey, E.Berger, G.Boutault (Lab. de Petrologie et Volcanologie, Univ. Paris-XI, Orsay, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.19, p.1559-62 (30 May 1983). In French.
Huahine Island is a link of the Society line produced by the hot spot now to SE of Mehetia. The island is polygenous and built in five phases. The first four following an echelon directed North-South, the last one is extensive following the direction of the Society line. (5 refs.)

104282 On dating the magmatism of Maio, Cape Verde Islands. J.G.Mitchell (School of Phys., Univ. of Newcastle upon Tyne, Newcastle upon Tyne, England), M.J.Le Bas, J.Zielonka, H.Furnes.
Earth & Planet. Sci. Lett. (Netherlands), vol.64, no.1, p.61-76 (July 1983).
Conventional K-Ar and ^{40}Ar/^{39}Ar studies of Mesozoic ocean floor basalts and Tertiary plutonic and volcanic rocks from Maio, Cape Verde Islands, have been determined to elucidate the magmatic evolution of this ocean island. Pillow lavas of the Basement Complex yield a minimum age of 113±8 Ma. Activity in the Central Intrusive Complex began before 20 Ma and plutons continued to develop until about 8 Ma. Sheet intrusion occurred throughout the period 20 to 9 Ma though the peak of this activity probably occurred 11 Ma ago. Volcanic activity began in the Tertiary, probably before 12 Ma, and culminated in the development of a stratovolcano at 7 Ma. (17 refs.)

104283 Calculations on the thermal conditions around a salt diapir. P.K.Jensen (Inst. for Geofysik, Kobenhavns Univ., Kobenhavn, Denmark).
Geophys. Prospect. (Netherlands), vol.31, no.3, p.481-9 (June 1983).
Temperature modeling around the Vejrum salt structure in Denmark shows that the heat flow near the top is twice the regional heat flow. The temperature in the vicinity of the top of the diapir is thus anomalously high. Overlying permeable formations could therefore be attractive for geothermal energy exploitation. A negative temperature anomaly of −20°C is calculated around the root of the salt body. Comparisons between calculated and measured temperatures are used to test the model. It is shown that measurements of heat flow (or temperature gradients) in wells penetrating the region of groundwater circulation could be used in identification of salt diapirs. (15 refs.)

104284 Geothermal conditions of Hungary. P.Dovenyi, F.Horvath (Dept. of Geophys., Eotvos Lorand Univ., Budapest, Hungary).
Geofiz. Koeslemenyek (Hungary), vol.29, no.1, p.3-58 (April 1983).
A brief review is given of the history of geothermal investigations in Hungary followed by a summary of the methods of temperature measurement, their reliability and applicability. All available and valuable temperature data are qualified on the basis of conditions and probable accuracy of measurements and are listed in a temperature catalogue. A map of geoisotherms at 1 km depth and another at 2 km depth are constructed for Hungary and adjoining territories. Average temperature vs. depth profiles are presented for different sub-units of the Pannonian basin. All Hungarian measurements are used to obtain the average thermal conductivities of Neogene sedimentary rocks and of basement rocks. Hungarian heat flow determinations are reviewed. A method is proposed for estimating the heat flow value for boreholes where no actual thermal conductivity measurements were performed but the temperature conditions and the lithology are well known. A review is given on the geodynamic interpretation of the Pannonian basin thermal anomaly and attention is called to the importance of knowledge of the paleogeothermal conditions. (148 refs.)

104285 Thermal regime of the Luanshya Mine, Republic of Zambia. D.S.Chapman (Dept. of Geology & Geophys., Univ. of Utah, Salt Lake City, UT, USA).
Geoexploration (Netherlands), vol.21, no.4, p.265-81 (1983).
Temperature surveys have been conducted in 24 drillholes within and surrounding the Luanshya Mine on the Zambian Copperbelt. Detailed temperature logs in drillholes within the mine reveal several thermal effects. A composite plot of temperatures versus depth on a north-south section through the Roan-Muliashi Basin reveals a systematic depression of isotherms and hence decreasing geothermal gradients from 23 to 18C° km^{-1} towards the deepest part of the syncline. Thermal conductivity measurements on 156 representative samples from the major lithologic units comprising and surrounding the Roan-Muliashi Basin indicate that the Mine Series formations are about 16% more conductive than the surrounding Basement Complex rocks. Theoretical thermal models for the mine, examined using finite difference numerical techniques are discussed. (15 refs.)

104286 A 550 km long Moho traverse in the Tyrrhenian Sea from OBS recorded P_N waves. L.Steinmetz, F.Ferrucci, A.Hirn (Inst. de Phys. du Globe, Univ. Pierre et Marie Curie, Paris, France), C.Morelli, R.Nicolich.
Geophys. Res. Lett. (USA), vol.10, no.6, p.428-31 (June 1983).
Six OBS deployed on a 550 km line in the Tyrrhenian Sea furnish reversed and overlapping profiles from 43 shots at 12 km intervals. Head waves recorded from a 8 km/s refractor, the Moho, permitted the computation of the crustal thickness, which shows this basin to be underlain by an oceanic type of crust, at least in two 100 km wide regions. Variations of Pn arrival times mirror strong topographical changes of the Moho. Differences in dips at the extremities towards Corsica and Calabria are documented. (12 refs.)

104287 The change in density in connection with metallization and the time required to form the Earth's metallic core. V.V.Nikolaichik (Schmidt Inst. for Phys. of Earth, Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.7 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli,* vol.18, no.7, p.481-5 (1982).
Estimates of the energy of formation of the metallic core are made for a two-layered uncompressed Earth. It is shown that the value of the relative change in density in connection with metallization does not exceed 0.3 for the present core to have formed during the lifetime of the Earth. Growth of the core most probably took place with a relative density change of from 0.1 to 0.2. (7 refs.)

104288 The East Pacific Rise and the thermal model. B.T.R.Lewis (Geophys. Program & School of Oceanography, Univ. of Washington, Seattle, WA, USA).
J. Geophys. Res. (USA), vol.88, no.B4, p.3348-54 (10 April 1983). [received: Aug. 1983] (Anton L. Hales Symposium on 'Some Recent Advances in Geophysics', Dallas, TX, USA, 5-6 Oct. 1981).
Although the thermal mode of lithosphere cooling can be used to predict the East Pacific Rise topography reasonably well, it does not adequately predict the observed gravity when the zero temperature boundary condition is at the seafloor. The misfit arises primarily because this model predicts thermally lowered densities in the crust at the rise axis which counteract the gravitational effect of the topography, generating a theoretical gravity anomaly smaller than that observed. It is shown, using data at 12°N as an example, that improved agreement with the thermal model is obtained if, to first order, the crust is treated as an isothermal, constant thickness, constant density layer with variable depth. This result is consistent with observations of convective cooling of the crust by seawater circulation. It implies that convective cooling of the whole crust is very rapid. (13 refs.)

104289 Origin of Mesozoic and Tertiary granite in the western United States and implications for pre-Mesozoic crustal structure. I. Nd and Sr isotopic studies in the geocline of the northern Great Basin. G.L.Farmer, D.J.DePaolo (Dept. of Earth & Space Sci., Univ. of California, Los Angeles, CA, USA).
J. Geophys. Res. (USA), vol.88, no.B4, p.3379-401 (10 April 1983). [received: Aug. 1983]
The Nd and Sr isotopic compositions of 25 Mesozoic and Tertiary bodies of granite (sensu lato) exposed in a 200-km wide transect of the northern Great Basin of the western United States have been determined. The purpose of the study was to combine the isotopic data with known aspects of the crustal structure and composition of a region extending from the continental margin to the interior craton and so determine the relative importance of mantle and crust as granite-magma sources as a function of distance from the continental margin. (110 refs.)

104290 Growth and dynamics of the Nordre Stromfjord shear zone. K.Sorensen (Dept. of Appl. Geology, Danish Tech. Univ., Lyngby, Denmark).
J. Geophys. Res. (USA), vol.88, no.B4, p.3419-37 (10 April 1983). [received: Aug. 1983]
The Nordre Stromfjord shear zone is exposed for a length of 170 km within the Precambrian Nagssugtoqidian Mobile Belt of West Greenland. Its western 100 km consists of a 15-20 km wide zone of syndeformational granulite facies rocks. The movement was sinistral with a displacement of 120 km across the zone. The strain across the shear zone margin increases exponentially but levels off to a near constant value over major sections of the inner zone. This profile suggests a growth model, in which the marginal zones are focii of instantaneous deformation that moves outward as hardening occurs along the inner boundaries and weakening occurs along the outer boundaries. This growth model allows the minimum possible viscosity change associated with the zone to be calculated from the logarithmic strain gradient and from the width across which weakening occurs. (35 refs.)

104291 Deep crustal geothermal measurements, hole 504B, Costa Rica Rift. K.Becker (Deep Sea Drilling Project, Scripps Inst. of Oceanography, La Jolla, CA, USA), M.G.Langseth, R.P.Von Herzen, R.N.Anderson.
J. Geophys. Res. (USA), vol.88, no.B4, p.3447-57 (10 April 1983). [received: Aug. 1983]
Reports and extensive suite of geothermal measurements in the deepest borehole yet drilled into the oceanic crust, hole 504B of the Deep Sea Drilling Project. Located in 6.2-m.y.-old crust of the Costa Rica Rift, hole 504B was cored during legs 69 and 70 in late 1979 and leg 83 in late 1981, to a total depth of 1350 m beneath the seafloor, through 274.5 m of sediment and 1075.5 m of basalt. During the three drilling legs, downhole temperatures were logged 11 times, and the thermal conductivities of 239 sediment and basalt samples were measured. The results indicate a dominantly conductive mode of heat transfer through the complete section, at 190±10 mW/m^2. This is consistent with the predicted plate heat transfer and the hypothesis that the thick sediment cover acts as a seal against hydrothermal circulation of seawater to basement. Seawater flow down the hole was observed. (46 refs.)

104292 Heat and mass transfer in a fault zone-controlled geothermal reservoir: numerical results. R.Pratt, D.R.Kassoy (Mech. Engng., Univ. of Colorado, Boulder, CO, USA), J.Gary.
J. Geophys. Res. (USA), vol.88, no.B4, p.3458-66 (10 April 1983). [received: Aug. 1983]
A model is described for planar geothermal reservoir charging by upflow in a permeable fault zone in the Earth's crust. Liquid water, heated at depth in basement materials, rises in the fracture system associated with the faulted region. When the fault is intersected by a horizontal layer of permeable material, charging of hot water into an adjacent aquifer can occur. The heat and mass transfer process for this system is defined in terms of natural and forced convection in a thermally active porous medium. Solutions to the basic mathematical model are obtained by finite-difference methods. The fluid mechanics and energy transport are resolved in both the narrow fault zone and the adjacent aquifer. (21 refs.)

104293 Effect of a Hadean terrestrial magma ocean on crust and mantle evolution. A.M.Hofmeister (Div. of Geological & Planetary Sci., California Inst. of Technol., Pasadena, CA, USA).
J. Geophys. Res. (USA), vol.88, no.B6, p.4963-83 (10 June 1983).
Presents a model for the thermal and chemical evolution of a global magma ocean created by impact heating during the Earth's accretion. Detailed calculations are given for a melt depth of 120 km for end member picritic and peridotitic compositions. Application of fluid mechanics and heat transfer principles shows as a first approximation that the chemical evolution can be portrayed by idealized fractional crystallization occurring only on the bottom of the magma ocean. (60 refs.)

104294 Eruption age of a Pleistocene basalt from ^{40}Ar-^{39}Ar analysis of partially degassed xenoliths. A.R.Gillespie, J.C.Huneke, G.J.Wasserburg (Div. of Geological & Planetary Sci., California Inst. of Technol., Pasadena, CA, USA).
J. Geophys. Res. (USA), vol.88, no.B6, p.4997-5008 (10 June 1983).
^{40}Ar-^{39}Ar dating has been applied to potassium-rich granitic xenoliths and host basalt from the Pleistocene Big Pine volcanic field, California. These xenoliths had been partially degassed upon their inclusion in the basaltic lava. Argon released from the xenoliths at extraction temperatures below ~900°C yielded plateau ages indistinguishable from the total K-Ar age of the basalt. The best estimate of the age of eruption was 1.18 m.y. The agreement of the low-temperature xenolith plateau ages and the basalt K-Ar ages demonstrates that ^{40}Ar-^{39}Ar analysis of xenoliths may be used to measure the age of eruption of very young lavas. This is significant because in many instances ages cannot be reliably determined by analysis of the lavas themselves. (27 refs.)

104295 Crustal structure in Izu Peninsula, central Japan, as derived from explosion seismic observations. I. Mishima-Shimoda profile. S.Asano, T.Yoshii (Earthquake Res. Inst., Univ. of Tokyo, Tokyo, Japan), S.Kubota, Y.Sasaki, H.Okada, S.Suzuki, T.Masuda, H.Murakami, N.Nishide, H.Inatani.
J. Phys. Earth (Japan), vol.30, no.5, p.367-87 (1982).
In December, 1979, a detailed explosion seismic experiment was conducted by Research Group for Explosion Seismology in the Mishima-Shimoda profile in Izu Peninsula, central Japan. The analysis of travel time data of good quality was made mainly by the time term method. The crustal structure derived revealed significant lateral heterogeneity especially around the middle of the profile. The comparison of the crustal structure with seismicity, gravity anomaly, crustal movement, and geology along the profile gives important results. (30 refs.)

104296 Quasi-static crustal deformations due to a surface load: rheological structure of the Earth's crust and upper mantle. T.Iwasaki, M.Matsu'ura (Geophys. Inst., Faculty of Sci., Univ. of Tokyo, Tokyo, Japan).
J. Phys. Earth (Japan), vol.30, no.6, p.469-508 (1982).
Treats quasi-static displacement fields due to an axially symmetric load applied on the surface of a composite medium which consists of elastic layers overlying a stratified viscoelastic half-space. Integral representations of the surface displacements are obtained from those in the associated elastic problem by applying the correspondence principle of linear viscoelasticity. General features of the viscoelastic displacements are examined from various aspects through the computation of numerical examples for a three-layered model. Uplift phenomena in two tectonically different regions, Fennoscandia and Lake Bonneville (the Basin and Range province), are analyzed to investigate regional difference in rheological structure of the Earth's crust and upper mantle. (35 refs.)

104297 Microearthquake activity in the West Philippine Basin and northern Ryukyu Trench region as observed by ocean bottom seismometers at the Amami Plateau. K.Suyehiro, A.Nishizawa, H.Shimizu (Observation Center for Earthquake Prediction, Faculty of Sci., Tohoku Univ., Sendai, Japan).
J. Phys. Earth (Japan), vol.30, no.6, p.509-16 (1982).
There are several anomalous bathymetry highs in the West Philippine Basin which imply complex tectonic history of the region. They are the Amami Plateau, Daito Ridge, Oki Daito Ridge, and Kyushu-Palau Ridge. Seismic investigations at these regions to clarify local seismicity and structures may provide important clues to the understanding of their tectonic roles, which are not yet well known. The authors deployed a tripartite seismic array of OBSs on the Amami Plateau to investigate the microearthquakes activity in the vicinity and the crustal structure underneath using airgun seismic source. The authors concentrate on the results of microearthquake observations. The OBS experiment was carried out during the KH-82-4 cruise of R/V Hakuho of the University of Tokyo in July through August, 1982. (11 refs.)

104298 Delineation of New Zealand ultramafic rocks by computer processing of digital data from satellite imagery. R.R.Brooks (Dept. of Chem., Biochem. & Biophys., Massey Univ., Palmerston North, New Zealand), R.R.Brooks.
N.Z. J. Sci. (New Zealand), vol.26, no.1, p.65-71 (1983).
Computer processing of LANDSAT digital data was used to find the most effective delineation of ultramafic rocks in New Zealand. Each subscene was enhanced by histogram equalisation of bands MSS 4, 5, and 6 (500-600, 600-700, and 700-800 nm), and the data were written in blue, red, and green respectively on to positive colour film. Better delineation of ultramafic rocks was obtained with this procedure than with incorporation of the MSS 7 infrared band (800-1100 nm) or by use of the more usual technique of band ratioing. The rocks studied were from 4 segments of the Dun Mountain Ophiolite Belt (Dun Mountain, Red Mountain, D'Urville Island, and North Cape). The technique of satellite imagery developed in this study will be of practical application elsewhere in the world. (20 refs.)

104299 The relationship of the thickness of the oceanic lithosphere to the physical properties of the upper mantle. I.Lukashevich (Shirshov Inst. of Oceanology, Acad. of Sci., Moscow, USSR).
Oceanology (USA), vol.22, no.3, p.313-17 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.3 (1982).
A model is developed for the formation of the lithosphere based on cooling of partially molten material in the upper mantle, incorporating the release of latent heat of crystallization and changes in thermophysical properties during phase changes in the flowing asthenosphere. A theoretical value for the thickness of the lithosphere is obtained which is quite consistent with seismological data. The thickness of the lithosphere is calculated separately for three age intervals which correspond to the plagioclase, spinel and garnet phases of 1 herzolite. (14 refs.)

104300 Relationship between the heights of Pacific seamounts and the age of the lithosphere. N.A.Marova (Shirshov Inst. of Oceanology, Acad. of Sci., Moscow, USSR).
Oceanology (USA), vol.22, no.3, p.322-4 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.3 (1982).
The patterns of distribution of seamounts of different heights within the different age provinces of the Pacific Ocean floor and the East Pacific and South Pacific Rises were analyzed. The data obtained suggest that the height distribution of the underwater volcanic mountains is related to the age of the lithosphere of the Pacific Ocean, and that a relatively larger number of tall seamounts are present on the older zones of the lithosphere. (20 refs.)

104301 Density profile and modern crustal and uppermost mantle geotherm of the Voronezh crystalline massif. A.P.Tarkov (Dept. of Geology, Voronezh State Univ., Voronezh, USSR).
Phys. Earth & Planet. Inter. (Netherlands), vol.32, no.4, p.342-51 (July 1983).
A density profile and a modern temperature distribution in the lithosphere of the Voronezh crystalline massif (VCM) are derived through the use of the $V_P(z)$, $V_S(z)$ seismic velocity models, petrological data, measurements of V_P, V_S, density (ρ) and mean atomic weight ($\bar{m}$) for several groups of rocks and minerals of different composition and genesis, as well as from pressure and temperature derivatives for different thermodynamic regimes. (14 refs.)

104302 Fission tracks in minerals: Annealing kinetics, track structure and age correction. E.Bertel, T.D.Mark (Leopold Franzens Univ., Innsbruck, Austria).
Phys. & Chem. Miner. (Germany), vol.9, no.5, p.197-204 (1983).
It is shown that the annealing kinetics of fission tracks in apatite can be described by a sum of exponential decay functions. From an analysis of the temperature dependence of this annealing law it is concluded that the etchability of fission tracks is due to extended defects, i.e. systems of dislocation loops. The multiexponential annealing law is also applied to prove that the plateau correction method is basically correct, but rather as a method for determining a lower limit than the 'true' fission track age. (41 refs.)

104303 Alignment of volcanoes in the central volcanic region of Spain. E.Ancochea (Dept. de Petrologia, Univ. Complutense, Madrid, Spain), J.L.Brandle.
Rev. Geofis. (Spain), vol.38, no.2, p.133-8 (1982). In Spanish.
The possible lineations including the volcanoes of the Spanish 'Region Volcanica Central' have been looked at by means of a FORTRAN program. The most significant directions are N 105°-120°, N 160°-170°, so that the N 15°-20°, N 135°-155° and N 175°-185° represent lineations of secondary importance that reflect solely the pre-existing Hercynian fracturing. (11 refs.)

104304 Early Tertiary age of pitchstone in the northern Black Hills, South Dakota. J.A.Redden (South Dakota School of Mines & Technol., US Geological Survey, Rapid City, SD, USA), J.D.Obradovich, C.W.Naeser, R.E.Zartman, J.J.Norton.
Science (USA), vol.220, no.4602, p.1153-4 (10 June 1983).
A block of pitchstone in the northern Black Hills, South Dakota, is Paleocene in age, according to potassium-argon dating of biotite and fission-track dating of zircon in the sample. These data invalidate published suggestions that the age is much younger. The pitchstone is not extrusive in its present position but instead is in a volcanic pipe with other fragments that came downward from as much as 1100 meters above the modern surface. (9 refs.)

Proceedings of Symposium 1 and Workshop V of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 98617

The Indian Ocean gravity low: evidence for an isostatically uncompensated depression in the upper mantle .... See Entry 104165

Chandler wobble and frequency dependence of Q_μ of the Earth's mantle .... See Entry 104166

Regional deformation of the Earth model for the San Diego region, California .... See Entry 104168

The multiple-frequency Chandler wobble .... See Entry 104169

Temporal variations in the anomalous magnetic field in the Fergana Valley in 1973-1979 and prediction of the Alay earthquake of 2 November 1978 .... See Entry 104191

Screening properties of the mantle and extrapolation of the variation field to the core-mantle boundary .... See Entry 104192

Devonian dikes from north central Newfoundland: a radiometric-paleomagnetic study .... See Entry 104193

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Electromagnetic geophysics and global tectonics .... See Entry 104197

Investigation of a Vine-Matthews magnetic lineation from a submersible: the source and character of marine magnetic anomalies .... See Entry 104198

Geomagnetic anomalies over the Fossa Magna region in central Japan .... See Entry 104202

A preliminary geoelectrical model of the Karelian megablock of the Baltic shield .... See Entry 104209

Geomagnetism of Earth's core .... See Entry 104215

Rampart seismic zone of central Alaska .... See Entry 104225

Partial derivative of Love numbers .... See Entry 104229

Reflection of spherical seismic waves in elastic layered media .... See Entry 104235

Generalized linear inversion of reflection seismic data .... See Entry 104236

Seismic shear-wave observations in a physical model experiment .... See Entry 104238

The seismic cross section and strength of the lithosphere of Iceland .... See Entry 104247

Multimode Rayleigh wave attenuation and Q_β in the crust of the Barents shelf .... See Entry 104252

COCORP and the continental crust .... See Entry 104253

Present seismic evidence for a boundary layer at the base of the mantle .... See Entry 104256

Focal depths of intracontinental and intraplate earthquakes and their implications for the thermal and mechanical properties of the lithosphere .... See Entry 104257

Spectral characteristics of high-frequency P_n, S_n phases in the Western Pacific .... See Entry 104263

The inverse problem of a spherically symmetric fluid Earth .. See Entry 104264

Visco-elastic interpretation of sedimentary subsidence .... See Entry 104307

Submerged Pliocene of the south eastern margin of Gavdos Island (eastern Mediterranean): tectonic implications .... See Entry 104308

Middle Miocene synsedimentary tectonic structures near Budapest: Evidence for extensional processes within the Pannonian Basin .... See Entry 104309

Importance of Mesozoic nappe structure tectonism in Central and Southern Japan .... See Entry 104310

Origin and emplacement of ophiolites from Western Alps: comparison with oceanic structures .... See Entry 104311

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Accreted terranes in the northern part of the Philippine Archipelago .... See Entry 104318

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A geologic consideration on the southern part of the East China Sea continental shelf .... See Entry 104331

The East Pacific Rise near 21°N, 13°N and 20°S: inferences for along-strike variability of axial processes of the Mid-Ocean Ridge .... See Entry 104334

Bathymetry estimates in the southern oceans from Seasat altimetry .... See Entry 104335

Diffusion between olivine and spinel: application to geothermometry .... See Entry 104339

Phase transitions and equations of state for the sodium halides: NaF, NaCl, NaBr, and NaI .... See Entry 104345

A semiempirical method for analysis of the reflectance spectra of binary mineral mixtures .... See Entry 104347

Oxygen isotopic compositions of Central Andean plutonic and volcanic rocks, latitudes 26°-29° south .... See Entry 104352

The chronology of intermontane-basin development in the northwestern Himalaya and the evolution of the Northwest Syntaxis .... See Entry 104353

Noble-gas evidence for geothermal activity in a karstic terrain: Rocky Mountains, Canada .... See Entry 104413

An axisymmetric model for the charging of a liquid-dominated geothermal reservoir .... See Entry 104414

Convection in an aquifer above a layer of heated impermeable bedrock .... See Entry 104418

Isotope geochemistry of the Amazon basin: a reconnaissance .... See Entry 104478

A warm, equable Cretaceous: the nature of the problem .... See Entry 104553

Continuous measurement of radon emanations from soil and groundwaters in southern France (Alpes Maritimes). Preliminary results .... See Entry 104576

Determination of iron contents in boreholes by neutron capture method .... See Entry 104581

The relationship of surface γ-ray intensity with groundwater in South Spring area, Chongqing .... See Entry 104582

Composite color images of aerial gamma-ray spectrometric data .... See Entry 104592

91.40 VOLCANOLOGY

104305 Observations of volcanic tremor at Mount St. Helens Volcano. M.Fehler (Geophys. Group, School of Oceanography, Oregon State Univ., Corvallis, OR, USA).
J. Geophys. Res. (USA), vol.88, no.B4, p.3476-84 (10 April 1983). [received: Aug. 1983]
Digital recordings of ground motion during tremor episodes accompanying eruptions at Mount St. Helens Volcano in the state of Washington on August 7 and October 16-18, 1980, are studied. The spectra of the vertical component waveforms contain at least two dominant peaks at 1.0 and 1.3 Hz for all events recorded during both eruptions that were studied. Spectra of horizontal ground motion show peaks at 0.9 and 1.1 Hz. The relative amplitude of the two peaks changes between tremor episodes and during single tremor episodes and shows no consistent relation to amplitude of ground motion. Spectra of long-period earthquakes are very similar to those of tremor events, suggesting that tremor is composed of many long-period earthquakes that occur over a period of time. The unique waveform of tremor events observed at Mount St. Helens must be due to a source effect. (29 refs.)

104306 Magma reservoir subsidence mechanics: theoretical summary and application to Kilauea Volcano, Hawaii. M.P.Ryan (Branch of Igneous & Geothermal Processes, US Geological Survey, Reston, VA, USA), J.Y.K.Blevins, A.T.Okamura, R.Y.Koyanagi.
J. Geophys. Res. (USA), vol.88, no.B5, p.4147-81 (10 May 1983).
An analytic model has been developed for the prediction of the three-dimensional deformation field generated by the withdrawal of magma from a sill-like storage compartment during an intrusion or eruption cycle. The model is based on the work of Berry and Sales (1961, 1962) and predicts the vertical displacement components over the areal plane. Systematic variation in model parameters within the context of Kilauea Volcano, Hawaii, have revealed that circular and elliptical deformation patterns result from the collapse of draining rectilinear intrusions at depth. Moreover, the geometric parameters of a storage compartment may interact in complex ways to produce similar deformation patterns. The model has been applied to Kilauea Volcano for three periods of pronounced summit subsidence. (57 refs.)

Third Symposium on Recent Crustal Movements and Phenomena Associated with Earthquakes and Volcanism .... See Entry 98643

Geochemistry, mineralogy and petrogenesis of lavas erupted along the Southwest Indian Ridge between the Bouvet triple junction and 11 degrees east .... See Entry 104275

Huahine Island: three successive volcanoes (Society Archipelago, Polynesia) .... See Entry 104281

On dating the magmatism of Maio, Cape Verde Islands .... See Entry 104282

Alignment of volcanoes in the central volcanic region of Spain .... See Entry 104303

Early Tertiary age of pitchstone in the northern Black Hills, South Dakota .... See Entry 104304

The East Pacific Rise near 21°N, 13°N and 20°S: inferences for along-strike variability of axial processes of the Mid-Ocean Ridge .... See Entry 104334

Oxygen isotopic compositions of Central Andean plutonic and volcanic rocks, latitudes 26°-29° south .... See Entry 104352

Increasing backscattered light from the stratospheric aerosol layer after Mt. El Chicon eruption laser radar measurement at Nagoya (35°N, 137°E) .... See Entry 104466

The contribution of volcanoes to the global atmospheric sulfur budget .... See Entry 104480

A decade of stratospheric sulfate measurements compared with observations of volcanic eruptions .... See Entry 104481

Sighting of El Chichon sulfur dioxide clouds with the Nimbus 7 total ozone mapping spectrometer .... See Entry 104530

91.45 PHYSICS OF PLATE TECTONICS

104307 Visco-elastic interpretation of sedimentary subsidence. J.Virieux (Univ. Paris VI, Paris, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.14, p.1061-6 (18 April 1983). In French.
The visco-elastic response of a flat thin lithosphere overlying an inviscid fluid and loaded by a sedimentary weight is studied. Analytical and integral solutions are developed for line sources and point sources, emphasizing the similarities. Thereafter a strategy for evaluating sedimentary deflections is proposed in order to compute the tectonic subsidence, one of the main pieces of information about tectonic basin formation and evolution. (15 refs.)

104308 Submerged Pliocene of the south eastern margin of Gavdos Island (eastern Mediterranean): tectonic implications. G.Glacon (Univ. Pierre et Marie Curie, Paris, France), H.Got, A.R.Larsen, A.Monaco, C.Muller, A.Murat.
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.15, p.1199-202 (25 April 1983). In French.
Occurrence of littoral and hemipelagic Pliocene sediments in three piston cores retrieved from a depth of 1600 to 2500 m allows the assumption that the margin has been foundering since the Late Pliocene (NN 17-MPL6). This hypothesis is consistent with the extensive structures observed on seismic reflection profiles of the inner wall of the Hellenic Trench. (18 refs.)

104309 Middle Miocene synsedimentary tectonic structures near Budapest: Evidence for extensional processes within the Pannonian Basin. F.Bergerat, J.Geyssant (Univ. Pierre-et-Marie-Curie, Paris, France), M.Kazmer.
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.16, p.1275-8 (2 May 1983). In French.
Synsedimentary tectonics that created remarkable patterns of NE-SW tension gashes have affected the Badenian strata near Budapest. Ridges of oomicrite bind these fissures and correspond to early cementation that occurred contemporaneously with sedimentation. The creation of these tension gashes is connected with the opening of the Pannonian Basin and, in detail, is interpreted as the earlier stage of an extensional process that leads to development of larger normal faults. (4 refs.)

104310 Importance of Mesozoic nappe structure tectonism in Central and Southern Japan. J.Charvet, J.-P.Cadet (Univ. d'Orleans, Orleans, France), M.Faure, J.Aubouin.
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.16, p.1279-86 (2 May 1983). In French.
Several nappes were emplaced during the Mesozoic tectonism in the Tamba zone and in the Sambagawa-Chichibu domain. In the Tamba zone, units composed mainly of sedimentary material, including a Jurassic olistostrome superimposed. In the Sambagawa Chichibu realm, south verging metamorphic and sedimentary thrusts are emplaced during the second deformation phase. The building of all these structures is suggested to be the result of a collision between at least two continental blocks: a northern one (Hilda) and a southern one (Kurosegawa). (45 refs.)

104311 Origin and emplacement of ophiolites from Western Alps: comparison with oceanic structures. J.-M.Auzende, R.Polino, Y.Lagabrielle, J.-L.Olivet.
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.19, p.1527-32 (30 May 1983). In French.
The authors suggest that some ophiolites of the 'Schistes Lustres Nappe' (Western Alps) originated from oceanic massives thrusted and tectonically incorporated into the ocean sediments during early compressive events. This interpretation is supported by field observations and oceanic data. (21 refs.)

104312 The North-Magne Shear Zone: a transverse fault zone of the Outer Hellenic Arc (South Peloponnesus, Greece). S.Lallemant, N.Lyberis, F.Thiebault (Dept. de Geotectonique, Univ. Pierre-et-Marie-Curie, Paris, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.19, p.1545-50 (30 May 1983). In French.
The North-Magne fault zone cutting through the Peloponnesus Alpine orogenic belt and the present continental margin extends out to the Hellenic Trench. This lineament is marked, on land, by polyphased fault populations. A left lateral movement was followed by a normal faulting mechanism. The strike slip motion is related to East-West trending folds present in the surrounding area. This compressive event clearly follows the nappe emplacement, and is considered as Late Serravalian-Early Tortonian in age. The extensional event is Late Miocene-Plioquaternary in age. (22 refs.)

104313 Stokes flow between parallel plates due to a transversely moving end wall. J.F.Harper, G.C.Wake (Math. Dept., Victoria Univ. of Wellington, Wellington, New Zealand).
IMA J. Appl. Math. (GB), vol.30, no.2, p.141-9 (March 1983).
Considers the two-dimensional Stokes flow in a semi-infinite strip of viscous fluid due to a transverse velocity of its end wall. This is an idealization of the motion in the asthenosphere due to a subducting slab. The authors give an iterative scheme for calculating the flow, prove existence and uniqueness, and obtain numerical approximations, using developments of Teodorescu's method (1960) and an approximate solution of the infinite matrix equation arising therein. (Simple truncation to finite order is not good enough.) The boundary conditions give rise to singularities which prevent other known methods (including the original form of Teodorescu's) from working. The solution reveals how surprisingly good an approximation its asymptotic forms near the corners and at infinity are in most of the flow field. (30 refs.)

104314 The graphical simulation of tectonic plate motion. M.R.Saunders, P.R.Miles (Inst. of Oceanographic Sci., Wormley, Godalming, England), M.W.Storey.
Comput. & Geosci. (GB), vol.9, no.2, p.245-54 (1983).
LANDROT is a computer program written for the Natural Environment Research Council Honeywell 66/60 Computer to simulate landmass paleomovement by the rotation of geographic outlines about poles of rotation on the Earth's surface. The output is a plot using the NERC GRAFIX subroutine library with optimal projections. (2 refs.)

104315 Speculations on the Mesozoic plate tectonic evolution of eastern China. M.P.Klimetz (Dept. of Geological Sci., State Univ. of New York, Albany, NY, USA).
Tectonics (USA), vol.2, no.2, p.139-66 (April 1983).
Several orogenic belts transecting eastern China are the sites of former convergent plate margins, although there have been varying views on the collisional framework of individual continental blocks, styles of convergence at these zones, and the timing of respective collisions. A tectonic study of eastern China, Mongolia and the southern Soviet Far East indicates the collision of the South China Block with a combined North China-Northeast China Fold Zone Block in the Late Triassio-Early Jurassic, their collective suturing to Eurasia in the Late Jurassic-Early Cretaceous, followed by the Sikhote Alin-Japan Block in the Mid to Late Cretaceous. The evidence is presented. (142 refs.)

104316 Tectonic analysis of the Dead Sea Rift region since the Late-Cretaceous based on mesostructures. Y.Eyal (Dept. of Geology, Ben-Gurion Univ., Beer-Sheva, Israel), Z.Reches.
Tectonics (USA), vol.2, no.2, p.167-85 (April 1983).
Measures the orientations of small faults, slickensides, tectonic stylolites, vein with secondary mineralization, small folds and dikes in Israel and Sinai. These structures are indicators of paleo-stress or strain and provide the pattern of tectonic deformation. The authors define two tectonic stress fields, each relatively uniform in both time and space. One stress field, with dominating maximum horizontal compression trending W to WNW, in the Late Cretaceous to Eocene rocks in the folds and plateaux west of the Dead Sea Rift. The second field, with dominating horizontal extension trending E to ENE, in all rocks inside the rift and proximal thereto. (43 refs.)

104317 A model for the crustal evolution of southern Scotland. J.K.Leggett (Dept. of Geology, Imperial Coll., London, England), W.S.McKerrow, N.J.Soper.
Tectonics (USA), vol.2, no.2, p.187-210 (April 1983).
Briefly reviews existing geological and geophysical evidence concerning deep crustal structure. The authors compare the likely geometries of the Early Palaeozoic Scottish (American), and English (northern European) continental margins with the modern margins. The authors consider seismic refraction profiles. (63 refs.)

104318 Accreted terranes in the northern part of the Philippine Archipelago. D.E.Karig (Dept. of Geological Sci., Cornell Univ., Ithaca, NY, USA).
Tectonics (USA), vol.2, no.2, p.211-36 (April 1983).
Discusses the tectonic framework of the N Philippines. The framework remains incomplete because of a paucity of information in some areas. The region under study (Luzon, Mindoro, Marinduque and interspersed smaller islands) consists of at least 6 terrains. (95 refs.)

104319 An analysis of a possible episodic plume trace in West Africa. D.E.Ajakaiye, P.J.T.Verheijen (Dept. of Phys., Ahmadu Bello Univ., Zaria, Nigeria).
Geophys. Res. Lett. (USA), vol.10, no.6, p.424-7 (June 1983).
The evolution of a plume trace which constitutes the granitic intrusives in the Hoggar, Air, Zinder and the Jos plateau regions has been analyzed using geochromological and topographic data. The trace location is consistent with the idea of the African plate rotating around a pole in West Africa located at about 1.0°W and 13.9°N with an angular velocity of about 0.216 degrees/my during the Cambrian to the Jurassic period, possibly with a small deceleration. The major activity seems to occur at intervals of 125±6 my. (14 refs.)

104320 Relationship between present and most recent movements of the Earth's crust and depth of the basement of the East European platform. V.V.Bronguleev, A.F.Grachev, I.V.Kalashnikova, V.A.Magnitskiy (O.Yu. Schmidt Inst. of Phys. of Earth, Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.4, p.255-63 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.4 (1982).
Correlation analysis of the depths of the basement, the amplitudes of the most recent and the velocities of contemporary crustal movements in the East European platform as well as a trend analysis of these parameters are used to discuss tectonic crustal movements. (19 refs.)

104321 The subduction of young lithosphere. I.S.Sacks (Dept. of Terrestrial Magnetism, Carnegie Inst. of Washington, Washington, DC, USA).
J. Geophys. Res. (USA), vol.88, no.B4, p.3355-66 (10 April 1983). [received: Aug. 1983] (Anton L. Hales Symposium on 'Some Recent Advances in Geophysics', Dallas, TX, USA, 5-6 Oct. 1981).
Studies, using a variety of techniques, of the subduction beneath western South America and the southwest Honshu-Kyushu region of Japan indicate that volcano-free segments occur where the subducted and continental lithospheres remain in contact without intervening asthenosphere. The subduction is initiated at normal dip angles, but the plate deforms at some depth to travel horizontally immediately beneath continental lithosphere. The most plausible reason for this geometry is that the subducted plate is buoyant. A model is developed constrained by age of the plate, bathymetry, and heat flow. Estimates of the density of oceanic plates as a function of age show that younger ocean floor may be less dense than the asthenosphere into which it subducts. If the high-density transformation of crustal basalt to eclogite is retarded by low temperatures, the plate can remain buoyant to considerable depth for long periods of time. (39 refs.)

104322 Wandering terranes in southern Alaska: the Aleutia microplate and implications for the Bering Sea. M.S.Marlow, A.K.Cooper (US Geological Survey, Menlo Park, CA, USA).
J. Geophys. Res. (USA), vol.88, no.B4, p.3439-46 (10 April 1983). [received: Aug. 1983]
The tectonic evolution of southern Alaska, the Aleutian arc and the Bering Sea areas are studied. Much of southern Alaska is a collage of tectonostratigraphic terranes which originated in Mesozoic time at paleolatitudes far south of their present position. The time of 'docking' of the terranes against cratonic Alaska is critical to defining their amalgamated size and extent during their northward motion as well as their role in the evolution of the Bering Sea. One of the largest of the tectonostratigraphic terranes, the Peninsular terrane of south central and southwestern Alaska, extends offshore along the outer Bering Sea continental margin (Beringia). Paleomagnetic data suggest that this terrane has moved northward through all of Cenozoic time, but geologic data imply that the terrane had accreted to Alaska by the end of the Mesozoic. Two accretion models, based on docking times for terranes in Alaska, are proposed, and they illustrate that large areas of the abyssal Bering Sea, the Alaska Peninsula, the Aleutian arc, and the Beringian continental margin may be part of a superterrane or microplate called Aleutia. (68 refs.)

104323 Error analysis for the determination of tectonic rotation from paleomagnetic data. H.H.Demarest,Jr. (Dept. of Geology, Oregon State Univ., Corvallis, OR, USA).
J. Geophys. Res. (USA), vol.88, no.B5, p.4321-8 (10 May 1983).
Recent determinations of tectonic rotation and flattening from paleomagnetic data have exaggerated the size of the confidence limits or error bars by about 25%. This has been caused by the misuse of conventional error propagation formulas to derive one degree of freedom error bars from a two dimensional cone of confidence (α_{95}). An analytical calculation, which is valid when error bars are small, shows that the correct error bars are 75% to 80% of the values derived in previous studies. The present author used numerical integration to check on the applicability of the analytical solution and to calculate error bars when the analytical approximation cannot be used. The analytical approximation may be used whenever α_{95} is less than 10° and the mean inclination is not too close to vertical. Confidence limits given for tectonic rotation and flattening in recent literature are too large and should be reduced by 20-25%. (17 refs.)

104324 A dislocation model of strain accumulation and release at a subduction zone. J.C.Savage (US Geological Survey, Menlo Park, CA, USA).
J. Geophys. Res. (USA), vol.88, no.B6, p.4984-96 (10 June 1983).
Strain accumulation and release at a subduction zone are attributed to stick slip on the main thrust zone and steady aseismic slip on the remainder of the plate interface. This process can be described as a superposition of steady state subduction and a repetitive cycle of slip on the main thrust zone, consisting of steady normal slip at the plate convergence rate plus occasional thrust events that recover the accumulated normal slip. Because steady state subduction does not contribute to the deformation at the free surface, deformation observed there is completely equivalent to that produced by the slip cycle alone. The response to that slip is simply the response of a particular Earth model to embedded dislocations. For a purely elastic Earth model, the deformation cycle consists of a coseismic offset followed by a linear-in-time recovery to the initial value during the interval between earthquakes. For an elastic-viscoelastic Earth model the postearthquake recovery is not linear in time. (32 refs.)

104325 Constraint on deep mantle viscosity from Lageos acceleration data. W.R.Peltier (Dept. of Phys., Univ. of Toronto, Toronto, Ontario, Canada).
Nature (GB), vol.304, no.5925, p.434-6 (4 Aug. 1983).
Recently reported analyses of $5^1/_2$ yr of orbital data for the laser geodynamics satellite (Lageos) have revealed a residual acceleration in the node of its orbit in the amount -14.7 ± 1.3 m arc s yr^{-2}. This acceleration is predominantly attributable to a secular decrease of the degree two component of the Earth's gravitational potential field J_2. The implied rate of change of J_2 is $(-3.5\pm0.3)\times10^{-11}$ yr^{-1}. The following analysis argues that this effect is due to Pleistocene deglaciation and that it can be used to constrain strongly the viscosity of the Earth's deep mantle. (14 refs.)

104326 Destabilization of a 650 km chemical boundary layer and its bearing on the evolution of the continental crust. C.T.Herzberg, R.D.Forsythe (Dept. of Geological Sci., Rutgers Univ., New Brunswick, NJ, USA).
Phys. Earth & Planet. Inter. (Netherlands), vol.32, no.4, p.352-60 (July 1983).
A mechanism for the production of a chemical change in the mantle, from primordial silicate compositions above the 650 km discontinuity to differentiated compositions below, is reviewed. Some consequences of this are the stabilization of two layer convection with a temperature contrast between the anhydrous mantle solidus and the geotherm which, at 650 km depth, is lower than any other location in the mantle. With thermal contributions from the concentration of the heat producing elements U, Th and K below the 650 km mantle boundary layer and the higher geotherms in the past, widespread or catastrophic melting may have taken place at this location. An episodic breach of this boundary layer by extensive heat and mass transport may have periodically destroyed any simple two-layer convection geometry in the mantle. Such episodic injections of mass and energy into the upper mantle from below may have been in the mechanism responsible for episodes of enhanced surface tectonism. (45 refs.)

104327 Geodynamic aspects of the Mediterranean-Alpine region. S.Mueller (Inst. fur Geophys., ETH-Honggerberg, Zurich, Switzerland).
Rev. Geofis. (Spain), vol.38, no.2, p.103-11 (1982). In English.
The geodynamic processes in the Mediterranean-Alpine region are primarily governed by the relative movement of the African plate against the Eurasian plate resulting in a predominantly compressional regime and leading to lithospheric shortening (~6 to 7 mm/year) and rifting in pre-conditioned zones of weakness. The boundary between these two major plates as defined by the present seismicity is rather complex. It extends all the way into the Alps due to the presence of the 'Adriatic promontory' of the African plate, thus providing an explanation for the collision structure of the Alps in this particular location. In the still ongoing plate collision process the lower lithosphere seems to have been subducted to depths of about 220-250 km. The continuing uplift of the Alpine mountain chain is due to isostatic adjustment of the heavily deformed upper portions of the 'lithospheric root' under the Alps. (17 refs.)

104328 Rotational deformation of an elastic Earth. M.J.Sevilla, A.Gonzalez Camacho (Catedra de Astron. y Geodesia, Univ. Complutense, Madrid, Spain).
Rev. Geofis. (Spain), vol.38, no.2, p.179-87 (1982). In Spanish.
The changes in the Earth's inertial tensor due to the rotational deformation are studied and some equations for these changes are obtained. (10 refs.)

104329 Crustal movement. L.Brown, R.Reilinger (Cornell Univ., Ithaca, NY, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.553-9 (April 1983).
Reviews the Southern California Uplift, the San Andreas transform system, earthquake deformations, magma induced deformation, the NW United States, subsidence due to fluid withdrawal, the E United States, and diagnosis and prognosis. (51 refs.)

Third Symposium on Recent Crustal Movements and Phenomena Associated with Earthquakes and Volcanism .... See Entry 98643

The Indian Ocean gravity low: evidence for an isostatically uncompensated depression in the upper mantle .... See Entry 104165

Regional deformation of the Earth model for the San Diego region, California .... See Entry 104168

Temporal variations in the anomalous magnetic field in the Fergana Valley in 1973-1979 and prediction of the Alay earthquake of 2 November 1978 .... See Entry 104191

Electromagnetic geophysics and global tectonics .... See Entry 104197

Investigation of a Vine-Matthews magnetic lineation from a submersible: the source and character of marine magnetic anomalies ....See Entry 104198

Detailed geomagnetic studies of the rift zone in the south of the Red Sea .... See Entry 104205

Paleomagnetism and the motion of large and small plates ..... See Entry 104217

Mechanism of deformation during cyclic undrained loading of saturated sands .... See Entry 104233

Focal depths of intracontinental and intraplate earthquakes and their implications for the thermal and mechanical properties of the lithosphere .... See Entry 104257

Triple seismic zone and the regional variation of seismicity along the northern Honshu arc .... See Entry 104258

Preseismic rupture progression and great earthquake instabilities at plate boundaries .... See Entry 104259

Stratigraphy and paleobiogeography of Upper Senonian rudistid reefs from southeastern Sicily. Relationships with submarine volcanism .. See Entry 104277

Radiometric data (^{40}K-^{40}Ar) on K-minerals from Triassic of the 'Zone des Nappes' in Northern Tunisia. Cretaceous and Tertiary thermal events .... See Entry 104278

The 'Cicatrice de Preit': a major structural discontinuity in the internal Brianconnais zone between Acceglio and the Argentera Massif (Southern Cottic Alps) .... See Entry 104279

Fault tectonics and Cenozoic stress fields in the Hungarian central mountains: mechanisms and chronology of the extension in the Pannonian basin (Hungary) .... See Entry 104280

The East Pacific Rise and the thermal model .... See Entry 104288

Growth and dynamics of the Nordre Stromfjord shear zone .. See Entry 104290

Quasi-static crustal deformations due to a surface load: rheological structure of the Earth's crust and upper mantle .... See Entry 104296

The relationship of the thickness of the oceanic lithosphere to the physical properties of the upper mantle .... See Entry 104299

Relationship between the heights of Pacific seamounts and the age of the lithosphere .... See Entry 104300

Magma reservoir subsidence mechanics: theoretical summary and application to Kilauea Volcano, Hawaii .... See Entry 104306

The East Pacific Rise near 21°N, 13°N and 20°S: inferences for along-strike variability of axial processes of the Mid-Ocean Ridge .... See Entry 104334

Measurements of frictional heating in granite .... See Entry 104348

The chronology of intermontane-basin development in the northwestern Himalaya and the evolution of the Northwest Syntaxis .... See Entry 104353

Drainage analysis in Taiwan and its tectonic implications ..... See Entry 104406

91.50 MARINE GEOLOGY AND GEOPHYSICS

104330 Petrologic and geochemical variations along the Mid-Atlantic Ridge from 29°N to 73°N. J.-G.Schilling, M.Zajac, R.Evans, T.Johnston, W.White, J.D.Devine, R.Kingsley (Graduate School of Oceanography, Univ. of Rhode Island, Kingston, RI, USA).
Am. J. Sci. (USA), vol.283, no.6, p.510-86 (June 1983).
Reports a comprehensive petrological and geochemical study of basalts dredged at regular intervals along the axis of the Mid-Atlantic Ridge from 29°N to 73°N. The results show that the influence of unusual processes occurring beneath the Jan Mayer, Iceland, and Azores shallow volcanic plateaus is reflected not only in the morphology and tectonics but also in the geochemistry and petrology of MAR basalts erupted in these regions. The data suggest that the mantle beneath these hotspots is enriched in large incompatible elements, H_2O and halogens. (148 refs.)

104331 A geologic consideration on the southern part of the East China Sea continental shelf. T.P.Yen (Nat. Central Univ., Chungli, Taiwan).
Bull. Geophys. (Taiwan), no.24, p.17-29 (March 1983).
The submarine geology of the southern part of the East China Sea continental shelf is considered based on the free-air gravity map, magnetic map and seismic stratigraphic records. The rock formations in this region seem to be arranged in zonal structure trending NE direction and the basement surfaces show basins and ridges (or plateaus) in alternation. The rock formations may include the Paleozoic/metamorphic, Mesozoic, Paleogene, Neogene and Quaternary formations, and the continuities of the strata sequences seem to be interrupted in many areas due to presence of unconformities. The thickness of the strata above the 6.0 km/sec layer in the southern area is commonly greater than that in the northern area. (10 refs.)

104332 Surface expressions of bathymetry on SEASAT synthetic aperture radar images. D.W.S.Lodge (Space & New Concepts Dept., Royal Aircraft Establ., Farnborough, England).
Int. J. Remote Sens. (GB), vol.4, no.3, p.639-53 (July-Sept. 1983).
Identifies three classes of feature observed on SEASAT synthetic aperture radar images that may be related to changes in water depth. The first if refraction of gravity waves. The second is the modulation of the surface roughness as tidal currents flow over changes in the depth of shallow water. The third is the detection of internal waves propagating from steep gradients in deep water. (7 refs.)

104333 A FORTRAN program for suspended sediment dynamics and tidal flux monitoring. A.P.Belperio (Geology Dept., Univ. of Adelaide, Adelaide, Australia), J.McManus, P.H.Cohen.
Comput. & Geosci. (GB), vol.9, no.2, p.221-7 (1983).
Research into estuarine and coastal fine sediment transport and sediment deposition is aided by a proposed routine for collection and analysis of hydrodynamic, particulate, and salinity data. Field measurements taken over a number of depth intervals and over one or more tidal cycles are used to calculate the point, depth-integrated, and net horizontal movements of water, suspended solids and salt at a fixed sampling site. (9 refs.)

104334 The East Pacific Rise near 21°N, 13°N and 20°S: inferences for along-strike variability of axial processes of the Mid-Ocean Ridge. J.Francheteau (Centre Oceanologique de Bretagne, Brest, France), R.D.Ballard.
Earth & Planet. Sci. Lett. (Netherlands), vol.64, no.1, p.93-116 (July 1983).
Data obtained along various segments of the Mid-Ocean Ridge (MOR) are used to construct an idealized model for crustal accretion. The model seeks to predict the topographic, volcanic, tectonic, and hydrothermal characteristics of any given spreading segment of the MOR as a function of distance from the bounding transform faults. This model is based on a series of detailed mapping efforts carried out on segments of the MOR having a broad range of spreading rates between 2 and 16 cm/yr. (74 refs.)

104335 Bathymetry estimates in the southern oceans from Seasat altimetry. T.H.Dixon, M.E.Parke (Jet Propulsion Lab., Pasadena, CA, USA).
Nature (GB), vol.304, no.5925, p.406-11 (4 Aug. 1983).
A mean sea surface height based on Seasat altimeter data has been high-pass filtered to reveal a pattern of geoid anomalies which are highly correlated with sea-floor topography. The technique is used to locate new bathymetric features in the poorly surveyed southern oceans. (27 refs.)

104336 Areas of distribution of different types of recent marine sediments. O.K.Leont'yev, M.B.Belodedenko (Univ. of Moscow, Moscow, USSR).
Oceanology (USA), vol.22, no.3, p.318-21 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.3 (1982).
On the basis of maps of ocean-bottom sediments published in the Soviet Union and abroad, a map of the bottom oceanic sediments has been compiled in the Laboratory of Marine Geomorphology of the Geography Faculty of Moscow University in a novel Werner-Murevskis equal-area projection (scale 1:20,000,000). An electronic planimeter was then used to calculate the areas of distribution of different genetic types of recent marine sediments. The data obtained significantly improved the data on the areas of distribution of marine sediments, presented in the widely-known work of Sverdrup, Johnson & Fleming (1942). (18 refs.)

Detailed geomagnetic studies of the rift zone in the south of the Red Sea .... See Entry 104205

Seismic shear-wave observations in a physical model experiment .... See Entry 104238

Deep crustal geothermal measurements, hole 504B, Costa Rica Rift .... See Entry 104291

Relationship between the heights of Pacific seamounts and the age of the lithosphere .... See Entry 104300

Submerged Pliocene of the south eastern margin of Gavdos Island (eastern Mediterranean): tectonic implications .... See Entry 104308

Thermodiffusional transport in pelagic clay: implications for nuclear waste disposal in geological media .... See Entry 104351

Dune formation on the humid tropical sector of the North Queensland coast, Australia .... See Entry 104357

91.60 PHYSICAL PROPERTIES OF ROCKS AND MINERALS

104337 Pore size distribution of shaly rock by small angle neutron scattering. P.L.Hall, D.F.R.Mildner (Res. Reactor Facility, Univ. of Missouri, Columbia, MO, USA), R.L.Borst.
Appl. Phys. Lett. (USA), vol.43, no.3, p.252-4 (1 Aug. 1983).
Information concerning pore microstructure of shaly rocks is of considerable relevance to petroleum exploration and production. Pore sizes and distributions within shaly samples have been determined by small angle neutron scattering. The data are indicative of a considerable spread of pore dimension, showing inhomogeneities with a range from 20 Å and greater. The cumulative pore volumes are compared with those derived from mercury intrusion porosimetry and nitrogen adsorption and desorption isotherms. (22 refs.)

104338 Thermomagnetic characteristics in late orogenic granites and gneisses of the southern Appalachian Piedmont. F.C.Davison,Jr. (Lamont-Doherty Geological Obs., Columbia Univ., Palisades, NY USA), B.B.Ellwood.
Earth & Planet. Sci. Lett. (Netherlands), vol.64, no.1, p.117-22 (July 1983).
Thermomagnetic curves have been obtained for samples from 25 granites and gneisses in Georgia, South Carolina, and North Carolina. This data set can be divided into two distinct curve types: Type I includes rocks which exhibit no distinct Curie points and a linear decrease in magnetization with increasing temperature; Type II curves exhibit a distinct Curie point over a range of temperatures expected for magnetite (500-580°C). The data are interpreted as indicating that Type I thermomagnetic curves are dominated by relatively large hematite/magnetic ratios while Type II granites are characterized by relatively coarse-grained magnetite. (21 refs.)

104339 Diffusion between olivine and spinel: application to geothermometry. J.Lehmann (CRSCM, GIS, CNRS-BRGM, IA, Orleans, France).
Earth & Planet. Sci. Lett. (Netherlands), vol.64, no.1, p.123-38 (July 1983).
Heating experiments were carried out, at 1100°C and 1200°C under controlled oxygen fugacity, on olivine-spinel assemblages from New Caledonia. The result was a marked change in chemical composition of the minor phase, olivine: it becomes enriched in iron and chromium and the magnesium and nickel contents decrease. The results show the possibility of an important subsolidus re-equilibration in natural assemblages containing olivine and spinel. A new equation for the geothermometer based upon Fe^{2+}-Mg^{2+} partitioning between olivine and spinel is proposed and some applications discussed. (22 refs.)

104340 A model for the high-frequency electrical response of wet rocks. P.C.Lysne (Sandia Nat. Labs., Albuquerque, NM, USA).
Geophysics (USA), vol.48, no.6, p.775-86 (June 1983).
In experiments on the electrical properties of rocks at high frequencies, the measured current has contributions from both conduction and displacement currents, and these are related to the bulk conductivity and dielectric permittivity, respectively. In the present model, the bulk electrical conductivity of a specimen is taken to be a constant given by Archie's (1942) rule, whereas its frequency-dependent permittivity is taken to be a generalization of Sillars' (1937) model of a composite dielectric. (33 refs.)

104341 Effect of the conditions of synthesis and heat-treatment regime on the magnetic properties of iron sulfides with a Curie temperature of 570°C. A.G.Zvegintsev, V.V.Onufriyenok, M.I.Petrov (L.V. Kirenskiy Inst. of Phys., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.4, p.298-300 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.4 (1982).
The magnetic properties and crystalline structure were studied in iron sulfides with a Curie temperature of 570°C. Mossbauer and X-ray studies were conducted for this phase at different temperatures. Conditions of synthesis were determined, as well as the regions for the stable and metastable states of the ferromagnetic phase with T_C=570°C. Magnetic measurements were made in a wide range of temperatures (4.5-860K) and magnetic fields (0-70000 oersteds). (6 refs.)

104342 Temperature conductivity of calcite, hornblende and crystalline shale at a pressure of up to 8 GPa. Yu.A.Sorokin, L.N.Dzhavadov, Yu.S.Genshaft (O.Yu. Schmidt Inst. of Phys. of Earth, Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.4, p.301-3 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.4 (1982).
Thermal conductivity of calcite, hornblende (hastingsite) and garnet-pyroxene-plagioclase schist, is measured at high pressures of up to 8 GPa at room temperature. There is an appreciable change of temperature-conductivity of calcite in the pressure range of 0.5-2.0 GPa, due to polymorphic transformations. The character of the change in thermal conductivity of hornblende and schist is the same, namely, a sharp increase in the initial pressure range of 0.5-0.7 GPa and a gradual increase for a further compression up to 8 GPa. (15 refs.)

104343 Low temperature heterophase alteration of titanomagnetite in oceanic basalts based on magnetic data. D.M.Pecherskii, L.V.Tikhonov (Schmidt Inst. of Earth Phys., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.7 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.7, p.506-13 (1982).
The magnetic properties of basalts from site 504B of the DSDP are investigated. It is shown that alongside single-phase oxidation, low temperature heterophase oxidation and decomposition of titanomagnetite takes place. It increases with depth and is related to superimposed heating of basalts at temperatures of the order of 100°C. Data on magnetic properties of oceanic basalts are correlated with the anomalous magnetic field over them. A number of features are attributed to single- and heterophase titanomagnetite alteration processes. (12 refs.)

104344 Magnetic properties and composition of ferromagnetic phases of basalts recrystallized at high temperatures and pressures. Yu.S.Genshaft, M.M.Sattarov (Schmidt Inst. of Earth Phys., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.7 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.7, p.514-19 (1982).
Investigates the magnetic characteristics of basalt and the compositions of the ore-mineral phases crystallizing in the pressure region of 4-13 kbar at high temperatures and oxygen fugacity close to NNO buffer. A substantial change in the composition of magnetite in the pressure region up to 8 kbar has been determined. Conditions of crystallization of ore-mineral phases in original samples corresponding to a depth near the continental Moho surface have been assessed. (12 refs.)

104345 Phase transitions and equations of state for the sodium halides: NaF, NaCl, NaBr, and NaI. Y.Sato-Sorensen (Dept. of Geological Sci., Harvard Univ., Cambridge, MA, USA).
J. Geophys. Res. (USA), vol.88, no.B4, p.3543-8 (10 April 1983). [received: Aug. 1983]
Phase changes and equations of state of four sodium halides, NaF, NaCl, NaBr, and NaI, have been studied up to $\sim$60 GPa at room temperature. NaF and NaCl transform from the B1 phase to the B2 phase at $\sim$23 GPa and $\sim$29 GPa, respectivity. At $\sim$33 GPa, NaBr transforms from the B1 phase to an unidentified phase with a lower symmetry than the B2 phase. NaI also transforms at $\sim$32 GPa to a new phase which seems to have the same structure as that of the high-pressure phase of NaBr. The bulk modulus of the NaF B2 phase was measured. Volume changes across transitions were also measured. (32 refs.)

104346 Anharmonicity of three minerals at high temperature: forsterite, fayalite, and periclase. O.L.Anderson, I.Suzuki (Inst. of Geophys. & Planetary Phys., Univ. of California, Los Angeles, CA, USA).
J. Geophys. Res. (USA), vol.88, no.B4, p.3549-56 (10 April 1983). [received: Aug. 1983]
Recent data on K_S (the adiabatic bulk modulus) and α (the volume coefficient of thermal expression) versus T (temperature) at high temperatures ($500°C<T<1000°C$) have been published or are in press. The high temperature anharmonic properties of forsterite and fayalite are presented for the first time in this paper, and they are compared with similar previously published data for MgO. The anharmonic properties referred to above concern the dependence of γ (the Gruneisen ratio), P_{TH} (the thermal pressure), and C_V (the specific heat) with T. If γ (at constant V) is independent of T at high T, the anharmonicity in γ is said to be nil; similarly, for C_V. If P_{TH} at constant V is proportional to T at high T, then the anharmonicity in P_{TH} is said to be nil. The anharmonicity determined by these experiments indicates that the minerals are not alike with regard to their properties γ, P_{TH}, and C_V. (18 refs.)

104347 A semiempirical method for analysis of the reflectance spectra of binary mineral mixtures. P.E.Johnson (Wyoming Infrared Obs., Dept. of Phys. & Astron., Univ. of Wyoming, Laramie, WY, USA), M.O.Smith, S.Taylor-George, J.B.Adams.
J. Geophys. Res. (USA), vol.88, no.B4, p.3557-61 (10 April 1983). [received: Aug. 1983]
A simple semiempirical method is presented for determination of the spectral reflectance of a powdered binary mineral mixture. This technique uses a two-stream radiative transfer model (a modified Kubelka-Munk model) on a particulate medium of isotropic scatterers. The particles are assumed to be much larger than the wavelength of light under consideration. This same method can be used to determine the relative proportion of components in a mixture for which the spectral reflectance is known. Binary mixtures of olivine, two pyroxenes, and magnetite are used to test this model. The theoretical and empirical results agree approximately within experimental errors. (13 refs.)

104348 Measurements of frictional heating in granite. D.A.Lockner, P.G.Okubo (US Geological Survey, Menlo Park, CA, USA).
J. Geophys. Res. (USA), vol.88, no.B5, p.4313-20 (10 May 1983).
A large ($150\times150\times40$ cm) granite sample, sawn diagonally in half to simulate a fault, was deformed in a biaxial rock press at normal stress up to 6.41 MPa. Displacements and local shear stress were monitored along the fault (200×40 cm). Temperature transients as large as 10 m°C were recorded following stick slip events at distances of 0.2 to 1.0 cm from the fault and were related to stress, displacement, and total work. The temperature measurements were used to calculate the heat generated on the fault during slip. Frictional heating was found to be 94±2% of the total work expended in each event, implying a seismic efficiency of 4-8%. When water was injected onto the fault, both frictional stress drop and static frictional stress increased. (24 refs.)

104349 Stress corrosion and crack propagation in Sioux quartzite. L.Peck (Dept. of Geology & Geophys., Yale Univ., New Haven, CT, USA).
J. Geophys. Res. (USA), vol.88, no.B6, p.5037-46 (10 June 1983).
Two aspects of the brittle deformation of Sioux quartzite have been studied: water-induced changes in the amount of energy consumed during fracture of the quartzite and the occurrence of microcracking during crack propagation. Wedge-loaded double cantilever beam test specimens were cracked in several environments (air, water, aqueous solutions of NaOH, HCl, NaCl, methanol) at crack velocities of 4.2×10^{-2} mm/s and 4.2 mm/s and temperatures of 17°-60°C. The fracture experiments measured the fracture energy of the quartzite, the specific energy required to produce a unit increment of crack extension, using the analysis of linear elastic fracture mechanics. The fracture energy of Sioux quartzite in water is 15% lower than that of quartzite cracked in air. The dependence of the quartzite fracture energy on crack velocity (time) and on the concentration of water in the test environment is characteristic of the occurrence of stress corrosion as a mechanism of enhanced crack growth in the presence of water. (47 refs.)

104350 Magnetic properties of three segments of the Mid-Atlantic Ridge at 37°N: FAMOUS, Narrowgate, and AMAR: AMAR 2. N.A.van Wagoner (Dept. of Geology, Dalhousie Univ., Halifax, Nova Scotia, Canada), H.P.Johnson.
J. Geophys. Res. (USA), vol.88, no.B6, p.5065-82 (10 June 1983).
During the AMAR 1978 Expedition, over 200 separate basalt samples were collected by Alvin and dredge from the Narrowgate and AMAR segments of the Mid-Atlantic Ridge near 37°N to determine the origin of reversely magnetized rocks previously recognized in the FAMOUS rift area to the north and to study the variations in rock magnetic properties that occur along the strike of the Mid-Atlantic Ridge. Magnetic intensity determinations of rocks collected in the FAMOUS area indicate that intensity decays with time by a factor of 5 in less than 10^6 years. Rocks with low intensities have high Curie temperatures (T_c) indicating that low-temperature oxidation of the magnetic minerals takes place soon after the basalts are extruded and is pervasive in crust older than 10^6 years. Magnetic intensity (J_{nrm}) of the uppermost oceanic crust can be expressed as a function of age (t) by the expression $J=5.82t^{-1/3}$. (66 refs.)

104351 Thermodiffusional transport in pelagic clay: implications for nuclear waste disposal in geological media. E.C.Thornton, W.E.Seyfried,Jr. (Dept. of Geology & Geophys., Univ. of Minnesota, Minneapolis, MN, USA).
Science (USA), vol.220, no.4602, p.1156-8 (10 June 1983).
Thermal gradient experiments in sediment-seawater systems revealed large-scale fluxes of aqueous electrolytic components away from the heat source through thermal diffusion. These findings indicate a need for similar studies in other geological materials of low permeability in order to assess the implications of this phenomenon for various nuclear waste disposal options. (6 refs.)

The magnetic characteristics of the oceanic crust in the Heezen Fracture Zone .... See Entry 104206

Dynamic interaction of a propagation crack with an oblique fault .... See Entry 104232

Mechanism of deformation during cyclic undrained loading of saturated sands .... See Entry 104233

Shear and compression wave measurements in shocked polycrystalline Al_2O_3 .... See Entry 104265

Fission tracks in minerals: Annealing kinetics, track structure and age correction .... See Entry 104302

91.65 GEOPHYSICAL ASPECTS OF GEOLOGY, MINERALOGY AND PETROLOGY

104352 Oxygen isotopic compositions of Central Andean plutonic and volcanic rocks, latitudes 26°-29° south. F.J.Longstaffe (Dept. of Geology, Univ. of Alberta, Edmonton, Canada), A.H.Clark, R.H.McNutt, M.Zentilli.
Earth & Planet. Sci. Lett. (Netherlands), vol.64, no.1, p.9-18 (July 1983).
Oxygen isotope data are reported for 27 igneous rocks of Mesozoic to Quaternary ages from the Central Andes, 26-29°S. The plutonic rocks and most of the volcanics, have $\delta^{18}O$ values between 6.2 and 8.3%. The whole-rock $\delta^{18}O$ values show a weak correlation with initial $^{87}Sr/^{86}Sr$ data. The oxygen isotope results indicate that the magmas evolved without significant contamination from supracrustal rocks (e.g. rocks that experienced ^{18}O enrichment during surficial weathering). The available O, Sr and Pb isotopic data for these rocks are best explained by magma generation in the upper mantle or lower crust. (47 refs.)

104353 The chronology of intermontane-basin development in the northwestern Himalaya and the evolution of the Northwest Syntaxis. D.W.Burbank (Dept. of Geological Sci., Univ. of Southern California, Los Angeles, CA, USA).
Earth & Planet. Sci. Lett. (Netherlands), vol.64, no.1, p.77-92 (July 1983).
The Northwest Syntaxis delineates a complex zone where the Himalayan Ranges meet the Hindu Kush and Indus Kohistan Ranges. Chronologic, stratigraphic, structural, and geophysical data from the syntaxial zone permit the construction of a model for intermontane-basin development and the evolution of the Northwest Syntaxis during the Late Cenozoic. The formation of the Kashmir and Peshawar Basins results from the transfer of thrusting and uplift to the southern margins of the basins. During the Pliocene, the morphotectonic emergence of the ancestral Pir Panjal and Attock Ranges coincides with changes in the patterns of sedimentation and deformation. (43 refs.)

104354 Mossbauer spectroscopic analysis of iron in soils and rocks in the eastern Himalayan foothill region. S.C.Das, S.K.Sengupta, N.C.Paul, N.Bhattacharya, J.B.Basu, N.Chaudhuri (Dept. of Phys., North Bengal Univ., Darjeeling, India).
Indian J. Pure & Appl. Phys., vol.21, no.6, p.376-8 (June 1983).
As a part of the study of iron-bearing minerals in the eastern Himalayan foothills, the ferrous-ferric ratio for a number of weathered samples in agricultural and forest-covered lands in the altitude range 100-2700 m has been estimated by the Mossbauer method. The results have been compared with similar such results for other countries with a view to indicating the trend of behaviour of iron in bulk and separated samples. The importance of these results in the field of geology and agriculture has been pointed out. (5 refs.)

Geochemical double beta decay experiments .... See Entry 99539

Seepage and heat flow in soil freezing .... See Entry 101330

On dating the magmatism of Maio, Cape Verde Islands .... See Entry 104282

Early Tertiary age of pitchstone in the northern Black Hills, South Dakota .... See Entry 104304

Petrologic and geochemical variations along the Mid-Atlantic Ridge from 29°N to 73°N .... See Entry 104330

Areas of distribution of different types of recent marine sediments .... See Entry 104336

Thermomagnetic characteristics in late orogenic granites and gneisses of the southern Appalachian Piedmont .... See Entry 104338

Diffusion between olivine and spinel: application to geothermometry .... See Entry 104339

A semiempirical method for analysis of the reflectance spectra of binary mineral mixtures .... See Entry 104347

Ore-controlling space geological objects .... See Entry 104355

91.90 OTHER TOPICS IN SOLID EARTH GEOPHYSICS

104355 Ore-controlling space geological objects. V.N.Brukhanov (All-Union Res. Inst. of Geology of Foreign Countries ('Zarubezhgeologia'),,Moscow. Min. of Geology,USSR), A.L.Stavtsev.
Acta Astronaut. (GB), vol.10, no.3, p.153-8 (March 1983).
Geological interpretation of space images plays an important part in recognition of location regularities of mineral deposits. Ore-controlling faults and ring structures have been revealed in the course of space geological investigations. Compilation of space mineragenic and space tectonic maps results in delineation of new ore-bearing and oil- and gas-bearing structures. (8 refs.)

104356 A test of granulometric control of desert dune geometry. R.J.Wasson (Dept. of Biogeography & Geomorphology, Australian Nat. Univ., Canberra, Australia), R.Hyde.
Earth Surf. Processes & Landforms (GB), vol.8, no.4, p.301-12 (July-Aug. 1983).
I.G. Wilson's hypothesis of coarse-tail grain-size control of dune spacing was derived from three dunefields in the Sahara and, although it was supplemented by measurements of spacing from other parts of the world, the grain-size data come only from North Africa. In this paper the hypothesis is tested in the Australian dunefields. Australian dunes do not form separate categories on a P_{20}/s (twentieth percentile/spacing) plot and, when placed on Wilson's diagram, the Australian data form a continuum between dunes and draas. Ripples maintain their identity, suggesting that the average saltation length of sand controls ripple wavelength while dune and Wilson's draas are formed by secondary flow of some kind. In Australia the spread of data on the P_{20}/s diagram indicates that grain-size is not the prime control on s. (14 refs.)

104357 Dune formation on the humid tropical sector of the North Queensland coast, Australia. K.Pye (Dept. of Earth Sci., Univ. of Cambridge, Cambridge, England).
Earth Surf. Processes & Landforms (GB), vol.8, no.4, p.371-81 (July-Aug. 1983).
Several previous attempts have been made to explain the apparent poor development of coastal dunes in the humid tropics in terms of lack of wind energy, failure of sand supply to the shoreline, excessive climatic wetness, salt crust formation on beaches, and the character of tropical back-beach vegetation. However, recent published reports indicate that coastal dune occurrences are more common in the humid tropics than was formerly thought, throwing suspicion on the idea that occurrences are more common in the humid tropics than was formerly thought, throwing suspicion on the idea that environmental conditions militate against dune formation in these areas as a whole. Evidence from the humid tropical sector of the North Queensland coast suggests that the poor development of dunes in this area primarily reflects poor sediment sorting in the beach and nearshore zone and low wind energy at the shoreline due to the nature of the coastal orientation and physiography in relation to the prevailing southeasterly winds. (57 refs.)

104358 Spatial resolution of remotely sensed imagery. A review paper. M.R.B.Forshaw (Blackett Lab., Imperial Coll., Univ. of London, London, England), A.Haskell, P.F.Miller, D.J.Stanley, J.R.G.Townshend.
Int. J. Remote Sens. (GB), vol.4, no.3, p.497-520 (July-Sept. 1983).
An important system-performance parameter for remote-sensing systems of the spatial resolution. This term has an imprecise meaning and there are a multinode of different definitions. The most important definitions are reviewed and consideration is given to the factors which influence the resolution of a given system. It is concluded that no single definition of spatial resolution can be applied to all systems, nor can spatial resolution alone be used to measure the significant information content of image data. (40 refs.)

104359 A composite Landsat image of the United Kingdom. R.H.Merson (Nat. Remote Sensing Centre, Royal Aircraft Establ., Farnborough, England).
Int. J. Remote Sens. (GB), vol.4, no.3, p.521-7 (July-Sept. 1983).
A composite image of the United Kingdom is constructed from 43 Landsat scenes by a wholly digital procedure, using a Prime 750 computer. The scenes are first transformed to National Grid coordinates, using 1200 ground control points, the resampling giving 100 m square pixels. A magnetic tape storage and retrieval system is designed to enable segments of a partially constructed composite image to be transferred to and from a working disk. As each new scene is added, its intensity level in each of four spectral bands are stretched to match the partially constructed image in the area of overlap. (1 ref.)

104360 Point spread functions in imaging a Lambert surface from zenith through a thin scattering layer. J.Otterman (Tel Aviv Univ., Ramat Aviv, Israel), M.Dishon, S.Rehavi.
Int. J. Remote Sens. (GB), vol.4, no.3, p.583-99 (July-Sept. 1983).
Effects of cross radiance, i.e. of reflection from one area and scattering to the zenith over another area (the object pixel) with a different reflectivity, are computed and presented as point-spread functions. The analysis concerns imaging a planar terrain with Lambert law reflectivity, when viewed from the zenith through an optically and geometrically thin horizontal layer of scatterers. The Henyey-Greenstein phase function, with various values of the anisotropy factor is assumed for the scatterers. Based on this analysis, spatial (surface) resolution, when effectively limited by the atmospheric cross radiance, is defined and computed. (8 refs.)

104361 Reflectance models and field measurements: some issues. J.A.Smith (Coll. of Forestry & Natural Resources, Colorado State Univ., Fort Collins, CO, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.356, p.131-7 (1983). (Field Measurement and Calibration Using Electro-Optical Equipment: Issues and Requirements, San Diego, CA, USA, 24-25 Aug. 1982).
Electro-optical field measurements of scene reflectance, together with appropriate target characterization, will play an increasingly important role in the testing, intercomparison, and extension of scene radiation models. Such models, in turn, will serve to extrapolate the range of applicability of field measurements to a wider set of environmental conditions and sensor/source viewing geometries than could practically be obtained by direct measurement. The author presents several issues which must be addressed before such a symbiotic relationship between modeling and measurement approaches can be achieved. The direct comparison of model predictions with field measurements is seen to be a somewhat more subtle task than might be suspected. (17 refs.)

104362 Exhalation of radon and thoron: the question of the effect of thermal gradients in soil. S.D.Schery, A.G.Petschek (New Mexico Inst. of Mining & Technol., Socorro, NM, USA).
Earth & Planet. Sci. Lett. (Netherlands), vol.64, no.1, p.56-60 (July 1983).
Experimental measurements show no evidence for diurnal variation in exhalation of radon and thoron from soil due to convection induced by thermal gradients in the top few decimeters of soil. Estimates based on convective calculations indicate that even in the unlikely event of either vertical temperature gradients large enough to cause vertical instability, or horizontal gradients sufficient to cause significant convection, any effect would be too small to be detected. (16 refs.)

104363 Generalized least-squares solutions to quasi-linear inverse problems with a priori information. M.Matsu'ura, N.Hirata (Geophys. Inst., Faculty of Sci., Univ. of Tokyo, Tokyo, Japan).
J. Phys. Earth (Japan), vol.30, no.6, p.451-68 (1982).
A quasi-linear inverse problem with a priori information about model parameters is formulated in a stochastic framework by using a singular value decomposition technique for arbitrary rectangular matrices. In many geophysical inverse problems, one has a priori information from which a most plausible solution and the statistics of its probable error can be guessed. Starting from the most plausible solution, the optimization of model parameters is made by the successive iteration of solving a set of standardized linear equations for corrections at each step. A best linear inverse operator which minimizes the variances of estimation errors within the framework of a generalized least-squares approach is directly obtained from the 'natural inverse' of Lanczos (1961) for a coefficient matrix by regarding an eigenvalue in the inverse as zero if it is smaller than unity. This provides a theoretical basis on the 'sharp cutoff approach' of Wiggins (1972) and Jackson (1972, 1979) in their general inverse formalisms. (17 refs.)

104364 Air and soil temperatures during an intense freeze in Shropshire. M.A.Fullen, J.P.Smith (Geography Section, Wolverhampton Polytech., Wolverhampton, England).
Weather (GB), vol.38, no.7, p.205-8 (July 1983).
Soil temperatures during periods of freezing weather are of considerable agricultural and geomorphological importance. Freezing of the uppermost soil influences disaggregation of mineral matter, the development of crumb structure, and the surface water balance in terms of runoff and snow melt. Low soil temperatures play a part in the regulation of soil micro-organisms, seed viability, over-wintering of pathogens and the uptake of nutrients by plants. Protracted periods of low soil temperatures determine the base level from which the soil needs to accumulate warmth for the growing season to come. Continuous measurements of a range of meteorological parameters at Wolverhampton Polytechnic's meteorological station during the severe winter of 1981/82 provided an opportunity to examine the behaviour of soil temperatures beneath snow cover, and during and after snowmelt. The station is located some 10 km west of the West Midland conurbation, near Claverley, east Shropshire (NGR SO 792 943). (no refs.)

Proceedings of Symposium 1 and Workshop V of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 98617

Meeting of the Nordic Association for Applied Geophysics .... See Entry 98626

Anton L. Hales Symposium on 'Some Recent Advances in Geophysics' .... See Entry 98630

Dynamic analysis of a slope failure from the 6 August 1979 Coyote Lake, California, earthquake .... See Entry 104228

Delineation of New Zealand ultramafic rocks by computer processing of digital data from satellite imagery .... See Entry 104298

Thermodiffusional transport in pelagic clay: implications for nuclear waste disposal in geological media .... See Entry 104351

Mathematical simulation of stable and equilibrium river bed profiles and slopes .... See Entry 104403

Variation of atmospheric optical depth for remote sensing radiance calculations .... See Entry 104565

Determination of iron contents in boreholes by neutron capture method .... See Entry 104581

The use of multispectral satellite imagery in the exploration for petroleum and minerals .... See Entry 104610

Synthetic aperture radar observations of ocean and land .... See Entry 104611

Large-scale explosion in the inhomogeneous atmosphere of the Earth with allowance for spectral radiation .... See Entry 104817

92.00 HYDROSPHERIC AND ATMOSPHERIC GEOPHYSICS

(for marine geology and geophysics, see 91.50)

92.10 PHYSICS OF THE OCEANS

(see also 43.30 Underwater sound)

104365 A simplified method for calculating the highest wave on deep water. M.A.Srokosz (Inst. of Oceanographic Sci., Wormley, England).
IMA J. Appl. Math. (GB), vol.30, no.2, p.151-9 (March 1983).
Following Longuet-Higgins' (1978) discovery of some new relations between Stokes' coefficients in the theory of gravity waves, it is shown that similar relations may be derived for the coefficients of the highest wave (on deep water) solution of Longuet-Higgins & Fox (1978). These new relations allow the solution to be computed more easily. (9 refs.)

104366 A new low-salinity sea-ice model for UHF radimetry. M.T.Hallikainen (Radio Lab., Helsinki Univ. of Technol., Otaniemi, Finland).
Int. J. Remote Sens. (GB), vol.4, no.3, p.655-81 (July-Sept. 1983).
A first-year sea-ice model, consisting of the dielectric properties and the geometry of ice and snow cover is used for interpreting brightness-temperature measurements of low-salinity sea ice. Dielectric measurements were made on about 400 ice samples, the salinity of which range from 0.1 to 5 per mille by weight and the temperature from −18 to −0.1°C. Measurements were made with the electric field at angles of 0, 30 and 90° to the horizontal in the natural ice field. The effect of the fluctuations in the properties of ice and snow within the radiometer antenna beam are included in the theoretical brightness-temperature model. (30 refs.)

104367 Eigenanalysis of recent United States sea levels. D.G.Aubrey, K.O.Emery (Woods Hole Oceanographic Instn., Woods Hole, MA, USA).
Cont. Shelf Res. (GB), vol.2, no.1, p.21-33 (May 1983).
Spatial and temporal patterns of recent sea-level rises along the United States coastline are examined to ascertain rates of rise, and possible causes for high-frequency fluctuations in sea level. Eigenanalysis identifies several distinct coastal compartments within each of which sea-level behavior is consistent. The United States east coast has three of these compartments: one north of Cape Cod, one between Cape Cod and Cape Hatteras, and the third from Cape Hatteras south to Pensacola. The western gulf coast represents another compartment and the final compartment is along the United States west coast. (21 refs.)

104368 Variability of currents and horizontal eddy coefficients in Eastern Long Island Sound. D.Tolmazin, W.F.Bohlen (Marine Sci. Dept./Inst., Univ. of Connecticut, Groton, CT, USA), M.Fecher.
Cont. Shelf Res. (GB), vol.2, no.1, p.35-48 (May 1983).
Various circulatory mechanisms within the mesoscale range of tidal flows in Eastern Long Island Sound are investigated. Two 13-day time series of current measurements were obtained using three moorings arranged in the form of a triangle. Each mooring contains a single Aanderaa current meter located at a depth of 18 to 20 m. Statistical analysis provides evidence of residual circulation effects of topographic origin in the average flow field. The relative importance and periods of orderly residual patterns and turbulent motions are examined. A computational technique is described to calculate horizontal eddy coefficients in various directions using the mixing length hypothesis. The coefficients developed using this technique are used to investigate various oscillatory mechanisms in the tidal flows. (14 refs.)

104369 An externally forced barotropic circulation model for the New York Bight. T.S.Hopkins, D.A.Dieterle (Dept. of Energy & Environment, Brookhaven Nat. Lab., Upton, NY, USA).
Cont. Shelf Res. (GB), vol.2, no.1, p.49-73 (May 1983).
The sea level and the barotropic, frictional circulation response for the New York Bight are used to demonstrate the effects of external sea-level forcing, bathymetry, and variable friction. The governing equation is the steady, integrated vorticity equation. The boundary conditions are based on the hypothesis that the dynamics of the shelf are driven by the external sea-level gradient and the coastal no-flux condition; and consequently the conditions at the lateral boundaries are dependent thereon. Therefore, the external sea-level slope must be independently specified, and the lateral boundary conditions must be dependently generated. The bottom friction is expressed as related to the sea level through a bottom length parameter and a veer angle. An additional bottom stress component, related to the surface stress, is determined for bottom depths less than the Ekman depth. The model is forced by different wind directions and the results are discussed. (35 refs.)

104370 A shallow core of Mediterranean Water off western Portugal. I.Ambar (Grupo de Oceanographia, Dept. de Fisica, Faculdade de Ciencias, Univ. de Lisboa, Lisboa, Portugal).
Deep-Sea Res. Part A (GB), vol.30, no.6A, p.677-80 (June 1983).
From an analysis of several sets of hydrological data taken in the Gulf of Cadiz area and off the southern half of the western coast of Portugal, it was possible to identify and establish the continuity of a shallow vein of Mediterranean Water, distinct from the already well-established two main cores. Its thermohaline characteristics, in the form of temperature and salinity maxima in the vertical profiles, allowed its identification at density (σ_t) levels between 27.25 and 27.45 with an equilibrium depth between 400 and 700 m and with a thickness of 50 to 100 m. (11 refs.)

104371 Experimental study of the coastal thermocline height variations caused by an impulsively applied wind of limited along-shore extent. D.S.Lee, P.Renouard (Inst. de Mecanique de Grenoble, Grenoble, France).
Dyn. Atmos. & Oceans (Netherlands), vol.7, no.3, p.129-45 (July 1983).
On the large rotating platform of Grenoble's University, a channel ($8\times2\times0.6$ m) has been built, equipped with a wind entrainment simulation effects mechanism. With a local wind, acting over a two-layered ocean, upwelling or downwelling patterns are induced, which are Kelvin-type height variations of the interface; propagating so that, in the northern hemisphere, they leave the coastline to the right of their direction of propagation, and having a profiled exponentially decreasing from the coastline towards the open sea. The agreement between these observations and the recently proposed model of Crepon and Richez (1982) is very good at some distance from the excitation zone. However, this model, for its application, is limited to the situation in which the Ekman layer is of the same order of magnitude as the upper layer. (32 refs.)

104372 A wave height hindcasting procedure tested considering statistical errors of measured waves. P.Aminti (Istituto di Ingegneria Civile, Firenze, Italy), A.Lamberti.
Energ. Elettr. (Italy), vol.60, no.4, p.129-37 (April 1983). In Italian.
Great care is generally needed to perform wave height hindcasting with simplified methods using wind records from a single weather station, usually at one end of the generating area. The results presented are of a comparison between hindcast wave heights and those measured at Termoli over about 3 years. Considering that even direct wave height measurements are not error free, because of the limited length of records, for waves higher than 2 m no evidence was found that disagreement between hindcast and measured values is not to be ascribed to measurement errors. Due to the simplified hypotheses chosen, hindcasting model errors seem on the contrary to prevail for lower waves. (7 refs.)

104373 Concurrent underwater acoustic wave-front fluctuations at two frequencies. H.W.Broek (Bell Labs., Whippany, NJ, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.559-63 (Aug. 1983).
An experiment was performed to determine whether or not a relative phase fluctuation between two receivers of a signal transmitted over a long ocean path can be expressed as the angular frequency times a frequency-independent delay fluctuation. Short pulses were transmitted alternately at 400 and 114 Hz every 15 s from a ship-suspended source at 1000-ft depth to a set of seven bottomed receivers at about 4400-ft depth in a slope northwest of Bermuda. Measurements were made at two ranges: 75 and 145 nmi. Relative delays in arrival at each receiver were measured and the data analyzed. It was concluded that delay fluctuation in units of time is independent of frequency. (13 refs.)

104374 Broadband interference patterns in shallow water. R.T.Bachman, G.T.Kaye (Naval Ocean Systems Center, San Diego, CA, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.576-80 (Aug. 1983).
Variations in received sound pressure level resulting from the multipath interference of broadband noise in shallow water were reconstructed using a simple ray model which ignores sound propagation through the sea floor. The frequency range was from 200-1200 Hz, and source-to-receiver distance varied between 50 and 1000 m. Qualitative agreement between the reconstructed and measured interference patterns was achieved using 12 ray paths at ranges beyond 200 m and at frequencies above 600 Hz. Evidently, a more comprehensive treatment of subbottom sound propagation, not justified by the environmental data currently available, is required for frequencies below 600 Hz. (9 refs.)

104375 The accuracy of the low-degree geopotential: implications for ocean dynamics. C.A.Wagner (NOAA/Nat. Oceanic Service/Nat. Geodetic Survey, Rockville, MD, USA).
J. Geophys. Res. (USA), vol.88, no.B6, p.5083-90 (10 June 1983).
The low-degree portion of a number of recent global gravitational fields have been tested for accuracy using precise accelerations measured on 24-hour satellites. These measurements are independent of the data in the field models. The results show that the most accurate of the recent solutions have degree error variances significantly less than 100 mm (geoid height equivalent) for all degrees less than five. The broad and lasting features of ocean circulation should now be visible when comparing the geoid computed from this model with the average sea surface computed from satellite altimetry. However, before accurate mapping is possible, the equivalent accuracy of the mean altimetric surface at long wavelengths needs to be verified. (31 refs.)

104376 A resonant test-field model of gravity waves. B.J.West (Center for Studies of Nonlinear Dynamics, La Jolla Inst., La Jolla, CA, USA).
J. Fluid Mech. (GB), vol.132, p.417-30 (July 1983).
The author proposes an 'irreversible' resonant test-field (RTF) model to describe the statistical fluctuations of gravity waves on deep water driven by a turbulent wind field. The non-resonant interactions in the gravity-wave Hamiltonian are replaced by a Markov process in the equation of motion for the resonantly interacting gravity waves, i.e. Hamilton's equations are replaced by a Langevin equation for the RTF waves. The RTF models the irreversible energy-transfer process by a Fokker-Planck equation for the phase-space probability density, the exact steady-state solution of which is determined to be non-Gaussian. An H-theorem for the RTF predicts the monotonic approach to the asymptotic steady state near which the transport properties of the field are studied. The steady-state energy-spectral density is calculated (in some approximation) to be k^{-4}. (40 refs.)

104377 Measurement of the statistical characteristics of a turbulent boundary layer in a natural environment [ocean]. V.E.Aerov, A.D.Solodukhin, S.V.Isaev, N.N.Luchko (A.V. Lykov Inst. of Heat & Mass Transfer, Acad. of Sci., Minsk, Belorussian SSR).
J. Eng. Phys. (USA), vol.43, no.6, p.1339-43 (Dec. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.6, p.919-24 (Dec. 1982).
Certain characteristics of a turbulent boundary layer are measured in a natural setting by means of an automated measurement system. Deviations of the investigated process from the Gaussian description are inferred on the basis of measurements of the higher statistical moments. (4 refs.)

104378 Wave heights estimated by the Voluntary Observing Fleet compared with instrumental measurements at fixed positions. A.E.Graham (Meteorological Office, Bracknell, England).
Meteorol. Mag. (GB), vol.112, no.1332, p.210-24 (July 1983).
Measured wave heights from twelve locations are compared with visual estimates made by the deck officers of merchant ships adjacent to the site. The methods of measurement and estimation are discussed together with the difficulties encountered in comparing the two different types of wave heights produced and in deriving extremes. (5 refs.)

104379 Wave deformation in the surf zone. K.Iwata, T.Sawaragi (Dept. of Civil Engng., Nagoya Univ., Nagoya, Japan).
Mem. Fac. Eng. Nagoya Univ. (Japan), vol.34, no.2, p.239-83 (Nov. 1982).
An elucidation of mechanics of wave breaking and wave deformation after breaking has been a matter of great interest to coastal engineers as well as researchers in the hydrodynamics field. The authors discuss the wave characteristics at the inception of wave breaking and the wave characteristics at the inception of wave breaking and the wave deformation in the surf zone up to the dry bed from theories and experiments. Both regular and irregular waves are treated. The wave breaking conditions and breaker types wave characteristics such as the wave height, wave profiles, etc., at the breaking point, internal mechanics of breaking waves, changes of wave heights and the mean water levels, and wave run-up heights are described. The main part of the paper discusses the regular wave deformation in the surf zone. (66 refs.)

104380 Theoretical analysis of wave refraction over a step-type sea bottom configuration. N.Marui (Dept. of Civil Engng., Tokyo Metropolitan Univ., Tokyo, Japan).
Mem. Fac. Technol. Tokyo Metrop. Univ. (Japan), no.32, p.3167-76 (1982).
The refraction phenomenon of periodic waves at a step where the water depth suddenly changes in shallow water is theoretically analysed. The refraction coefficient and the reflection coefficient are defined and derived from dynamic laws. Results are also applied to the case of a double step-type bottom and the energy transmitted to the shoreside is evaluated with consideration for the energy reflected to the offshore side. (2 refs.)

104381 An interpretation of synoptic phenomena in the Baltic Sea. A.M.Aitsam, L.A.Talpsepp (Inst. of Thermophys. & Electrophys., Acad. of Sci., Tallin, Estonian SSR).
Oceanology (USA), vol.22, no.3, p.263-6 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.3 (1982).
Current velocity and temperature measurements obtained with self-contained buoy stations in the open Baltic Sea are analyzed. The measured dominant 6 to 8-day fluctuations are interpreted as unstable topographic waves. (10 refs.)

104382 Notes on the generation and structure of turbulent eddies in the equatorial countercurrents of the central Pacific. V.D.Pozdynin (Shirshov Inst. of Oceanology, Acad. of Sci., Moscow, USSR).
Oceanology (USA), vol.22, no.3, p.267-70 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.3 (1982).
Measurements at an equatorial study area prove that, with a probability close to unity, no less than one turbulent eddy with $0.08 \leq u_{\max}'^2 \leq 0.90$ cm^2.sec^{-2} can be generated in the 40 to 90-m layer over a distance of 5 to 6 n mi or during 3 to 4 hr. The mean thickness of the turbulent layer does not exceed 10 m and the horizontal length of the eddy is several hundred meters. The turbulence level decrease away from the center of the disturbance is described by the Gaussian curve. The critical value of the Richardson number is estimated to be ≤ 0.1 to 0.15. (5 refs.)

104383 On variability of the fine structure of the temperature field in the seasonal thermocline. L.L.Sukhov (Shirshov Inst. of Oceanography, Acad. of Sci., Moscow, USSR).
Oceanology (USA), vol.22, no.3, p.271-3 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.3 (1982).
Data on the measurements of the fine structure of the temperature field in the seasonal thermocline are examined. The profiles of the fine structure, the phase difference, and the coherence K between profiles with different time lags τ are calculated. The behavior of the coherence function suggests that internal waves with an inertial period have no effect on the profiles. (5 refs.)

104384 Statistical properties of whitecaps on a rough sea. V.G.Bondur, E.A.Sharkov (Inst. of Space Res., Acad. of Sci., Moscow, USSR).
Oceanology (USA), vol.22, no.3, p.274-9 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.3 (1982).
Statistical analysis of data obtained by aerial photography of the sea surface gave distributions of the areas occupied by specific whitecap formations. The function describing the generation of whitecaps exhibits a wind-velocity threshold of 4 to 5 m.sec^{-1}. The dependence of the average areas covered by whitecaps on the wind velocity is defined for the wind speed range of 2 to 10.5 m.sec^{-1}. (14 refs.)

104385 'Reconstitution' of the spectral light attention coefficients of sea water in the 270 to 590 nm range from measurements at two wavelengths. O.V.Kopelevich (Shirshov Inst. of Oceanography, Acad. of Sci., Moscow, USSR).
Oceanology (USA), vol.22, no.3, p.288-92 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.3 (1982).
The spectral values of the light attenuation coefficients of sea water in the range 270-590 nm can be calculated with the help of the system of eigenvectors of their covariance matrix using data from measurements at two wavelengths (390 and 550 nm); the average errors over the spectrum for such a calculation are $\sim$0.01 m^{-1} in the visible and $\sim$0.04 m^{-1} in the ultraviolet ranges. (6 refs.)

104386 Penetration of photosynthetically-active solar radiation into Atlantic Ocean waters. V.A.Rutkovskaya, V.N.Pelevin, V.I.Voytov (Shirshov Inst. of Oceanology, Acad. of Sci., Moscow, USSR).
Oceanology (USA), vol.22, no.3, p.293-7 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.3 (1982).
The attenuation of photosynthetically-active solar radiation (PAR) in the Atlantic Ocean to the 100-m depth is computed. A map of the optical index m that describes water types and controls PAR attenuation, is plotted. A relationship between the *m* distribution thus obtained and hydrophysical parameters of a given water basin is defined. The method used to evaluate the level of PAR at depth and spectral composition of light down to the 100 m level in different ocean regions is described. The values of *m* and primary production levels are compared. (17 refs.)

104387 The physical oceanography of fjords. D.M.Farmer, H.J.Freeland (Inst. of Ocean Sci., Sidney, BC, Canada).
Prog. Oceanogr. (GB), vol.12, no.2, p.147-220 (1983).
Places some theoretical and observational studies in perspective and indicates some of the problems and opportunities in the study of fjords that make it such a challenging and intriguing aspect of oceanographic research. While no attempt is made to reference inclusively the many descriptive accounts of fjords, when discussing specific processes the authors use examples drawn from their own observations and in particular from Knight Inlet, BC. This choice does not reflect any particular bias and the processes occurring in Knight Inlet are certainly not representative of all fjords, but they do provide ready examples illustrating the mechanisms under discussion. Knight Inlet is a useful example from another point of view in that it has become a testing ground for several different theories of fjord circulation; such comparisons are more easily made using data from a single fjord. (157 refs.)

104388 Influence of Rossby waves on the sound-velocity distribution in the ocean. V.M.Kurtepov (P.P. Shirshov Inst. of Oceanology, Acad. of Sci., USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.45-7 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.80-3 (Jan.-Feb. 1983).
A procedure is proposed for taking into account the influence of Rossby waves on the distribution of the sound-velocity field in the ocean. Specific calculations carried out for the northwestern part of the Pacific Ocean show that Rossby waves can alter considerably the structure of the underwater sound channel. (7 refs.)

104389 'Linear' source of explosion waves in the ocean. E.N.Pelinovskii, V.E.Fridman, L.N.Tsodikovich (Inst. of Appl. Phys., Acad. of Sci., USSR).
Sov. Phys.-Acoust. (USA), vol.29, no.1, p.72 (Jan.-Feb. 1983). Translation of: *Akust. Zh. (USSR)*, vol.29, no.1, p.121-2 (Jan.-Feb. 1983).
The parameters of underwater acoustic signals generated by explosive sources are calculated in stages. In the first stage, at small distances from the source, empirical expressions are used, taking into account the simultaneous action of nonlinearity, dissipation, and spherical spreading. In the second stage, at large distances from the source, the expressions of linear theory are used, taking into account primarily the real stratification of the ocean along with the absorption and scattering of sound waves by the rough surface and botttom of the ocean. The conditions for 'matching' these solutions and the dimensions of the 'nonlinear' zone have been determined. From the point of view of long-range sound propagation it is useful to introduce an equivalent source determined by the parameters of the explosion, permitting the calculations to be carried out strictly within the scope of linear theory. This procedure is discussed by the authors. (4 refs.)

104390 A simple dynamic stochastic model for major anomalies in surface water temperature in the oceans. S.G.Dobrovol'skii (Water Problems Inst., USSR).
Sov. Meteorol. & Hydrol. (USA), no.6, p.53-8 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.6, p.68-75 (1982).
The real outline of the coasts is used in examining the response of a two-dimensional thermodynamic model for the upper layer of the oceans to the excitation of stochastic fluctuations in wind speed and air temperature near the water. Numerical experiments are performed for 120 months of model time, and it is shown that the model spectra correspond to the spectra for the fluctuations in water temperature estimated from observations. The variances of the monthly anomalies in surface temperature agree with observations in the North Atlantic. Contributions to the fluctuations from various components of the heat balance are discussed. (13 refs.)

104391 Topographic waves on the continental slope at high latitudes. P.V.Bogorodskii, A.P.Nagurniy (Arctic & Antarctic Res. Inst., USSR).
Sov. Meteorol. & Hydrol. (USA), no.6, p.82-5 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.6, p.105-7 (1982).
A theoretical interpretation is given for the observed current fluctuations on the continental slope off Eastern Greenland. It is shown that there exists a bounded spectrum of stable topographic waves for the reverse wave propagating along the continental slope whose period is dependent on the latitude and on the period of the depths on the slope. At high latitudes, these oscillations may coincide with the half-daily tide, which may result in a special condition of large-scale change in the hydrological patterns in the region of the continental slope. (4 refs.)

104392 The kinetic energy in the oceans. V.N.Stepanov, E.I.Shul'man, K.I.Galerkin (Inst. of Oceanology, USSR).
Sov. Meteorol. & Hydrol. (USA), no.8, p.47-51 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.8, p.62-7 (1982).
Average water velocities have been used in determining kinetic energies in the Atlantic, Indian, and Pacific oceans, as well as in the World Ocean as a whole. Estimates have been made for the surface, intermediate, deep, and bottom waters. (5 refs.)

104393 Nature of the central water in the North Atlantic. A.A.Kutalo (Hydrometeorological Res. Center, USSR).
Sov. Meteorol. & Hydrol. (USA), no.9, p.51-4 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.9, p.69-73 (1982).
A mechanism of formation is presented for the North Atlantic central water without invoking hypotheses on water mixing or turbulent transfer of heat and salts. (7 refs.)

104394 Spatial and time structures of North Atlantic water-temperature anomalies. O.A.Vladimirov (Arctic & Antarctic Res. Inst., USSR).
Sov. Meteorol. & Hydrol. (USA), no.9, p.55-62 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.9, p.74-82 (1982).
Considers the spatial and time structures of water-temperature anomalies in the North Atlantic. The mean anomaly lifetime is determined along with the mean rate of change and the scales of the anomalies. Particular attention is given to the long-period trend in the variability. Trend calculation techniques are demonstrated. (7 refs.)

104395 Dynamic-stochastic calculations of seasonal geostrophic surface water circulation in the eastern tropical zone of the Indian Ocean. V.A.Sokolov, V.B.Kholmanov (State Oceanographic Inst., USSR).
Sov. Meteorol. & Hydrol. (USA), no.5, p.50-5 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.5, p.64-70 (1982).
Describes methods of calculation of currents and three-dimensional smoothing of density fields by means of which water circulation is determined. The initial data are the area-averaged one-degree squares of the seawater density field, bottom relief, and variances of these quantities. The calculation results are presented in the form of vector charts of summer and winter circulation of the ocean surface waters on which estimates of the accuracy of determining these vectors are indicated. A comparative analysis of the current pattern obtained with the results of earlier investigations is given. (9 refs.)

104396 Investigation of the surface-film temperature from results of marine observations. V.V.Shigaev, S.N.Druzhinin, V.L.Lebedev (Moscow State Univ., Moscow, USSR).
Sov. Meteorol. & Hydrol. (USA), no.5, p.60-4 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.5, p.75-9 (1982).
The results of temperature sounding of a thin water-air boundary layer obtained during the Comprehensive Eastern Expedition of the Geography Department of Moscow State University in the Sea of Japan in July-August 1980 are analyzed. For the first time for marine conditions empirical relations were obtained for the deviations of the radiation temperature of water caused by the film from the temperature of the subsurface water as a function of the total heat flux and wind speed at a height of 10 m. (13 refs.)

Green's function continuation for acoustic propagation in range-dependent environments	See Entry 100954
Operation of a horizontal line array in a shallow sea	See Entry 100959
Theory of sound propagation in a layered variable-density ocean	See Entry 100960
Excitation of groups of modes in a layered ocean	See Entry 100961
Moving load applied to a layer on an acoustic half-space	See Entry 101061
Simulation of water exchange and pollutant dispersal in the Gulf of Neva	See Entry 103743
Structure of ELF electromagnetic fields in the Arctic Ocean	See Entry 104189
Electromagnetic fields induced in the world's oceans and the spatial distribution of electrical conductivity functions	See Entry 104208
Surface expressions of bathymetry on SEASAT synthetic aperture radar images	See Entry 104332
Oyster (Crassostrea virginica) as indicator of heavy metal pollution in some lagoons of the Gulf of Mexico	See Entry 104402
Control of spurious oscillations in the salt water intrusion problem	See Entry 104416
Extreme distributions of Australian annual rainfall in relation to sea surface temperature	See Entry 104444
The persistence and the rhythm of anomalies of monthly mean atmospheric circulation in relation to ocean-atmospheric interactions	See Entry 104450
Regimes of validity for balanced models	See Entry 104459
Comparison of the extended boundary condition method and perturbation method for scattering from a sinusoidal sea surface	See Entry 104500
Climatic anomalies in the tropical Pacific Ocean and corn yields in the United States	See Entry 104529
Estimation of heat transfer between the sea and atmosphere in the intratropical convergence zone	See Entry 104535
Estimation of the temperature at the upper boundary of the clouds over the oceans	See Entry 104536
Dynamic velocity and tangential stress at the surface of the world ocean	See Entry 104541
Changes in global water exchange	See Entry 104557
Measuring the climate from space	See Entry 104569
Airborne dual laser excitation and mapping of phytoplankton photopigments in a Gulf Stream warm core ring	See Entry 104572
Multiple level finite element analysis and its applications to tidal current flow in Tokyo Bay	See Entry 104575
Abyssal temperature measurements with Aanderaa current meters	See Entry 104589
The simultaneous use of tracers for ocean circulation studies	See Entry 104590
Deep ocean temperature profile measurements	See Entry 104599
Multifrequency remote acoustic sensing of suspended materials in water	See Entry 104600
Application of lasers in oceanographic investigations (review)	See Entry 104604
Synthetic aperture radar observations of ocean and land	See Entry 104611
Detection of large-scale ocean circulation and tides	See Entry 104612
Observation of ocean waves	See Entry 104613

Observations of sea-surface temperature for climate research .... See Entry 104614

Satellite observations of ocean colour .... See Entry 104616

Application of microwave remote sensing to studies of sea ice .... See Entry 104617

Satellite observations of polar ice fields .... See Entry 104618

92.20 INTERDISCIPLINARY ASPECTS OF OCEANOGRAPHY

104397 Vertical concentration profiles of lead in the Central Pacific at 15°N and 20°S. A.R.Flegal (Moss Landing Marine Labs., Mos Landing, CA, USA), C.C.Patterson.
Earth & Planet. Sci. Lett. (Netherlands), vol.64, no.1, p.19-32 (July 1983).
Concentrations of lead were measured in a surface transect and at two vertical profile stations (15°N and 20°S) in the Central Pacific. The new transect of surface water concentrations of lead corroborates previous measurements, which decrease from 13 ng/kg at 30°N to 4 ng/kg at 17°S. This transect gradient is shown to overlie a similar geographic gradient of subsurface maximum concentrations of lead in the vertical profile stations. Lead concentrations at each of those locations exhibit maxima at 400 m, decreasing concentrations to 2500 m and approximately concentrations of 0.8-1.1 ng/kg below that depth. This relationship makes it possible to view the anthropogenic perturbations of the marine lead cycle on a global scale. (52 refs.)

104398 Uptake of excess CO_2 by an Outcrop-diffusion model of the ocean. U.Siegenthaler (Phys. Inst., Univ. of Bern, Bern, Switzerland).
J. Geophys. Res. (USA), vol.88, no.C6, p.3599-608 (20 April 1983). (Analysis and Interpretation of Atmospheric CO_2 Data, Bern, Switzerland, 14-18 Sept. 1981).
A carbon cycle model is presented in which direct ventilation of intermediate and deep ocean waters in high latitudes is taken into account. The $1^1/_2$-dimensional ocean model is an extension of a box diffusion including a deep-sea outcrop at the surface. If both are calibrated in a consistent way, the outcrop-diffusion ocean takes up more excess CO_2 than the box-diffusion ocean because the outcropping deep water is essentially virgin as to fossil CO_2. Calibration methods are compared. (36 refs.)

104399 Methyl halides in and over the eastern Pacific (40°N-32°S). H.B.Singh, L.J.Salas, R.E.Stiles (Atmospheric Sci. Center, SRI Internat., Menlo Park, CA, USA).
J. Geophys. Res. (USA), vol.88, no.C6, p.3684-90 (20 April 1983).
Methyl chloride methyl bromide and methyl iodide measurements in an over the eastern Pacific show mean air concentrations of 633 parts per trillion (ppt), 23 ppt, and 2 ppt, and mean surface seawater concentrations of 11.5 ng/l, 1.2 ng/l and 1.6 ng/l respectively. Long-term ambient measurements at a marine Pacific site (39°N) show an essentially unchanging background with some indication of high concentrations of methyl bromide and methyl iodide during summertime. The oceanic data indicate a mean surface supersaturation of 275%, 250%, and 340%, respectively, for these three methyl halides. Depth profiles show that methyl halides are most abundant in the top mixed layer of the ocean. The exchange of these natural occurring compounds across the air-sea interface was studied. (27 refs.)

104400 Dispersal by randomly varying currents. G.T.Csanady (Woods Hole Oceanographic Instn., Woods Hole, MA, USA).
J. Fluid Mech. (GB), vol.132, p.375-94 (July 1983).
The long-term oceanic dispersal of persistent contaminants is approached as a problem in turbulent diffusion, with tidal, wind-driven, and other variable currents relegated to turbulence. The mean advection velocity in this problem is typically small compared with the RMS fluctuation. Therefore, close to a continuous concentrated source, puffs of contaminant of all ages are present and have significant effects. Old puffs, i.e. those released a long time previously, give rise to a background concentration field. Young puffs affect the local contaminant concentration PDF according to the probability of their presence, quantified by the visitation frequency. (15 refs.)

104401 A two layer model for salinity stratification in the Eastern Irish Sea. F.Ahmad (Dept. of Appl. Phys., Univ. of Karachi, Karachi, Pakistan).
Nucleus (Pakistan), vol.18, no.4, p.21-7 (Oct.-Dec. 1981).
An appreciable amount of salinity stratification was observed at a number of stations in the Eastern Irish Sea during the summers of 1975 and 1976. It is shown that this stratification is mainly due to the spreading of the river water outward from the coast and the importance of excess of rainfall over evaporation is about 2% only. This spreading of the river water from the coast is explained on a two layer model. The river flow deduced from the model agrees quite well with that from the records in 1976 but is twice as large in 1975. (6 refs.)

104402 Oyster (Crassostrea virginica) as indicator of heavy metal pollution in some lagoons of the Gulf of Mexico. I.Rosas, A.Baez, R.Belmont (Dept. de Quimica de la Atmosfera, Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
Water, Air & Soil Pollut. (Netherlands), vol.20, no.2, p.127-35 (Aug. 1983).
The littoral lagoons of the Gulf of Mexico have been investigated to determine the amount of heavy metal pollution. Some lagoons have been contaminated by liquid wastes mainly originating from sugar refining and petrochemical industries, as well as petroleum exploitation and refining. Since mollusks concentrate trace elements, determination of levels of Cd, Cr, Hg, and Pb in oysters (Crassostrea virginica) were measured in some of these lagoons. The results have shown that the concentrations of these metals in lagoon water were below the recommended levels to protect aquatic life, and it was found that oysters are able to concentrate metals, mainly Cd and Pb above the maximum permissible limits for edible consumption. (30 refs.)

Analysis and Interpretation of Atmospheric CO_2 Data .... See Entry 98631

The computation and reporting of dissolved gas levels .... See Entry 103744

Penetration of photosynthetically-active solar radiation into Atlantic Ocean waters .... See Entry 104386

The global distribution of atmospheric carbon dioxide. I. Aspects of observations and modeling .... See Entry 104469

Some comments of the exchange of CO_2 across the air-sea interface .... See Entry 104472

Selected man-made halogenated chemicals in the air and oceanic environment . ... See Entry 104476

The recent ^{14}C record in the north-west Mediterranean atmosphere .... See Entry 104504

Airborne dual laser excitation and mapping of phytoplankton photopigments in a Gulf Stream warm core ring .... See Entry 104572

An apparatus for the measurement of radon in sea water ..... See Entry 104609

92.40 HYDROLOGY AND GLACIOLOGY

104403 Mathematical simulation of stable and equilibrium river bed profiles and slopes. A.M.Trofimov (Kazan Univ., Kazan, USSR), V.M.Moskovkin.
Earth Surf. Processes & Landforms (GB), vol.8, no.4, p.383-90 (July-Aug. 1983).
Two approaches to the simulation of stable and equilibrium longitudinal profiles and slopes are considered. The first one deals with a solution to the equation of solid matter (sediment) continuity in the equilibrium case and the second approach deals with the application of variational principles. The approaches considered and results obtained can be used in hydroengineering construction for designing stable and equilibrium longitudinal profiles of water streams and slopes. (20 refs.)

104404 Results of investigations of extreme water supply from a snow cover and liquid precipitation in the GDR lowlands. II. H.Matthaus (Forschungsinst. fur Hydrometeorologie, Berlin, Germany).
Z. Meteorol. (Germany), vol.33, no.2, p.96-8 (1983). In German.
For pt.I see ibid., vol.32, no.4, p.241-6 (1982). Extreme 3-day totals of water supply from snow cover and from liquid precipitation have been obtained for the lowlands. In extreme situations the maximum may well exceed 110 mm. (3 refs.)

104405 Methodology and results of the calculation of average annual variations of the equilibrium temperature and of the natural temperature of water surfaces in stagnant-water bodies in the GDR. W.Neubert (Forschungsinst. fur Hydrometeorologie, Berlin, Germany).
Z. Meteorol. (Germany), vol.33, no.2, p.99-110 (1983). In German.
Presents a procedure for the calculation of the long-term average annual variation of the temperature of any type of water surface observed from April up to and including November. The deep Stechlinsee and the shallow Goldberger See are studied. (9 refs.)

104406 Drainage analysis in Taiwan and its tectonic implications. Quocheng Sung (Nat. Central Univ., Chungli, Taiwan).
Bull. Geophys. (Taiwan), no.24, p.41-56 (March 1983).
Previous studies on the lineament analysis of remotely sensed images are reviewed. The author suggests that drainage analysis be more objective to extract structural information. Drainage patterns of the two geothermal areas, namely Lushan and Chinhsui-Tutsang, are studied using orientation statistics. Different patterns are recognized in these areas and interpreted as the consequence of different tectonic histories. (20 refs.)

104407 Snow particle morphology in the seasonal snow cover. S.C.Colbeck (US Army Cold Regions Res. & Engng. Lab., Hanover, NH, USA).
Bull. Am. Meteorol. Soc. (USA), vol.64, no.6, p.602-9 (June 1983).
Snow precipitation degenerates rapidly once it reaches the ground. A wide variety of particle types develop in seasonal snow covers, thus leading to a wide range of snow properties. The most common varieties of particles are shown. The physical processes responsible for the growth and development of these particles are described in general terms, although these processes are not understood as well as the processes of crystal growth in the atmosphere. The heat and mass flows associated with the development of these crystals in the snow cover are complicated because of snow's complex geometry. (14 refs.)

104408 Studies on the rainfall runoff mechanism on hillside. II. T.Mishima, A.Kanamaru.
Bull. Fac. Eng. Hiroshima Univ. (Japan), vol.30, no.2, p.103-7 (Nov. 1982). In Japanese.
The paper presents the results of experimental study on the water runoff characteristics from the surface-layer models of hillside. As the result of investigating many data, the existence of the flow moving under the forces of gravity and capillarity and the excellent effect of capillary saturated part on the water holding capacity which take part in water runoff are confirmed, and it can be considered that the mean coefficient of permeability in the zone is constant—and so Darcy's Law is applicable to the zone—in which the depth of flow is composed of both capillary saturated part and gravitational part. (5 refs.)

104409 An agrometeorological method for estimating the infiltration depth and soaking rain in spring for the North China Plain. Tao Zuwen, Pei Buxiang (Acad. of Meteorological Sci., Nat. Meteorological Bureau, China).
Acta Meteorol. Sin. (China), vol.41, no.1, p.97-105 (Feb. 1983). In Chinese.
Using the concept of infiltration of gravity moisture, a model for estimating infiltration depth is presented, using the rainfall and the soil moisture before rain. An index for estimating the amount of soaking rain is presented. 'Soaking' means enough rainfall for adequate growth of the major crop concerned and an infiltration depth to provide adequate soil moisture. Results of calculations are tested with actual determinations. (8 refs.)

104410 Studies on accumulation-ablation processes and distribution of snow in mountain regions, Hokkaido. T.Yamada (Inst. of Low Temperature Sci., Hokkaido Univ., Sapporo, Japan).
Contrib. Inst. Low Temp. Sci. Ser. A (Japan), no.31, p.1-33 (1982).
Orographic characteristics of solid precipitation and accumulation-ablation process of snow in the mountain regions are studied based on the areal distributions of newly fallen snow and of deposited snow in typical mountain regions in Hokkaido throughout accumulation and ablation seasons for several winters. Some simple general rules are found for the distribution of snowfall and the increase and decrease of deposited snow in mountain slopes. The rules allow one to estimate the snow amount at an arbitrary altitude and time from the data of solid precipitation and temperature at the Piedmont Observatory together with the data of only one snow survey at an altitude. (27 refs.)

104411 Experimental studies of coupled heat and moisture transfer in soils during freezing. M.Fukuda (Inst. of Low Temperature Sci., Hokkaido Univ., Sapporo, Japan).
Contrib. Inst. Low Temp. Sci. Ser. A (Japan), no.31, p.35-91 (1982).
Attempts to verify the mechanism and model of heat and moisture transfer in a soil during freezing. The author conducted verificatory experiments to show moisture flows both in the frozen and the unfrozen layer of a freezing soil and made a mathematical analysis of the model using the computer simulation method. (26 refs.)

104412 Gas exchange in the Pee Dee River based on ^{222}Rn evasion. R.J.Elsinger, W.S.Moore (Geology Dept., Univ. of South Carolina, Columbia, SC, USA).
Geophys. Res. Lett. (USA), vol.10, no.6, p.443-6 (June 1983).
Excess ^{222}Rn concentrations decrease downstream in the fresh water section of the Pee Dee River. Groundwater is the primary source of the excess ^{222}Rn to the river. Using the radon concentration gradients determined during four sampling periods, gas exchange rates based on the stagnant film model are calculated. Stagnant film thicknesses range from 19 μm to 48 μm and mass transfer coefficients range from 2.1 m/d to 4.1 m/d. (14 refs.)

104413 Noble-gas evidence for geothermal activity in a karstic terrain: Rocky Mountains, Canada. E.Mazor (Geo-isotope Group, Weizmann Inst. of Sci., Rehovot, Israel), R.O.Van Everdingen, H.R.Krouse.
Geochim. & Cosmochim. Acta (GB), vol.47, no.6, p.1111-15 (June 1983).
Geothermally heated fluids are identified as a component in warm (up to 54°C) springs in the southern Canadian Rocky Mountains. High concentrations of radiogenic He and atmospheric Ne, Ar, Ke and Xe in the gases at the Fairmont Hot Spring, assign the latter to be a 'drowned' fumarole, fed by geothermal steam. Up to 75% depletions in the atmospheric noble gases in several warm springs indicate contributions of residual geothermal water. (12 refs.)

104414 An axisymmetric model for the charging of a liquid-dominated geothermal reservoir. J.Troncoso, D.R.Kassoy (Dept. of Mech. Engng., Univ. of Colorado, Boulder, CO, USA).
Int. J. Heat & Mass Transfer (GB), vol.26, no.9, p.1389-401 (Sept. 1983).
Heat and mass transfer processes occurring in a model of an axisymmetric liquid-dominated geothermal reservoir are described. The system is composed of a vertical cylindrical region of fractured rock surrounded by a much larger annular aquifer. Hot liquid water, convected into and up the central cylindrical zone is forced into the neighbouring aquifer. Heat is lost to the cold surface as the liquid flows horizontally (radially) in the aquifer. A combination of boundary layer techniques and numerical methods are used to obtain solutions for velocity, temperature and pressure distributions in the system and for the heat flux emanating from the surface of the cap rock. The deep portion of the axisymmetric aquifer is found to be cooled faster than the equivalent part of a planar model. (28 refs.)

104415 On uranium concentration in water. B.C.Talukdar, P.K.Chowdhary, K.M.Pathak (Gauhati Univ., Gauhati, India).
Indian J. Pure & Appl. Phys., vol.21, no.6, p.381-2 (June 1983).
Uranium concentration in water collected from several parts of Assam, India are determined in clear and stirred conditions by the fission track method. In the clear condition U-concentrations are found to vary from $(0.08 \pm .002)$ to $(5.32 \pm .02)$ μg/1. It is observed that the U-concentration increases in the stirred condition. The results are compared with the global background. (5 refs.)

104416 Control of spurious oscillations in the salt water intrusion problem. R.S.Wikramaratna (Inst. of Hydrology, Wallingford, England), W.L.Wood.
Int. J. Numer. Methods Eng. (GB), vol.19, no.8, p.1243-51 (Aug. 1983).
Shows that the 'streamline upwinding' proposed by Hughes and Brooks (1979) is particularly simple to implement with the coupled nonlinear equations of the problem of salt water intrusion in a coastal aquifer. Because the mechanical dispersion effect is far larger than the molecular diffusion, the notorious spurious oscillations can be controlled by limiting the ratio of grid size to the streamline mixing length. The method is demonstrated on an example of a typical aquifer by giving the diagnostic variation of concentration and various salt profiles for different values of the key parameter. (13 refs.)

104417 Bedrock fracture parameters from the interpretation of well tides. D.R.Bower (Earth Physics Branch, Dept. of Energy, Mines & Resources, Ottawa, Ontario, Canada).
J. Geophys. Res. (USA), vol.88, no.B6, p.5025-35 (10 June 1983).
Presents a theory to account for the main features of the tidal response of an isolated plane fracture as revealed by the water level in an intersecting open borehole. According to the theory the diurnal and semidiurnal tidal constituents (both amplitude and phase) of water level variations depend on the fracture aperture, the orientation (dip and strike) and the radial extent of the fracture, and the compressibility of the asperites. The theory is applied to water level observations made in six open boreholes located in crystalline rock at a test site at the Chalk River Nuclear Laboratories, Atomic Energy of Canada Limited, in Chalk River, Ontario, Canada. (31 refs.)

104418 Convection in an aquifer above a layer of heated impermeable bedrock. R.McKibbin (Dept. of Theoretical & Appl. Mech., Univ. of Auckland, Auckland, New Zealand).
N.Z. J. Sci. (New Zealand), vol.26, no.1, p.49-64 (1983).
It has been proposed (Donaldson 1962) that a convective geothermal aquifer might overlie a layer of impermeable bedrock which conducts heat from the magmatic source below. Using a perturbation analysis similar to that applied to general materially layered porous media by McKibbin and O'Sullivan (1980, 1981) it is found that the presence of such a layer of bedrock markedly affects the convection patterns and heat flow compared with those which occur when the heat source is in direct contact with the convective system. Results show that the overall temperature difference between the heat source and the top surface required for instability is greater, while the heat flux is reduced for both impermeable and constant pressure upper boundary conditions. (4 refs.)

104419 A runoff model for the influx section of a river. N.P.Chernova (Hydrometeorological Res. Center, USSR).
Sov. Meteorol. & Hydrol. (USA), no.6, p.59-63 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.6, p.76-81 (1982).
A model is considered for the transformation of water flow rates in part of a river on the basis of a Duhamel integral, which includes the transformation of the distributed lateral influx or efflux. Results of numerical experiments are given. (5 refs.)

104420 Numerical simulation of currents in Lake Sevan. M.A.Akopyan, Yu.L.Demin (Inst. of Oceanology, USSR).
Sov. Meteorol. & Hydrol. (USA), no.8, p.52-7 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.8, p.68-74 (1982).
A nonlinear diagnostic model has been used in a series of numerical experiments on the currents in Lake Sevan. The roles of various hydrodynamic factors have been examined. Nonlinear effects are important in the water dynamics. (7 refs.)

104421 Influence of noise on estimation of head and transmissivity in two-dimensional groundwater flow field. T.Ueda, F.Hirano, K.Jinno.
Technol. Rep. Kyushu Univ. (Japan), vol.56, no.2, p.101-10 (March 1983). In Japanese.
The authors discuss the influence of the system noise and measuring noise in the estimation of the spatial distribution of aquifer transmissivity and groundwater head. They apply the Kalman filtering theory to an equation of motion of a two-dimensional groundwater flow and to an autoregressive model that describes the spatial structure of the transmissivity. Through the numerical simulations they obtain that the system noise and measuring noise play important roles in the rapid convergence of the estimates of the head and the transmissivity, and in the mutual relations among the observed, estimated, and true values. (4 refs.)

104422 Computation of sedimentation basin behavior. B.E.Larock (Civil Engng. Dept., Univ. of California, Davis, CA, USA), W.K.C.Chun, D.R.Schamber.
Water Res. (GB), vol.17, no.8, p.861-7 (1983).
Parametric numerical studies were conducted to investigate quantitatively the hydraulic performance of typical sedimentation basins. These studies used a mathematical model of basin hydrodynamics, which consists of a continuity equation, two Reynolds equations a two-equation turbulence closure model and a particle transport equation. The resulting distributions of particle concentration throughout the basin, and the basin particle removal efficiencies were computed as a function of particle fall velocity and the amount of particle deposition on the basin floor. A method for extending the model to an investigation of hindered settling is presented. (23 refs.)

Niagara River-Lake Ontario Pollution Problem	See Entry 98615
An experimental evaluation of the Neyman-Pearson detector	See Entry 100991
Seepage and heat flow in soil freezing	See Entry 101330
Occurrence of uranium in drinking water in the US	See Entry 103741
The computation and reporting of dissolved gas levels	See Entry 103744
VLF survey of the weathered layer in southern India	See Entry 104184
The East Pacific Rise and the thermal model	See Entry 104288
Deep crustal geothermal measurements, hole 504B, Costa Rica Rift	See Entry 104291
Heat and mass transfer in a fault zone-controlled geothermal reservoir: numerical results	See Entry 104292
A model for the high-frequency electrical response of wet rocks	See Entry 104340
Air and soil temperatures during an intense freeze in Shropshire	See Entry 104364
A probability analysis of precipitation surplus or deficit	See Entry 104443
Isotope geochemistry of the Amazon basin: a reconnaissance	See Entry 104478
Continuous measurement of radon emanations from soil and groundwaters in southern France (Alpes Maritimes). Preliminary results	See Entry 104576
The relationship of surface γ-ray intensity with groundwater in South Spring area, Chongqing	See Entry 104582
Satellite observations of polar ice fields	See Entry 104618
Calculation of maximum discharges in a multiflood regime	See Entry 104627

92.60 METEOROLOGY

(see also 43.28 Aeroacoustics and atmospheric sound)

104423 Temporal variations in acid precipitation over New York State—what the 1965-1979 USGS data reveal. R.A.Bilonick (Consolidation Coal Co., Pittsburgh, PA, USA), D.G.Nichols.
Atmos. Environ. (GB), vol.17, no.6, p.1063-72 (1983).
During the period from 1965 to 1979, the USGS collected rainfall samples throughout New York State, pH, sulfate, nitrate and calcium levels were measured, among other species. The statistical nature of the variation of these quantities with time was examined. The results indicate that the long-term mean levels of hydrogen, sulfate, nitrate and calcium ion in the bulk (wet plus dry) precipitation samples were essentially constant. Use of the Box-Jenkins method was appropriate because samples that were collected close together in time were clearly more alike than those far apart, indicating autocorrelation. An analysis that fails to take this dependency into account could lead to incorrect conclusions. (10 refs.)

104424 Acid clouds and precipitation in Eastern Colorado. C.T.Nagamoto, F.Parungo, R.Reinking, R.Pueschel, T.Gerish (Office of Weather Res. & Modification, ERL, NOAA, Boulder, CO, USA).
Atmos. Environ. (GB), vol.17, no.6, p.1073-82 (1983).
Rain and snow samples were collected at the eastern foothills of the Rocky Mountains and analysed for chemical composition. Many precipitation samples had pH values considerably more acidic than the 5.6 value of pure water containing only an equilibrium amount of atmospheric CO_2. Clear and considerable dependencies of the acidity on seasonal synoptic scale weather patterns are demonstrated. Cloud water samples, collected by aircraft over eastern Colorado, also showed low pH values. The acidity of clouds was greatest near the city of Denver. (10 refs.)

104425 A regional scale modelling study of the sulfur oxides with a comparison to ambient and wet deposition monitoring data. L.I.Kleinman (Dept. of Energy & Environment, Brookhaven Nat. Lab., Upton, NY, USA).
Atmos. Environ. (GB), vol.17, no.6, p.1107-21 (1983).
Monthly average SO_2 and SO_4^{2-} concentrations and wet deposition of total sulfur have been calculated from the AIRSOX (Atmospheric Impact of Residual Sulfur Oxides) long-range transport model and compared with monitoring data from the SURE (Sulfate Regional Experiment) air quality and MAP3S (Multistate Atmospheric Power Production Pollution Study) precipitation chemistry networks. Model output has also been used to determine the rate constants, distance scales and budgets describing the behaviour of the sulfur oxides in the eastern US during a summer month. Although the accuracy of these later quantities cannot be directly determined via a comparison with monitoring data, the comparison of monthly average model predictions with observations provides a check on the consistency of the SO_x time and distance scales. (26 refs.)

104426 The nocturnal surface inversion height in the Po Valley. C.Tomasi (Istituto Fisbat, CNR, Bologna, Italy).
Atmos. Environ. (GB), vol.17, no.6, p.1123-9 (1983).
Measurements of nocturnal surface inversion height are obtained from radiosonde data taken from a station in the Po Valley on days characterised by anticyclonic conditions, cloudless skies and calm winds at ground level. These measurements are examined in terms of the evolution models for the nocturnal inversion height, as proposed by Anfossi et al. (1974), Yamada (1979), and Nieuwstadt (1980). The results show that Yamada's model can be reliably used in both urban and rural areas, when the surface temperature rate ranges between around -1.3 and $-0.6°C\ h^{-1}$. Nieuwstadt's model, as defined for no turbulent heat flux, is found to produce realistic evolution patterns of the inversion height, very similar to those observed by Anfossi et al. (1974) in rural areas, provided that values of parameter α ranging between 1.5 and 2.5 are used. (8 refs.)

104427 Past and present sulphur pollution in the southern Pennines. P.Ferguson, J.A.Lee (Dept. of Botany, Univ. of Manchester, Manchester, England).
Atmos. Environ. (GB), vol.17, no.6, p.1131-7 (1983).
The southern Pennines are surrounded by towns which were the early centres of the Industrial Revolution, and so are likely to have been exposed to atmospheric pollution for at least 200 years, a fact which may have been responsible for major changes in the vegetation of southern Pennine blanket bogs. Published concentrations of sulphate and hydrogen ions in rain and sulphur dioxide in air in the region during the last century are reviewed, and are compared with an investigation of these pollutants, together with bisulphite concentrations in precipitation at a site in the southern Pennines and Manchester. The results reveal that concentrations of sulphur pollutants in the region have fallen during the last century, but suggest that the acidity of rainwater may be increasing. (30 refs.)

104428 On baroclinic instability in the case of vanishing viscosity. W.Eckhaus, H.P.Penning, F.V.van der Wel (Math. Inst., Utrecht, Netherlands).
Arch. Mech. (Poland), vol.34, no.3, p.243-52 (1982).
In the two-layer model, describing baroclinic instability, viscosity plays a subtle role. The marginal stability curves for the nonviscous model and the one for the viscous model with viscosity tending to zero, do not coincide. An explanation in terms of polynomials with complex coefficients is given and the growth-rate for decreasing viscosity is calculated. (11 refs.)

104429 Millimeter wavelength groundbased observations of two minor constituents of the atmosphere. J.de La Noe, A.Baudyr, N.Monnanteuil, J.-M.Colmont, P.Dierich (Obs. de Bordeaux, Floirac, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.16, p.1243-8 (2 May 1983). In French.
A millimeter wave telescope located at the Bordeaux Observatory has been used to carry out observations of the 115 GHz line of mesospheric CO and of the 110 GHz line of stratospheric O_3. Optical thickness and column density of these constituents are reported. For the ozone molecule, laboratory collisional broadening measurements associated with model fitting computations allows derivation of the O_3 vertical density profile from the observations. (13 refs.)

104430 The effects of vertical motions induced by orography and of ground friction upon the development and the movement of baroclinic waves in numerical models of different vertical resolution. U.Damrath, A.Meyer (Zentrale Wetterdienststelle, Potsdam, Germany).
Z. Meteorol. (Germany), vol.33, no.2, p.72-91 (1983). In German.
Orographically induced vertical motions and surface friction are studied in a 2-level model, the model of Bengtsson and a 5-parameter model. Baroclinic unstable waves are expressed in terms of the potential vorticity equation. Differences between the models and possibilities of reducing forecast errors are considered. (34 refs.)

104431 Evaluation of the spectral analysis of hourly air temperature values in Banjul in 1973. N.Michelchen (Inst. fur Meereskunde, Akad. der Wissenschaften, Rostock, Germany).
Z. Meteorol. (Germany), vol.33, no.2, p.92-5 (1983). In German.
The power spectra of hourly air-temperature values in Banjul (Republic of The Gambia) for 1973 reveal mesoscale variations. The seasonal division of time series shows the dominance of periods $T \approx 14$-15 d for the central dry season (January-March) and $T \approx 4$-5 d for the rainy season (July-September). The monthly amplitude maximum and minimum of diurnal and semi-diurnal waves follow the solar altitude with a delay of 1-2 month, which seems to be an effect of land-sea breeze. (7 refs.)

104432 A study of the lateral boundary conditions in a numerical storm model. Ching-Sen Chen, Shi-Ming Lin (Nat. Central Univ., Chungli, Taiwan).
Bull. Geophys. (Taiwan), no.24, p.57-76 (March 1983). In Chinese.
Discusses four different methods dealing with horizontal wind on the lateral boundary in a limited domain by using a two-dimensional numerical storm model. The methods developed by Orlanski (1976), Klemp and Wilhelmson (1978), Chen (1980) and Miller and Thorpe (1981) have been expanded into fourteen schemes. From a storm simulation a modified Chen model is found to give best results. The influence of a fixed initial temperature on the lateral boundary is also discussed. (9 refs.)

104433 Budget equations for the energetics of mean, transient and quasi-stationary motions. Long-Nan Chang (Nat. Central Univ., Chungli, Taiwan).
Bull. Geophys. (Taiwan), no.24, p.77-92 (March 1983). In Chinese.
A set of budget equations governing the energetics of time averaged zonal mean, transient and quasi-stationary motions is derived through the use of a moving average procedure. The system involves three available potential energy equations and three kinetic energy equations representing the energy budget . The system derived provides a simple method for the diagnostic study of atmospheric motion in blocking systems. (7 refs.)

104434 Corrections and additions to verification study of performance of 1976 University of Wisconsin model. R.P.Harnack, W.R.Sammler (Dept. of Meteorology & Phys. Oceanography, Rutgers-The State Univ. of New Jersey, New Brunswick, NJ, USA).
Bull. Am. Meteorol. Soc. (USA), vol.64, no.6, p.611-13 (June 1983).
Revised and complete verification statistics for mainland United States long-range forecasts made for the period 1976-80 by the 1976 version of the University of Wisconsin model are presented. Corrections to earlier published values are given, as well as skill scores obtained using a much more complete set of stations for which forecasts are made. (2 refs.)

104435 Recurrence relations for the truncation error coefficients for the extended Stokes function. M.K.Paul (Earth Phys. Branch, Dept. of Energy, Mines & Resources, Ottawa, Canada).
Bull. Geod. (France), vol.57, no.2, p.152-66 (1983).
Recurrence relations for the truncation error coefficients of the extended Stokes function required in the computation of gravimetric geoidal heights at any elevation above the Earth's surface have been derived. The computation of these coefficients generally involves a small fixed number of terms except at altitudes of 2700 km or more when one of the terms involved has to be computed from an infinite series. To confirm the accuracy of the coefficients a verification formula has been devised which uses a series expansion of a piece-wise continuous function such that it is equal to the extended Stokes function over a given range but vanishes elsewhere. (7 refs.)

104436 Correlation of optical propagation near the sea surface with bulk meteorological measurements. F.Replogle,Jr. (Submarine Electromagnetic Systems Dept., Naval Underwater Systems Center, New London, CT, USA).
Boundary-Layer Meteorol. (Netherlands), vol.25, no.4, p.327-43 (April 1983).
Observations of optical propagation and bulk meteorological measurements were made from a tower located off the entrance to Narragansett Bay, RI. Measurements of air and sea temperatures, wind speed, and dew point are used to derive mean values of C_n^2. Then an optical propagation formulation employing C_n^2 (height) are used to predict mean values of the spreading of a narrow target line at ranges of up to 5 km. Predicted line widths are compared with measured ones. Ratios are formed of C_n^2 values obtained from line-width measurements to corresponding values derived from bulk meteorological measurements under unstable atmospheric conditions. (7 refs.)

104437 Turbulence structure in convective boundary layers and implications for diffusion. S.J.Caughey (Meteorological Office, Belfast, N Ireland), M.Kitchen, J.R.Leighton.
Boundary-Layer Meteorol. (Netherlands), vol.25, no.4, p.345-52 (April 1983).
Probability density distributions of vertical velocity fluctuations from the daytime convective boundary layer and from convection within a nighttime stratocumulus-capped boundary layer are described and contrasted. Some implications for the diffusion of released, neutrally buoyant, material are identified and discussed. (15 refs.)

104438 Wind fluctuations in stable air at the Boulder Tower. Z.Leyi, H.A.Panofsky (Dept. of Meteorology, Pennsylvania State Univ., University Park, PA, USA).
Boundary-Layer Meteorol. (Netherlands), vol.25, no.4, p.353-62 (April 1983).
Spectra and variances of velocity components and pressure in stable air are analyzed at the 300 m tower of the BAO. Spectra in very stable air in light winds usually contain low-frequency fluctuations of large magnitude, and high-frequency fluctuations with considerably less energy, separated by a gap. The wave-length of the gap follows Monin-Obukhov scaling. The high-frequency portion of the spectra has characteristics of turbulence. The low-frequency energy is almost certainly due to gravity waves. Variances of surface pressure changes appear to be positively correlated with variances of vertical velocity above 100 m, and also to some extent, with horizontal velocity components at all levels. (11 refs.)

104439 A barotropic planetary boundary layer. D.Yordanov (Geophys. Inst., Acad. of Sci., Sofia, Bulgaria), D.Syrakov, G.Djolov.
Boundary-Layer Meteorol. (Netherlands), vol.25, no.4, p.363-73 (April 1983).
The temperature and wind profiles in the planetary boundary layer (PBL) are investigated. Assuming stationary and homogeneous conditions, the turbulent state in the PBL is uniquely determined by the external Rossby number and the stratification parameters. A simple two-layer barotropic model is proposed. It consists of a surface and overlying Ekman-type layer. The system of dynamic and heat transfer equations is closed using K theory. Analytical solutions for the wind and temperature profiles in the PBL are obtained. The internal PBL characteristics necessary for the calculation are presented in terms of the external parameters. (15 refs.)

104440 Numerical experiments with a one-dimensional higher order turbulence model: simulation of the Wangara Day 33 case. C.Chen, W.R.Cotton (Dept. of Atmospheric Sci., Colorado State Univ., Fort Collins, CO, USA).
Boundary-Layer Meteorol. (Netherlands), vol.25, no.4, p.375-404 (April 1983).
A one-dimensional stratocumulus model is developed and incorporated into a cloud/mesoscale model to simulate the evolution of the marine stratocumulus-capped mixed layer. The authors describe the formulation of the higher-order turbulence model. The second-order moments of this model are partially diagnosed. In order to close the system, the parameterization for the third-order moments given by Zeman and Lumley (1976) is adopted and is generalized to include total water and cloud water. A new scheme to parameterize the skewness terms is proposed in order to satisfy the enforced realizability. Those skewness terms are used to close the third-order moments. Experiments are carried out to test the turbulence model by using the Wangara Day 33 data, which represents a 'dry' case study. (20 refs.)

104441 Roughness length of sea, sand, and snow. A.C.Chamberlain (AERE, Harwell, England).
Boundary-Layer Meteorol. (Netherlands), vol.25, no.4, p.405-9 (April 1983).
Profiles of wind speed in driving sand and snow show roughness length increasing as the square of the friction velocity, in accordance with Charnock's (1955) relation for the roughness length of the sea. (12 refs.)

104442 The use of average annual rainfall to derive estimates of orographic enhancement of frontal rain over England and Wales for different wind directions. F.F.Hill (Met Office Radar Res. Lab., Royal Signals & Radar Establ., Great Malvern, England).
J. Climatol. (GB), vol.3, no.2, p.113-29 (April-June 1983).
A field of average annual enhancement, defined as the mean rainfall rate at inland sites minus the mean rate over the coast, has been derived for England and Wales. Past cases of frontal rain associated with low-level winds from the SW quadrant were analysed so as to determine the typical distribution and intensity of orographic enhancement. It is shown that these results are sensitive to wind speed and, in particular, direction. (8 refs.)

104443 A probability analysis of precipitation surplus or deficit. H.S.Takhar, D.J.Cook (Simon Engng. Labs., Univ. of Manchester, Manchester, England).
J. Climatol. (GB), vol.3, no.2, p.131-42 (April-June 1983).
The surplus or deficit of precipitation is of fundamental importance in hydrology. An analysis is presented which provides for the prediction of surplus or deficit conditions as far as six months ahead. Data from Yorkshire, together with thirteen years' data from a station in Nottinghamshire, are used statistically to analyse problems in water supply, irrigation and drainage. This analysis is based upon a technique developed by Stol (1958) in which differences between evaporation and precipitation are analysed over different periods of time. (11 refs.)

104444 Extreme distributions of Australian annual rainfall in relation to sea surface temperature. N.A.Streten (Australian Numerical Meteorology Res. Centre, Melbourne, Victoria, Australia).
J. Climatol. (GB), vol.3, no.2, p.143-53 (April-June 1983).
Sea surface temperature (SST) measurements from 1950 to 1969 are analysed for an extensive region of the Southern Hemisphere for six years of very high and very low areal extent of above normal Australian continental rainfall. Years of extensive drought are found to be associated with a predominantly low SST persisting throughout the year over the eastern Indian Ocean and the south-west Pacific in the Australasian region particularly at low latitudes, very wet years over the continent are associated with a persistently warm SST extending from the equator to mid latitudes in the same region. (13 refs.)

104445 Spatial and temporal aspects of the surface wind regime on the Canterbury Plains, New Zealand. I.G.McKendry (Univ. of Canterbury, Christchurch, New Zealand).
J. Climatol. (GB), vol.3, no.2, p.155-66 (April-June 1983).
Seasonal and diurnal patterns produced by the interaction of synoptic scale winds and two thermo-topographic systems, the land/sea breeze and mountain/plain winds, are investigated in a spatial context. Together with gradient winds and the shallow 'lee trough' north-easterlies these local winds create a wind regime composed of several distinctive regional elements, the boundaries

of which are transitional in nature and dependent on time of day and year and the strength of synoptic influences. The sea breeze shows maximum frequency by day in summer in coastal areas whereas katabatic flows are most frequent by night in winter adjacent to the Alps. (22 refs.)

104446 Secular variations of surface temperature and precipitation patterns over the Great Lakes region. W.A.R.Brinkmann (Dept. of Geography, Univ. of Wisconsin, Madison, WI, USA).
J. Climatol. (GB), vol.3, no.2, p.167-77 (April-June 1983).
Spatial patterns of surface temperature and precipitation variability over the Great Lakes region and their changes during the past 78 years are examined using eigenvector analysis. The results show that the region is homogeneous in terms of temperature variations. The most important regional temperature trends have been very similar to the trends in the average annual temperature for the Northern Hemisphere. In the case of precipitation, however, an important boundary divides the region into a north-western and south-eastern portion. (26 refs.)

104447 Estimation of the daily global solar irradiation at Corvallis, Oregon (USA) from the hours of bright sunshine, the daily temperature range and relative humidity. C.R.Nagaraja Rao, W.A.Bradley (Dept. of Atmospheric Sci., Oregon State Univ., Corvallis, OR, USA).
J. Climatol. (GB), vol.3, no.2, p.179-85 (April-June 1983).
Simple empirical relationships based on the hours of bright sunshine, the daily temperature range and relative humidity have been developed to estimate the daily global solar irradiation at Corvallis, Oregon. It is observed that the greater part of the variability in the daily solar radiation income at the surface is explained by changes in the available solar energy at the top of the atmosphere in the course of the year. The relationship based on the hours of bright sunshine yields estimates of the daily global solar irradiation which compare favorably with the measured values (coefficient of determination >0.90). (19 refs.)

104448 The relative importance of the initial variables for numerical rain storm prediction. Chen Shoujun, Xie An, Xiao Wenjun (Dept. of Geophys., Peking Univ., Peking, China).
Acta Meteorol. Sin. (China), vol.41, no.1, p.6-13 (Feb. 1983). In Chinese.
Some experiments were made to determine the relative importance of the meteorological variables in the initial conditions for numerical rain storm prediction. A time integration is made with a 5 L-FLM, using a complete set of realistic initial conditions. This is a 'control run'. Next, the integration is repeated, but one of the initial variables is modified. Both results are compared. If the solutions are found to be essentially the same, it may be concluded that the variable is redundant. Three variables: moisture, boundary wind and surface pressure are tested. (9 refs.)

104449 On the general circulation and barotropic energetics at the 500 mb level during January 1977. Qiu Yong yen, Zhu Ya fen (Dept. of Geophys., Peking Univ., Peking, China).
Acta Meteorol. Sin. (China), vol.41, no.1, p.14-23 (Feb. 1983). In Chinese.
January 1977 was unusually cold throughout the mid-latitude continental region in the Northern Hemisphere. By using 500 mb level daily data for January, the general circulation and barotropic energetics are investigated. The nonlinear wave-zonal and wave-wave exchanges of kinetic energy for January are measured over the latitude belt 17.5°N to 77.5°N. The monthly averaged values of these quantities are compared with the normal ones. (12 refs.)

104450 The persistence and the rhythm of anomalies of monthly mean atmospheric circulation in relation to ocean-atmospheric interactions. Wang Shao wu, Zhao Zong ci, Chen Zhen hua (Dept. of Geophys., Peking Univ., Peking, China).
Acta Meteorol. Sin. (China), vol.41, no.1, p.33-42 (Feb. 1983). In Chinese.
The formation of anomalies of monthly mean atmospheric circulation is examined in relation to the interactions between the atmosphere and the sea-surface temperature. In the current regions, the ocean as a heat source exerts a deep influence on the formation of the anomalies of atmospheric circulation. But in the non-current regions the thermal regimes of the oceans are controlled by the atmospheric circulation. The persistence of anomalies in the atmospheric circulation is investigated. The investigation of natural analogies shows that when the circulation or sea surface temperature anomalies for two months have similar characteristics, then the following months also have some similarity, but the similarity does not decrease monotonously with increasing time interval. (26 refs.)

104451 Structure of the mean circulation and the heat budget in July over Asia. Li Wei liang, Chen Long xun, Jin Zu hui (Inst. of Atmospheric Phys., Acad. Sinica, Beijing, China).
Acta Meteorol. Sin. (China), vol.41, no.1, p.43-55 (Feb. 1983). In Chinese.
The vertical velocity and the heat budget Q/Cp in July are evaluated. The aerological data in China is averaged for 1961-1974. For the calculation of the atmospheric heat source Q/Cp, a diagnostic equation is designed. The results are discussed. (12 refs.)

104452 A random solution of a model for long-range forecasts. Li Tianshang (Song Hua Jian Meteorological Service, China).
Acta Meteorol. Sin. (China), vol.41, no.1, p.56-68 (Feb. 1983). In Chinese.
The earth-atmosphere system is approximately assumed to be one which has a linear-responsive system of random interference to solar radiation. The author obtains a random solution and proves that the long-range state of atmospheric motion is dependent on the influence of innumerable random factors. (5 refs.)

104453 Numerical simulation of rain and seeding processes in warm layer clouds. Hu Zhijin, Yan Caifan (Acad. of Meteorological Sci., Nat. Meteorological Bureau, China), Wang Yu-bin.
Acta Meteorol. Sin. (China), vol.41, no.1, p.79-88 (Feb. 1983). In Chinese.
A one-dimensional time-dependent model of precipitation in warm layer cloud is given. The influence of some factors on the warm rain process and its initiation is tested. The process of rain enhancement by salt-seeding is simulated and discussed. (7 refs.)

104454 A study of the microscopic structure of hailstones. Shi Wenquan (Meteorological Inst. of Xinjiang, China), Wang Angsheng.
Acta Meteorol. Sin. (China), vol.41, no.1, p.89-96 (Feb. 1983). In Chinese.
From polarised light and transmitted light photographs of fifty-one hailstone sections made from samples taken in five hailstorms, in Zhaosu, Xinjiang, three kinds of microscopic structure are found, showing crystals, air bubbles, layers and embryo characteristics. Raindrop and hail spectra are sampled. (10 refs.)

104455 Meteosat measurements of vertical fluxes in thunderstorms. N.R.Ward, R.W.Saunders, G.E.Hunt (Dept. of Phys. & Astron., Univ. Coll. London, London, England).
Int. J. Remote Sens. (GB), vol.4, no.3, p.609-16 (July-Sept. 1983).
Measures the fluxes of mass and latent heat in summer thunderstorms over Europe by using Meteosat images to measure the rates of expansion of the cirrus anvils. These measurements are compared with previous satellite estimates of thunderstorm fluxes in both mid-latitudes and the tropics, and also estimates made using other techniques. Four of the storms had mass fluxes in excess of 10^9 kg s^{-1}, which is large for a mid-latitude thunderstorm and comparable with a large tropical thunderstorm. (15 refs.)

104456 Remote sensing of Arkansas tornadoes on 11 April 1976 from a satellite, a balloon and an inonospheric array. R.J.Hung (Univ. of Alabama, Huntsville, AL, USA), R.E.Smith.
Int. J. Remote Sens. (GB), vol.4, no.3, p.617-30 (July-Sept. 1983).
The Arkansas tornadoes on 11 April 1976 were investigated using regular 30 min interval GOES digital infrared data, rawinsonde observations, Doppler sounder records and radar summaries covering the 3 hour time period immediately preceding the touchdown of the tornadoes. Clouds associated with the tornado are compared to other clouds that are not associated with tornadoes. It appears as if the altitude to which the overshooting cloud top penetrates above the tropopause is the major factor that controls tornado formation. Rawinsonde and radar observations are used to establish the background meteorological conditions. Waves are also discussed. (36 refs.)

104457 Photochemical reactivity of perchloroethylene: a new appraisal. B.Dimitriades, B.W.Gay,Jr., R.R.Arnts, R.L.Seila (US Environmental Protection Agency, Research Triangle Park, NC, USA).
J. Air Pollut. Control Assoc. (USA), vol.33, no.6, p.575-87 (June 1983).
Perchloroethylene (PCE), a solvent used in dry cleaning, has been suspected of contributing significantly to photochemical ozone/oxidant (O_3/O_x) problems in urban atmospheres. Past evidence, however, was neither complete nor consistent. To interpret more conclusively the past evidence, and further understand PCE's role in the O_3/O_x problem, a smog chamber testing program was conducted. The program's objectives were: (a) to explain the mechanism of the PCE reaction in smog chamber atmospheres, and (b) to extrapolate the smog chamber findings regarding PCE reactivity to the real atmosphere. Results showed that in smog chambers, PCE reacts and forms O_3/O_x following what appears to be a Cl instigated photooxidation mechanism rather than the OH initiated mechanism accepted in current smog chemistry. (43 refs.)

104458 Over-reflection and instability. Chang-Kou Tai (Dept. of Earth & Planetary Sci., MIT, Cambridge, MA, USA).
Dyn. Atmos. & Oceans (Netherlands), vol.7, no.3, p.147-65 (July 1983).
Stability problems involving parallel shear flow are considered in the context of wave-reflection problems. It is found that if an unstable solution exists and its growth rate is sufficiently small, the growth rate can be connected to the reflection coefficient through a formula as if the unstable growth were the direct result of repeated over-reflections. If the stability problem under consideration has time symmetry, then for every growing solution there exists a corresponding decaying solution. It is shown that a consistent formula can also be derived for the decaying solution, and the existence of at least one critical layer in the corresponding wave-reflection problem is needed in order to account for both the growing and decaying solutions. As an application of these concepts, the small-scale geostrophic instabilities found by Stone (1970) are identified to be associated with over-reflection of inertia-gravity waves. (18 refs.)

104459 Regimes of validity for balanced models. P.R.Gent, J.C.McWilliams (Nat. Center for Atmospheric Res., Boulder, CO, USA).
Dyn. Atmos. & Oceans (Netherlands), vol.7, no.3, p.167-83 (July 1983).
Scaling analyses are presented which delineate the atmospheric and oceanic regimes of validity for the family of balanced models described in Gent and McWilliams (1983a). The analyses follow and extend the classical work of Charney (1948) and others. The analyses use three non-dimensional parameters which represent the flow scale relative to the Earth's radius, the dominance of turbulent or wave-like processes, and the dominant component of the potential vorticity. For each regime, the models that are accurate both at leading order and through at least one higher order of accuracy in the appropriate small parameter are then identified. In particular, it is found that members of the balance family are the appropriate models of higher-order accuracy over a broad range of parameter regimes. Examples are also given of particular atmospheric and oceanic phenomena which are in the regimes of validity for the different balanced models. (15 refs.)

104460 Some radiation budget and cloud measurements derived from Meteosat 1 data. R.W.Saunders, G.E.Hunt (Dept. of Phys. & Astron., Univ. Coll. London, London, England).
Tellus Ser. B (Sweden), vol.35B, no.3, p.177-88 (July 1983).
Visible and infrared digitally encoded images from Meteosat 1 have been converted into broad band reflected and emitted irradiances in order to derive the radiation budget of the underlying surface/atmosphere. These fluxes were determined once an hour over Western Europe for August 21, 1978, averaged over a 1° lat./long. grid. This has allowed a daily mean to be calculated from the twenty-four observations and a standard deviation, a measure of the diurnal variability of the albedo and emitted irradiance. In addition, cloud amounts at three levels were derived every hour. (25 refs.)

104461 The transport and spatial scale of Asian dust-storm clouds: a case study of the dust-storm event of April 1979. Y.Iwasaka, H.Minoura, K.Nagaya (Water Res. Inst., Nagoya Univ., Nagoya, Japan).
Tellus Ser. B (Sweden), vol.35B, no.3, p.189-96 (July 1983).
A dust storm which originated in the China desert area covered the Japanese Islands on April 14-15, 1979. Simultaneous measurement by lidar and geosynchronous meteorological satellite enable the spatial structure and transport path of the dust storm cloud to be characterized. The lidar measurements indicated that the dust cloud consisted of two distinct layers. The trajectory analysis of air mass suggests that the particulate matter contained in the upper layer is probably transported from the Takla-Makan desert and that in the lower layer from the Gobi desert and the Huang-Ho basin. (18 refs.)

104462 Molecular state of sulfate aerosols in the remote Everest highlands. A.Ono, M.Yamato, M.Yoshida (Water Res. Inst., Nagoya Univ., Nagoya, Japan).
Tellus Ser. B (Sweden), vol.35B, no.3, p.197-205 (July 1983).
For the selective detectoin of the sulfuric acid component in individual submicron atmospheric aerosol particles, a new in situ approach using a vapor-deposited calcium thin film as a reactive aerosol-collecting surface has been tested in field observations carried out in the remote Everest highlands. It would appear that there is a vertical stratification in the acidity of sulfite-containing aerosols in the troposphere. (17 refs.)

104463 pH of rainwater in Coimbra, Portugal: the seasonal variation. J.S.Branco, S.J.Formosinho (Inst. Geofisico, Univ. de Coimbra, Coimbra, Portugal).
Tellus Ser. B (Sweden), vol.35B, no.3, p.237-9 (July 1983).
Daily measurements of pH and electrical conductivity of rainwater at Coimbra, Portugal, in the period between autumn 1978 to autumn 1980 are reported. The average conductivity is 26 $\mu\Omega^{-1}$ cm^{-1} and the average pH is 4.75. Neutral salt contribution to conductivity is significant and is highest in autumn/winter. Correlations between neutral salt conductivity and wind direc-

tion were found. pH values have a large dispersion and more than 30% of the samples had a pH <5.0. A seasonal variation of 1.2 pH units was found for the acidity with the highest average pH in autumn and the lowest in summer. A bimodal pH frequency distribution was found for the winter and spring seasons. (3 refs.)

104464 Evidence of an additive effect for ozone plumes from small cities. K.Sexton (Dept. of Environmental Sci. & Physiology, School of Public Health, Harvard Univ., Boston, MA, USA).
Environ. Sci. & Technol. (USA), vol.17, no.7, p.402-7 (July 1983).
Results of an aerial monitoring examining ozone plumes from small cities (population <200000) are presented. Measurements (e.g. ozone, nitrogen oxides, hydrocarbons) by the instrumented aircraft focused on delineating plume dimensions, composition, and chemistry during the first 6 h of transport. In-plume ozone buildup was noted downwind of some small cities on a routine basis, while only sporadically or not at all for others. Airborne emissions from several small cities were observed to overlap when prevailing winds were from either the north or south. Photochemical ozone was consistently recorded in the combined plume produced by these meteorological conditions. Plume dimensions were on the same order of magnitude as those normally associated with large metropolitan areas. (21 refs.)

104465 Prediction of global solar radiation from bright sunshine hours and other meteorological data. H.P.Garg, S.N.Garg (Centre of Energy Studies, Indian Inst. of Technol., New Delhi, India).
Energy Convers. & Manage. (GB), vol.23, no.2, p.113-18 (1983).
Three existing empirical relations which predict global radiation from bright sunshine hours and meteorological parameters were tried for 14 Indian stations where all relevant data was available. A large amount of error ($\pm50\%$) was found. So a new empirical relation was established between global radiation and meteorological parameters. The new relation predicted the insolation within a $\pm10\%$ error limit in most cases. Global radiation dependence on ambient temperature and relative humidity was introduced through atmospheric water content per unit volume. The relation is given. (6 refs.)

104466 Increasing backscattered light from the stratospheric aerosol layer after Mt. El Chicon eruption laser radar measurement at Nagoya (35°N, 137°E). Y.Iwasaka, S.Hayashida, A.Ono (Water Res. Inst., Nagoya Univ., Nagoya, Japan).
Geophys. Res. Lett. (USA), vol.10, no.6, p.440-2 (June 1983).
The increase of backscattered light from the stratospheric aerosol layer was measured by laser radar at Nagoya during the period from the end of April to early July, 1982. On the basis of much information (e.g. SEAN Bull., 1982), this is certainly due to the volcanic eruptions of Mt. El Chichon (Mexico) in March and April 1982. The effect of the Mt. El Chicon eruption on the stratospheric aerosol layer is longer lasting than that of Mt. St. Helens (Washington, USA) in May of 1980. (16 refs.)

104467 Study of daytime peak frequency and bandwidth of atmospherics as a function of azimuth. V.S.Varaprasad, S.Gopalakrishna, P.Sitaramaswamy (Dept. of Appl. Phys., Andhra Univ., Waltair, India).
Int. J. Electron. (GB), vol.55, no.2, p.265-70 (Aug. 1983).
The variation of spectral peak frequency and bandwidth as a function of source distance of atmospherics received during daytime from different directions is presented. Comparing these values with night-time values, it is noticed that the peak frequency is always higher for atmospherics propagating during daytime than those propagating during nighttime in any direction of propagation, the distance of propagation being the same. The bandwidth of the atmospherics received during the night is higher than that received during the day, for any direction of propagation, the distance of propagation being the same. These results are interpreted on the basis of attenuation rates during day and night. (11 refs.)

104468 The role of seasonal reservoirs in the Mars water cycle. II. Coupled models of the regolith, the polar caps, and atmospheric transport. B.M.Jakosky (Div. of Geological & Planetary Sci., California Inst. of Technol., Pasadena, CA, USA).
Icarus (USA), vol.55, no.1, p.19-39 (July 1983).
For pt.I see ibid., vol.55, no.1, p.1-18 (1983). The behavior of water vapor in the Mars atmosphere requires that there be a seasonally accessible nonatmospheric reservoir of water. Coupled models have been constructed which include exchange of water with the regolith and with the polar caps, and transport through the atmosphere due to its circulation. Comparison of the model results with the vapor observations and with other data regarding the physical nature of the surface allows constraints to be placed on the relative importance of each process. (44 refs.)

104469 The global distribution of atmospheric carbon dioxide. I. Aspects of observations and modeling. G.I.Pearman, P.Hyson, P.J.Fraser (Div. of Atmospheric Phys., CSIRO, Aspendale, Australia).
J. Geophys. Res. (USA), vol.88, no.C6, p.3581-90 (20 April 1983). (Analysis and Interpretation of Atmospheric CO_2 Data, Bern, Switzerland, 14-18 Sept. 1981).
A two-dimensionsal global atmospheric transport model is used to relate estimated air to surface exchanges of CO_2 to spatial and temporal variations of atmospheric concentration of CO_2. This serves to illustrate the gross features of the carbon cycle and the measurement precision required of the burgeoning global observational network if the latter is to contribute useful information to the quantitative description of the cycle. Calculations are based on the atmospheric model coupled to a fixed, or variable depth, oceanic mixed layer. Zonally averaged air-sea fluxes of CO_2 are estimated from a relationship between flux, partial pressure, temperature, and wind stress. The result is a time dependent (pre-industrial to 1980) estimate of the meridional rates of net exchange of CO_2 with the oceans. (37 refs.)

104470 The global distribution of atmospheric carbon dioxide. II. A review of provisional background observations, 1978-1980. P.J.Fraser, G.I.Pearman, P.Hyson (Div. of Atmospheric Phys., CSIRO, Mordialloc, Victoria, Australia).
J. Geophys. Res. (USA), vol.88, no.C6, p.3591-8 (20 April 1983). (Analysis and Interpretation of Atmospheric CO_2 Data, Bern, Switzerland, 14-18 Sept. 1981).
For pt.I see ibid., vol.88, no.C6, p.3581-90 (1983). An attempt is made to bring together provisional data collected throughout the world to construct a global picture of the background atmospheric carbon dioxide concentration distribution. The uncertainties, calibration and sampling difficulties, and measurement needs are discussed, and it is concluded that in general the accuracy of the provisional data of each sampling location is $\sim\pm1$ ppmv. The most recent data available (for 1980) indicate annual average northern hemisphere high latitude CO_2 concentrations 4 to 5 ppmv above those at high latitudes of the southern hemisphere ($\sim$336 ppmv). The greatest uncertainty in the zonal average concentration exists in the latitude band 10-30° N. The seasonality of the concentrations is discussed. (33 refs.)

104471 A deconvolution of the tree ring based $\delta^{13}C$ record. Tsung-Hung Peng (Oak Ridge Nat. Lab., Oak Ridge, TN, USA), W.S.Broecker, H.D.Freyer, S.Trumbore.
J. Geophys. Res. (USA), vol.88, no.C6, p.3609-20 (20 April 1983). (Analysis and Interpretation of Atmospheric CO_2 Data, Bern, Switzerland, 14-18 Sept. 1981).
It is assumed that the tree-ring based $^{13}C/^{12}C$ record constructed by Freyer and Belacy (1983) to be representative of the fossil fuel and forest-soil induced $^{13}C/^{12}C$ change for atmospheric CO_2. Through the use of a modification of the Oeschger et al. ocean model, the authors have computed the contribution of the combustion of coal, oil and natural gas to this observed $^{13}C/^{12}C$ change. A large residual remains when the tree-ring-based record is corrected for the contribution of fossil fuel CO_2. A deconvolution was performed on this residual to determine the time history and magnitude of the forest-soil reservoir changes over the past 150 years. (52 refs.)

104472 Some comments of the exchange of CO_2 across the air-sea interface. D.Lal (Phys. Res. Lab., Amhedabad, India), H.E.Suess.
J. Geophys. Res. (USA), vol.88, no.C6, p.3643-6 (20 April 1983). (Analysis and Interpretation of Atmospheric CO_2 Data, Bern, Switzerland, 14-18 Sept. 1981).
Boundary values are estimated for the long-term rate of exchange of carbon dioxide between the atmosphere and the ocean based on the analyses of the experimentally determined shapes of 'wiggles' in the atmospheric $^{14}C/^{12}C$ ratios, for which accurate tree ring data are available for the past 8 millennia. It is shown that the high frequency wiggles (characteristic period of about 200 years) can be explained as entirely due to temporal variations in the global production rate of ^{14}C arising from solar modulaton of galactic cosmic ray flux provided the mean residence time of carbon dioxide in the atmosphere lies in the range (3-25) years. These calculations are based on a four-box model for the carbon cycle. (26 refs.)

104473 Nonlinear response of Stratospheric ozone column to chlorine injections. R.J.Cicerone, S.Walter (Nat. Center for Atmospheric Res., Boulder, CO, USA), S.C.Liu.
J. Geophys. Res. (USA), vol.88, no.C6, p.3647-61 (20 April 1983).
With a reasonably complete and up-to-date photochemical model of the stratosphere, the authors find that the calculated stratospheric ozone-column response to chlorine injections is highly nonlinear. The model calculation assume that the background inorganic (or odd) chlorine , ClX is due to CH_3Cl and CCl_4. Additional ClX is added to the stratosphere by varying input fluxes of CCl_2F_2 and CCl_3F. The sensitivity, $\Delta O_3/\Delta ClX$, of the stratospheric O_3 column to added ClX is relatively small for $ClX\leq3$ ppb or $\Delta ClX\leq2$ ppb; slight ozone increases with ClX are possible over a limited range of ClX if the formation of chlorine nitrate proceeds rapidly. If stratospheric ClX increases to about 9 ppb due to continued usage of CCl_2F_2, CCl_3F and CH_3CCl_3, the stratospheric O_3 column depletion is calculated to be 6.7-9.0%. (53 refs.)

104474 Correlative nature of ozone and carbon monoxide in the troposphere: implications for the tropospheric ozone budget. J.Fishman (NASA Langley Res. Center, Hampton, VA, USA), W.Seiler.
J. Geophys. Res. (USA), vol.88, no.C6, p.3662-70 (20 April 1983).
The small-scale vertical variability of tropospheric O_3 and CO is examined from a set of simultaneous measurements obtained in July and August 1974, between 55°S and 67°N. From this set of vertical profiles, it is noted that many of the fluctuations are coincident in both species, and a method is presented that quantifies the correlation between the observed O_3 and CO variability. A two-dimensional depiction of the distribution of these O_3-CO correlations shows that there are regions in the troposphere where these trace gases are positively correlated, while at the same time there are preferred locations where these two species are primarily anticorrelated. (42 refs.)

104475 Aqueous oxidation of SO_2 by hydrogen peroxide. S.M.Kunen, A.L.Lazrus, G.L.Kok, B.G.Heikes (Nat. Center for Atmospheric Res., Boulder, CO, USA).
J. Geophys. Res. (USA), vol.88, no.C6, p.3671-4 (20 April 1983).
The aqueous oxidation of S(IV) by H_2O_2 is one of the principal paths of acid formation in the atmosphere. The authors measured the rate constant of the reaction: $H_2O_2\ (a)+S(IV)(a)\rightarrow H_2SO_4$ at condition and concentrations found in the atmosphere. An analytical technique was used in which excess S(IV) (10^{-6} to 10^{-5}M) was reacted with H_2O_2 ($\sim10^{-7}$M). The decay in H_2O_2 concentration with time was followed by using an H_2O_2 luminol-chemiluminescent instrument. The measurements of the S(IV)-H_2O_2 rate constant were in substantial agreement with previous measurements. A first order dependence in the rate constant with hydrogen ion concentration was noted and at 22°C the results can be represented by $k=(8.03\pm0.18)\times10^7[H^+]dm^3mole^{-1}s^{-1}$ when the pH is between 4.0 and 5.8. (17 refs.)

104476 Selected man-made halogenated chemicals in the air and oceanic environment. H.B.Singh, L.J.Salas, R.E.Stiles (Atmospheric Sci., Center, SRI Internat., Menlo Park, CA, USA).
J. Geophys. Res. (USA), vol.88, no.C6, p.3675-83 (20 April 1983).
Latitudinal distribution (40°N to 32°S) of a number of synthetic halogenated species show that for unreactive species (i.e. fluorocarbon 12 (F 12), F 11, F 113, F 114, F 13B1, SF_6 and CCl_4) the northern hemispheric (NH) burden is only 5 to 10% higher than the southern hemispheric (SH) value. The mean NH/SH concentration ratios for 1,1,1-trichloroethane; dichloromethane; chloroform; 1,2 dichloroethane; and tetrachloroethane are found. A 'mean hydroxyl radical' concentration of $4\text{-}6\times10^5$ mol cm^{-3} and an average interhemispheric exchange rate of 1.2 years best fit the observational data. Oceanic surface and water measurements in the Eastern Pacific show that F 12, F 11 and F 113 concentrations are in rough equilibrium with air concentrations, carbon tetrachloride is significantly undersaturated ($\sim$25%), and chloroform, dichloromethane, trichloroethane and tetrachloroethane are oversaturated. (37 refs.)

104477 A general circulation model study of atmospheric carbon monoxide. J.P.Pinto (NASA Goddard Space Flight Center, Inst. for Space Studies, New York, NY, USA), Y.L.Yung, D.Rind, G.L.Russsell, J.A.Lerner, J.E.Hansen, S.Hameed.
J. Geophys. Res. (USA), vol.88, no.C6, p.3691-702 (20 April 1983).
The carbon monoxide cycle is studied by incorporating the known and hypothetical sources and sinks in a tracer model that uses the winds generated by a general circulation model. Photochemical production and loss terms, which depend on OH radical concentrations are calculated in an interactive fashion. The computed global distribution and seasonal variations of CO are compared with observations to obtain constraints on the distribution and magnitude of the sources and sinks of CO, and on the tropospheric abundance of OH. The simplest model that accounts for available observations requires a low latitude plant source of about 1.3×10^{15} g yr^{-1}, in addition to sources from incomplete combustion of fossil fuels and oxidation of methane. (52 refs.)

104478 Isotope geochemistry of the Amazon basin: a reconnaissance. A.Longinelli (Inst. di Mineralogia Petrografia e Geochemica, Univ. of Palermo, Palermo, Italy), J.M.Edmond.
J. Geophys. Res. (USA), vol.88, no.C6, p.3703-17 (20 April 1983).
On the transects of the Amazon River made by the Alpha Helix in 1976 and 1977, an extensive suite of samples was collected for isotopic analyses. The water isotopes ($^{18}O/^{16}O$, D/H) were determined in atmospheric water vapour and in river, rain and leaf waters. $^{13}C/^{12}C$ ratios were measured in the dissolved and atmospheric CO_2. Determinations were made of $^{34}S/^{32}S$ and oxygen isotopes in dissolved sulphate. The effect of 'continentality' on the water isotopes is minor reflecting the large scale recycling by evapotranspiration from the huge area of forest within the basin. Variations in the isotopic abundances between 1976 (June-July, dry season) and 1977 (May-June, end of wet season) are consistent with the changes in meteorological conditions. The isotopic composition of the CO_2, both atmospheric and dissolved is dominated by biological effects. (32 refs.)

104479 Unusual behavior in the condensation nuclei concentration at 30 km. J.M.Rosen, D.J.Hofmann (Dept. of Phys. & Astron., Univ. of Wyoming, Laramie, WY, USA).
J. Geophys. Res. (USA), vol.88, no.C6, p.3725-31 (20 April 1983).
The results obtained with an improved balloon-borne condensation nuclei (CN) counter that is capable of operating to altitudes of at least 30 km are presented. Of major interest is the appearance of a quasiannual variation near 30 km which could be described by a sudden concentration increase of unusually small particles occurring in the winter of spring followed by a 1- to 3-month decay period to background levels. The magnitude of the variation has increased dramatically following the recent generally higher levels of volcanic activity affecting the lower stratosphere. Several potential explanations for the event are considered, but none appear entirely satisfactory or complete. (16 refs.)

104480 The contribution of volcanoes to the global atmospheric sulfur budget. H.Berresheim, W.Jaeschke (Center for Environmental Protection, J.W. Goethe-Univ., Frankfurt/Main, Germany).
J. Geophys. Res. (USA), vol.88, no.C6, p.3732-40 (20 April 1983).
A new assessment of the global volcanic emission rates of H_2S, SO_2 and $SO_4$2- is presented. The assessment is based on the development of a suitable classification of volcanic activity and its application to the authors' measurements and data given in the literature. Using this classification, the volcanic sulfur release is estimated to 1.18×10^7 t S/a total. This estimate must be regarded as a minimum since the data available for major explosive events are very uncertain. On the other hand the frequency of such events is comparatively low. A global volcanic emission of 1.52×10^7 t SO_2/a for the period 1961-79 is estimated. (63 refs.)

104481 A decade of stratospheric sulfate measurements compared with observations of volcanic eruptions. W.A.Sedlacek, E.J.Mroz (Los Alamos Nat. Lab., Los Alamos, NM, USA), A.L.Lazrus, B.W.Gandrud.
J. Geophys. Res. (USA), vol.88, no.C6, p.3741-76 (20 April 1983).
Sulfate aerosol concentrations in the stratosphere have been measured for 11 years (1971-81). Data collected seasonally at altitudes between 13 km and 20 km spanning latitudes from 75°N to 51°S are reported. These data are compared with the reported altitudes of volcanic eruption plumes during the same decade. It is concluded that several unreported volcanic eruptions or eruptions to altitudes higher than reported did occur during the decade. The *e*-fold removal time for sulfate aerosol from the stratosphere following the eruption of Volcan Fuego in 1974 was estimated. The volcanic contribution to the average stratospheric sulfate concentration over the decade was greater than 50%. (36 refs.)

104482 Lidar- and balloon-borne particle counter comparisons following recent volcanic eruptions. R.Hofmann, J.M.Rosen (Dept. of Phys. & Astron., Univ. of Wyoming, Laramie, WY, USA), R.Reiter, H.Jager.
J. Geophys. Res. (USA), vol.88, no.C6, p.3777-82 (20 April 1983).
Ballon-borne particle counter measurements at Laramie, Wyoming (41°N) are used to calculate the expected lidar bakscatter at 0.694 μm wavelength from July 1979 to February 1982, a period which included at least four detectable perturbations of the stratospheric aerosol layer due to volcanic eruptions. These calculations are compared with lidar measurements conducted at Garmisch-Partenkirchen (47.5°N) during the same period. While the agreement is generally good using only the main mode in the particle size distribution (radius $\sim$0.07 μm) during approximately the first 6 months following a major volcanic eruption, a measured secondary mode near 1 μm radius, when included, improves the agreement. (10 refs.)

104483 Measurement of stratospheric aerosol near Sanriku (39°N, 142°E) in Japan on May 31, 1979. A.Matsuzaki, Y.Nakamura, T.Itoh (Inst. of Space & Astron. Sci., Tokyo, Japan).
J. Geophys. Res. (USA), vol.88, no.C6, p.3783-8 (20 April 1983).
The altitiude profile of the scattering extinction of stratospheric aerosols was measured by using the balloon-borne spectrometer with the solar occulation method near Sanriku (39°N, 142°E) in Japan on May 31, 1979. The result confirmed that the altitude profile of the scattering extinction turned out to be close to that of the SAM II measurement near Alaska during July 16-19, 1979. (41 refs.)

104484 Spectroscopic measurements of carbon monoxide in the stratosphere. N.Louisnard (ONERA, Chatillon, France), O.Lado-Bordowsky.
J. Geophys. Res. (USA), vol.88, no.C6, p.3789-97 (20 April 1983).
Results obtained from two experiments concerning the repartition of carbon monoxide in the stratosphere are presented and compared to model predictions. Infrared solar adsorption spectra were recorded during a balloon flight from Aire-sur-Adour, France (about 44°N Latitude), in September 1980. The height profile of the mixing ratio presents a minimum of 8 ± 1 ppb around 22-25 km; it reaches 14 ± 1 ppb at 35 km. A similar experiment was performed in April-May 1980 from an aircraft between 64°N and 62°S. The integrated vertical amount above 11.5 km is deduced. There is an important variation of this amount with a maximum at low latitude and a minimum at high latitude related to the height of the tropopause. (25 refs.)

104485 Stratospheric N_2O, CF_2Cl_2, and $CFCl_3$ composition studies utilizing in situ cryogenic, whole air sampling methods. C.C.Gallagher, C.A.Forsberg, R.V.Pieri (Geophys. Lab., Hanscom Air Force Base, MA, USA).
J. Geophys. Res. (USA), vol.88, no.C6, p.3798-808 (20 April 1983).
The fluorocarbon and nitrous oxide content of the stratosphere have been studied as a function of altitude, latitude, and time. Whole air samples have been gathered from a balloon platform, primarily through use of a cryogenic sampler. Twenty-two flights were conducted between 1975 and 1980, and gas chromatography was utilized to determine species mixing ratios in the retrieved samples. Results are evaluated in terms of various stratosphere models. (36 refs.)

104486 Evidence for quasi-periodic components in Dobson network total ozone records. P.D.Guthrie (Lab. for Planetary Atmospheres, NASA Goddard Space Flight Center, Greenbelt, MD, USA).
J. Geophys. Res. (USA), vol.88, no.C6, p.3809-18 (20 April 1983).
Power spectrum analysis has been applied to the total ozone time series at each of a sample of Dobson stations with records of more than 15 years in the interval 1957 to 1981. The distributions of strongly periodic or quasi-periodic signals in these spectral estimates, for three spectral estimators and two levels of confidence, show distinct features. These appear at the previously known or suspected periods of 3.5-4.0 years, 27 months, and 21 months as well as the previously unreported period of 11.5 months. Possible geophysical implications are discussed. (19 refs.)

104487 The distribution and annual cycle of ozone in the upper stratosphere. J.E.Frederick (Lab. for Planetary Atmospheres, NASA/Goddard Space Flight Center, Greenbelt, MD, USA), F.T.Huang, A.R.Douglass, C.A.Reber.
J. Geophys. Res. (USA), vol.88, no.C6, p.3819-28 (20 April 1983).
Study of the global distribution of upper stratospheric ozone derived from backscatter ultraviolet (BUV/SBUV) instruments on the Nimbus 4 and 7 satellites reveals the following characteristics for the period June 1970 through May 1972 plus portions of 1978 and 1979. At pressures less than 5 mbar a local midlatitude maximum in the ozone mixing ratio develops in autumn and persists through the winter season in both hemispheres. However, by a pressure of 10 mbar the seasonal trend has reversed, with midlatitude summer values exceeding those in winter. The largest ozone mixing ratios in a global sense occur at tropical latitudes between pressures of 7 and 9 mbar. (18 refs.)

104488 The delta band dissociation of nitric oxide: a potential mechanism for coupling thermospheric variations to the mesosphere and stratosphere. J.E.Frederick (Lab. for Planetary Atmospheres, NASA Goddard Space Flight Center, Greenbelt, MD, USA), R.B.Abrams, P.J.Crutzen.
J. Geophys. Res. (USA), vol.88, no.C6, p.3829-35 (20 April 1983).
Depletion of solar radiation at discrete wavelengths by nitric oxide has a significant impact on the dissociation rate of this gas in the $\delta(0,0)$ and $\delta(1,0)$ bands. Inclusion of the opacity provided by a typical NO profile reduces the dissociation rate in the upper stratosphere to 50-70% of that predicted when the optical depth calculation omits this contribution. Variations in the thermospheric NO abundance modulate the radiation field at the precise wavelengths absorbed by this molecule in the mesosphere and upper stratosphere. Predicted changes in the dissociation rate arising from a varying thermospheric opacity exceed 8% throughout the mesosphere and reach 15% between 65 km and 95 km. (34 refs.)

104489 The evolution of latitudinal shear in Rossby gravity wave, mean flow interaction. T.J.Dunkerton (Phys. Dynamics, Inc., Bellevue, WA, USA).
J. Geophys. Res. (USA), vol.88, no.C6, p.3836-42 (20 April 1983).
The effects of latitudinal mean wind shear on the Rossby gravity wave are investigated. It is shown that this wave stabilizes barotropically unstable mean flows near the equator. Easterly curvature expands the wave scale and helps to insure the relevance of this theorem. It is also suggested that latitudinal shear, if incorporated into a Holton-Lindzen type experiment, might act to produce a correct asymmetry in shear zone strength in the two phases of the quasi-biennial oscillation. (21 refs.)

104490 Mid-latitude lidar observations of planetary waves in the middle atmosphere during the winter of 1981-1982. A.Hauchecorne, M.L.Chanin (Service d'Aeronomie, CNRS, Verrieres-Le-Buisson, France).
J. Geophys. Res. (USA), vol.88, no.C6, p.3843-9 (20 April 1983).
A quasi-continuous survey of the stratospheric and mesospheric temperature was performed, between June 1981 and April 1982, using the lidar station of the Observatory of Haute-Provence (44°N, 6°E). During the period of easterly winds in the lower stratosphere (i.e. from June to September), the variability of the temperature is observed to be very low. As long as prevailing winds are westerlies, from October to March, temperature profiles are continuously perturbed by planetary waves, with a maximum of amplitude in January 1982, before the 'strong minor warming' of the winter. Spectral analysis of the data indicates the presence of a well-defined 18-day wave interpreted as a free Rossby wave and the existence of large perturbations with periods of 25 to 40 days which are tentatively explained as a succession of minor upper stratospheric warmings due to the interference of the 18 day traveling Rossby wave and a stationary wave. (11 refs.)

104491 Fine Doppler resolution observations of thin turbulence structures in the tropostratosphere at Millstone Hill. R.H.Wand, P.K.Rastogi (Haystack Obs., MIT, Westford, MA, USA), B.J.Watkins, G.B.Loriot.
J. Geophys. Res. (USA), vol.88, no.C6, p.3851-7 (20 April 1983).
The 440-MHz radar at Millstone Hill (42.6°N, 71.5°W) was employed to examine the detailed evolution of turbulence structures in the tropostratosphere with a very fine Doppler resolution of 0.12 Hz, corresponding to 4 cm s^{-1} radial velocity resolution. The measurement technique involved directing the antenna downwind at a low elevation angle (15° or 20°) and processing the echoes from a range where the background wind shear was high. A wide variety of turbulence structures were evident by virtue of their different Doppler shifts in the presence of a high wind shear. Using arguments based on the dominance of 'shear broadening' and the required velocity gradient to create instabilities, maximum layer thicknesses in the vicinity of 20-300 m were inferred. (20 refs.)

104492 The effects of energetic particle precipitation on the atmospheric electric circuit. J.B.Reagan, R.E.Meyerott, J.E.Evans, W.L.Imhof (Lockheed Palo Alto Res. Lab., Palo Alto, CA, USA), R.G.Joiner.
J. Geophys. Res. (USA), vol.88, no.C6, p.3869-78 (20 April 1983).
The solar particle event (SPE) of August 1972 is one of the largest that has occurred in the last 20 years. Since it is so well documented, it can serve as a good example of a major perturbation to the atmospheric electric system. In this paper, ion production rates and conductivities from the ground to 80 km at the peak intensity of the event on August 4 and for 30, 35, and 40 km for the 6-day duration of the event are presented. At the peak of the event, the proton and electron precipitation currents, the ohmic current, and the vertical electric field are calculated inside the polar cap. The particle precipitation currents at this time greatly exceed the normal air Earth current at altitudes above 30 km and produce reversals in the vertical electric field at 28 km and above. (41 refs.)

104493 Acoustic and electric signals from lightning. N.K.Balachandran (Lamont-Doherty Geological Obs., Columbia Univ., Palisades, NY, USA).
J. Geophys. Res. (USA), vol.88, no.C6, p.3879-84 (20 April 1983).
Observations of infrasound apparently generated by the collapse of the electrostatic field in the thundercloud, are presented along with electric field measurements and high-frequency thunder signals. The frequency of the infrasound pulse is about 1 Hz and amplitude a few microbars. The observations seem to confirm some of the theoretical predictions of Wilson (1920) and Dessler (1973). The signal is predominated by a compressional phase and

seems to be beamed vertically. Calculation of the parameters of the charged region using the infrasound signal give reasonable values. (5 refs.)

104494 Polarized microwave radiation transfer in precipitating cloudy atmospheres: applications to window frequencies. R.Huang, K.-N.Liou (Dept. of Meteorology, Univ. of Utah, Salt Lake City, UT, USA).
J. Geophys. Res. (USA), vol.88, no.C6, p.3885-93 (20 April 1983).
A microwave radiation transfer model taking into account Mie scattering polarization effects is developed for a plane-parallel precipitating cloudy atmosphere. In the model the azimuthally averaged Mie scattering phase matrix elements are expressed in terms of double Legendre polynomial expansion and the cloud temperature is approximated by a linear function of the optical depth. The complete solution of the fundamental transfer equation is derived utilizing the discrete-ordinates method for horizontal and vertical polarization components. Using this model, the brightness temperature and degree of polarization for three microwave window frequencies of 19.35, 37.0, and 85.5 GHz are calculated for a number of rainfall rates over both land and ocean surfaces. (17 refs.)

104495 Observations of unusual structures of high-latitude stratospheric electric fields. M.M.Madsen, N.D'Angelo, I.B.Iversen (Danish Space Res. Inst., Lyngby, Denmark).
J. Geophys. Res. (USA), vol.88, no.C6, p.3894-6 (20 April 1983).
Reports the observation, by means of balloon-borne sensors, of three cases of unusual stratospheric electric field structures at high latitudes. In all three cases a region of downward directed electric field is flanked by regions with upward field. In two out of the three cases, the central downward field is much stronger than the average fair weather field. The vertical current densities involved are $<5\times10^{-11}$ A/m^2. These field structures are observed only about 0.5% of the time. (9 refs.)

104496 Stratospheric water vapor. H.W.Ellsaesser (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
J. Geophys. Res. (USA), vol.88, no.C6, p.3897-906 (20 April 1983).
Presents a tutorial review of the understanding of stratospheric H_2O and the processes controlling it. A consistent global picture is synthesised that requires rejection of a minimum of the conflicting observational data. As such, this synthesis is determined somewhat by the personal opinions and beliefs of the author. Paradoxes posed by currently available observational data are noted and ways they might be resolved are suggested. (61 refs.)

104497 Corona point measurements in a thundercloud at Langmuir laboratory. M.E.Weber, M.F.Stewart, A.A.Few (Dept. of Space Phys. & Astron., Rice Univ., Houston, TX, USA).
J. Geophys. Res. (USA), vol.88, no.C6, p.3907-10 (20 April 1983).
A meteorological radiosonde, modified by the attachment of vertically oriented, pointed, metal rods, and associated instrumentation, was released beneath a thundercloud at Langmuir Laboratory, New Mexico. In addition to information on temperature and winds, the instrument provided an estimate of the vertical component of the cloud electric field by measurement of corona current induced in the rods. Charge volumes were inferred from the sounding. (17 refs.)

104498 Deductions concerning accumulations of electrified particles in thunderclouds based on electric field changes associated with lightning. B.Vonnegut (Atmospheric Sci. Res. Center, State Univ. of New York, Albany, NY, USA).
J. Geophys. Res. (USA), vol.88, no.C6, p.3911-12 (20 April 1983).
The relationships between the space charge in thunderclouds and the lightning that it causes are so complex or so poorly understood that deductions concerning the nature or location of this charge based solely on observations of lightning are open to question. (5 refs.)

104499 Resuspension of volcanic ash from Mount St. Helens. P.V.Hobbs, D.A.Hegg, L.F.Radke (Atmospheric Sci. Dept., Univ. of Washington, Seattle, WA, USA).
J. Geophys. Res. (USA), vol.88, no.C6, p.3919-21 (20 April 1983).
Measurements are presented of the size spectra of ash particles, previously deposited on the ground from the May 18, 1980 eruption of Mount St. Helens, that were resuspended into the air in eastern Washington. It is concluded that winds of just a few meters per second were capable of resuspending most of the smaller ash particles and that this caused dramatic reduction in visibility. (5 refs.)

104500 Comparison of the extended boundary condition method and perturbation method for scattering from a sinusoidal sea surface. R.H.Ott, D.J.Fang (Propagation Studies Dept., COMSAT Labs., Clarksburg, MD, USA).
J. Math. Phys. (USA), vol.24, no.8, p.2240-9 (Aug. 1983).
Scattering from a lossy sinusoidal surface is examined by using two methods: extended boundary condition (EBC) and perturbation. The range of applicability of the perturbation approach is established by comparison with EBC. The range of applicability of EBC is established through numerical examples. A convergence criterion based on the sequence of partial sums of the scattered energy is suggested for the application of EBC to lossy surface. New analytical expressions for the perturbation solutions are given. (11 refs.)

104501 Accelerated precipitation of water fogs due to acoustic action of a CO_2 laser pulse. N.N.Belov, K.A.Davydov, N.P.Datskevich, N.V.Karlov, V.V.Konov, G.P.Kuz'min, A.E.Negin, A.A.Nesterenko, A.V.Pakhomov, A.M.Prokhorov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
JETP Lett. (USA), vol.37, no.3, p.167-70 (5 Feb. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.3, p.139-41 (5 Feb. 1983).
Accelerated precipitation of water fogs, induced by the acoustic action of a pulsed CO_2 laser with energy in the range 0.8-3.2 J/cm^2 and pulse duration $\sim 1\ \mu$s, is observed. (6 refs.)

104502 Measurement of the turbulent dissipation rate and of the vertical exchange coefficient in stable atmospheric layers with a smoke puff technique. D.Guedalia, J.Viguier, A.Druilhet, J.Fontan (Lab. d'Aerologie, Univ. Paul Sabatier, Toulouse, France).
J. Rech. Atmos. (France), vol.17, no.1, p.1-11 (Jan.-March 1983). In French.
Several experiments of diffusion of a puff in stable stratified layers located between 150 and 1500 metres are presented. The vertical diffusion at the early stage gives the dissipation rate ϵ and the exchanges coefficient K_z for a scale of about 10 metres. The variation of K_z and ϵ with the stability of the layer are obtained. (17 refs.)

104503 The influence of a watersurface on the microclimate of the downwind zone. II. Experimental control of local advection models. B.Itier (INRA Station de Bioclimatologie-Teledetection, Versailles, France), D.Cardon, A.Baille, G.Sappe.
J. Rech. Atmos. (France), vol.17, no.1, p.33-44 (Jan.-March 1983). In French.
Following a climatological study around a small lake (Antonioletti et al., 1982), this paper reports the results of the experimental control of predictions by two local advection models of temperature and humidity changes. Horizontal gradients of temperature up to 150 m from the leading edge are measured at four heights (0.5, 1, 2, 3 m) over a flat, dry salt table south-east of a 500 m large water surface. Under strong wind conditions, measurements are in good agreement with the Itier-Perrier model (1976, 1978). Under low wind conditions, and consequently for larger instability, measurements agree better at high level (2-3 m) with Taylor calculations (1970) but remain closer to Itier-Perrier forecasts near the soil surface (0.5, 1 m). Finally, practical rules are given to compute the influence of the water-land temperature difference on the air temperature in the downwind zone, as a function of height, roughness length and distance from the leading edge. (11 refs.)

104504 The recent ^{14}C record in the north-west Mediterranean atmosphere. J.Thommeret, Y.Thommeret (Lab. de Radioactivite Appliquee, Centre Sci. de Monaco, Monaco), M.S.Baxter.
J. Rech. Atmos. (France), vol.17, no.1, p.45-51 (Jan.-March 1983).
A continuous record of atmospheric ^{14}C levels measured in Monaco during the past two decades is presented and analysed. The dominant features reflect input of excess ^{14}C by nuclear weapons tests in the early 1960s followed by exponential decrease of atmospheric ^{14}C levels as the bomb ^{14}C equilibrates within the dynamic carbon cycle. The characteristics of the response to the weapons input are analysed and the halfing-time of atmospheric ^{14}C decrease assessed to be 12 ± 2 years. This figure has wide relevance as a measure of the response time of the carbon cycle to atmospheric perturbations. The concomitant rise in ^{14}C levels in Mediterranean sea water is also illustrated. Predictions of future atmospheric ^{14}C concentrations, including consideration of fossil CO_2 dilution effects, suggest that levels will fall to natural values between 1995 and 2010 AD. (22 refs.)

104505 Variations of rainfall rate and raindrop spectra for stratiform and convective rainshowers. G.Donnadieu (Obs. du Puy de Dome, Univ. de Clermont-Ferrand II, Aubiere, France).
J. Rech. Atmos. (France), vol.17, no.1, p.53-65 (Jan.-March 1983). In French.
During the second and third PEP experiments, it was found that the VIDIAZ spectropluviometer and the Joss-Waldvogel disdrometer were both quite suitable to analyze the time variations of rainfall rate R and parameters N_0 and λ which characterize an exponential raindrop distribution, as well as for rain generated by stratiform clouds (Donnadieu, 1982) as by convective clouds. It is shown that these three parameters are related by the relationship $R=N_0/(6.9\ \lambda^{4.8})$ which is comparable with one established theoretically. Applying the theoretical relationship to these two different rainfall types, it was found that an important increase of R results rather from an increase in N_0 with λ nearly constant for stratiform rain and from a decrease in N_0 and λ for convective rain. A method is described for determining the parameters N_0 and λ by measurements of radar reflectivity and rainfall rate. (9 refs.)

104506 Ice crystal production by cold objects in supercooled clouds. D.Leonard, A.Detwiler (State Univ. of New York, Albany, NY, USA).
J. Rech. Atmos. (France), vol.17, no.1, p.83-88 (Jan.-March 1983).
The number of ice crystals produced by dropping cold metal spheres through supercooled water clouds in a laboratory cold box increases exponentially as sphere temperature decreases from −40°C to −100°C. Over this range of sphere temperatures, ice crystal production increases by at least seven to eight orders of magnitude. Spheres warmer than approximately −40°C did not produce ice crystals in these clouds. Cloud temperature has little influence on ice crystal production for spheres colder than −60°C. For sphere temperatures near and just below −40°C, ice crystal production is predominantly due to the freezing of cloud droplet. For sphere temperatures lower than this, spontaneous homogeneous nucleation from the vapor clearly becomes the predominant process. (10 refs.)

104507 Analyses of moisture and convective activity from cloud, visibility and present weather reports. A.G.Higgins, P.R.W.Wardle (Meteorological Office, Bracknell, England).
Meteorol. Mag. (GB), vol.112, no.1332, p.189-99 (July 1983).
Techniques are developed to obtain analyses of the cloud water mixing ratio of stratiform clouds from cloud, visibility and present weather reports, and to identify and analyse convective activity. The authors describe two techniques and present some examples of the analyses. One application of the work is in the enhancement of initial fields for the mesoscale numerical forecast model. (5 refs.)

104508 Global star radiation measurements on 6 August 1981. A day of midday darkness. R.J.Armstrong (Meteorological Office, Bracknell, England).
Meteorol. Mag. (GB), vol.112, no.1332, p.200-9 (July 1983).
Describes the effect on the solar radiation of the severe storms that hit southern England on 6 August 1981. The feature that distinguished this day from other days of violent thunderstorms, and made front page news, was the darkness that beset many areas, including London, in the middle of the day. From the solar radiation values provided by twelve sites the movement and intensity of the storms across southern and eastern England can be identified. (11 refs.)

104509 Aqueous-phase source of formic acid in clouds. W.L.Chameides, D.D.Davis (School of Geophys. Sci., Georgia Inst. of Technol., Atlanta, GA, USA).
Nature (GB), vol.304, no.5925, p.427-9 (4 Aug. 1983).
In remote regions, formic acid (HCOOH), and to a lesser extent acetic acid (CH_3COOH), have been identified as major acidic components of rain. These two organic acids have also been observed in the gas phase in the southwestern US. The sources of organic acids remain largely unknown. The authors investigated the coupled gas- and aqueous-phase cloud chemistry of HCOOH and report that during the daylight hours aqueous-phase OH radical reactions can both produce and destroy HCOOH in cloud droplets and may, in fact, control the HCOOH levels in rain. Similar mechanisms may also exist for acetic and other organic acids. (26 refs.)

104510 Particle size distributions of *n*-alkanes and ^{210}Pb in aerosols off the coast of Peru. J.K.Schneider, R.B.Gagosian, J.K.Cochran, T.W.Trull (Dept. of Chem., Woods Hole Oceanographic Inst., Woods Hole, MA, USA).
Nature (GB), vol.304, no.5925, p.429-32 (4 Aug. 1983).
Reports as part of the Sea/Air Exchange Program (SEAREX), the particle size distributions of aliphatic hydrocarbons and ^{210}Pb in aerosols over the upwelling zone off the coat of Peru to elucidate the mechanism of transport from continental areas. (28 refs.)

104511 Lidar measurements of the vertical ozone distribution during the June 1981 Intercomparison Campaign GAP/OHP. J.Pelon, G.Megie (CNRS, Verrieres-le-Buisson, France).
Planet. & Space Sci. (GB), vol.31, no.7, p.717-21 (July 1983).
Lidar measurements of the vertical ozone distribution (0-25 km) have been performed on a routine basis from 12 June to 24 June 1981 as part of the International Intercomparison Campaign held at the Observatoire Haute Provence. A brief description of the experimental system is given. Data are presented in terms of vertical ozone profiles and continuous monitoring of the ozone total content in various altitude layers. (7 refs.)

104512 Total atmospheric ozone measured by ground based high resolution infrared spectra—comparison with Dobson measurements. P.Marche, C.Meunier, A.Barbe, P.Jouve (Lab. de Physique Moleculaire, CNRS, Reims, France).
Planet. & Space Sci. (GB), vol.31, no.7, p.723-7 (July 1983).
Total atmospheric ozone has been measured at the 'Observatoire de Haute-Provence', Chiran Station, 1905 m high with a ground based, high resolution IR spectrometer, using the Sun as a source. Results are compared with a Dobson spectrophotometer which has been calibrated and intercompared with a standard. Total ozone values found with Dobson are 4% lower than values given by IR measurements. In addition, a negative correlation between total ozone and tropopause height has been found. (7 refs.)

104513 Tropospheric, stratospheric and mesospheric ozone observed using the Umkehr method. C.Meunier, Ahmed Bekaddour, P.Marche, P.Jouve (Lab. de Phys. Moleculaire, CNRS, Reims, France).
Planet. & Space Sci. (GB), vol.31, no.7, p.729-30 (July 1983).
Ozone vertical profiles have been obtained above the 'Observatoire de Haute-Provence' from 9 to 19 June 1981, with both conventional and short Umkehr methods: the mesospheric and stratospheric ozone variability has been found to be very small while the ozone variability was large in the troposphere and maximum at the tropopause level. (2 refs.)

104514 Atmospheric trace species measured above Haute-Provence Observatory. P.Marche, C.Meunier (Lab. de Phys. Moleculaire, CNRS, Reims, France).
Planet. & Space Sci. (GB), vol.31, no.7, p.731-3 (July 1983).
Trace species have been measured in June 1981, at the 'Observatoire de Haute-Provence' Chiran station, 1905 m high, with a ground based high resolution IR spectrometer using the Sun as a source. Column abundance amounts are given for methane, formaldehyde, hydrogen chloride and hydrogen fluoride. (6 refs.)

104515 Total ozone intercomparison measurements made with a scanning filter photometer. W.A.Matthews (Max-Planck-Inst. fur Aeronomie, Katlenburg-Lindau, Germany).
Planet. & Space Sci. (GB), vol.31, no.7, p.735-6 (July 1983).
A scanning filter photometer using narrow band interference filters for ozone solar absorption studies was installed on Mt Chiran Observatory (1905 m high, 43.9°N, 6.2°E) of the 'Observatoire de Haute-Provence' for the initial part of the intercomparison campaign. The total ozone data obtained agreed to within 2% with the Dobson spectrophotometer at the same site. A sample of the data obtained on one of the intercomparison days is presented. (3 refs.)

104516 Measurements of the vertical distribution of ozone by ground-based microwave techniques at the Bordeaux Observatory during the June 1981 Intercomparison Campaign. J.De La Noe, A.Baudry, M.Perault (Obs. de Bordeaux, Floirac, France), P.Dierich, N.Monnanteuil, J.M.Colmont.
Planet. & Space Sci. (GB), vol.31, no.7, p.737-41 (July 1983).
Spectra of the ozone emission line at 110.832 GHz were obtained by a ground-based technique using radio microwaves at the Bordeaux Observatory, France during the Intercomparison Ozone Campaign on 19 and 26 June 1981. From the spectra, it is possible to obtain altitude profiles of the ozone concentration by a model-fitting computation method which is briefly described. The resulting profiles are given, which can be compared with other observations in the same altitude range. (9 refs.)

104517 Measurement of the vertical ozone distribution by means of an in situ gas phase chemiluminescence ozonometer during the Intercomparison Ozone Campaign, Gap, France, June 1981. P.Aimedieu (CNRS, Verrieres-le-Buisson, France).
Planet. & Space Sci. (GB), vol.31, no.7, p.743-8 (July 1983).
Two vertical ozone profiles have been obtained above Gap (France), with an instrument using a gas phase chemiluminescence technique. Data are given for each 0.5 km. The absolute uncertainty on the measurements increase with altitude from 8% of mixing ratio at 16 km to, at most, 15% at 38 km. Uncertainty analysis leads to an incompressible 6%. The integrated column content between 16 km and flight ceiling is also given. (12 refs.)

104518 GSFC optical ozonesonde results during the Gap, France, intercomparisons, June 1981. A.J.Krueger (NASA/Goddard Space Flight Centre, Greenbelt, MD, USA), P.Simeth, C.A.Fry, K.Tewari.
Planet. & Space Sci. (GB), vol.31, no.7, p.749-59 (July 1983).
A GSFC Super Loki optical ozonesonde instrument was flown as part of the ozone sensor intercomparison balloon campaign at Gap, France, in June 1981. A primary objective was to confirm biases between external absorption techniques, such as the GSFC sonde, and in situ techniques, which include ECC, Mast-Brewer, and DASIBI sondes. The total ozone derived by integrating the optical ozonesonde and ECC profiles is within 2% of the Chiran Dobson Spectrophotometer observation based on a pre-campaign calibration but is 9% greater than the amount derived using a post-campaign calibration. (9 refs.)

104519 NASA-JSC measurements during 'La Campagne d'Intercomparaison d'Ozonometres', GAP, France, June 1981. D.E.Robbins (NASA-Johnson Space Center, Houston, TX, USA).
Planet. & Space Sci. (GB), vol.31, no.7, p.761-5 (July 1983).
Measurements made by the NASA-JSC ozone instrument during the ozone intercomparison campaign from Gap, France during June 1981 are reported. Two flights were made on board the large balloon platform with other instruments using different techniques. The NASA-JSC instrument employs UV absorption photometry to obtain in situ results. Concentration (molecules cm^{-3}) and mixing ratio (pp mV) profiles are given for altitudes from 16 km to float altitudes of 32 and 39 km, respectively for the two flights. A measure of the total column content of ozone was obtained. (1 ref.)

104520 Stratospheric ozone measurements by solar ultraviolet absorption. S.Roeland, C.Lippens, P.C.Simon (Inst. d'Aeronomie Spatiale de Belgique, Bruxelles, Belgique).
Planet. & Space Sci. (GB), vol.31, no.7, p.767-72 (July 1983).
Vertical distributions of ozone in the stratosphere have been determined by means of a UV differential absorption technique using the Sun as a source. The filter radiometer and the data processing are described. Results obtained between altitudes of 22 and 32 km during the Intercomparison Ozone Campaign held in France in June 1981 are presented and discussed. (8 refs.)

104521 Nimbus 7 Total Ozone Mapping Spectrometer (TOMS) data during the GAP, France, ozone intercomparisons of June 1981. A.J.Krueger (NASA/Goddard Space Flight Center, Greenbelt, MD, USA).
Planet. & Space Sci. (GB), vol.31, no.7, p.773-7 (July 1983).
The Nimbus 7 Total Ozone Mapping Spectrometer data over Europe have been specially processed for the 2 days of the ozone sensor intercomparison balloon campaign in June 1981 at Gap, France. The 19 June TOMS map shows an elongated ozone maximum (~400 DU) extending in a NW-SE direction across central Europe and an ozone minimum (300 DU) in the central Atlantic. On 26 June a much smaller ozone maximum (400 DU) is centred in northern France with its main axis running in a SW-NE direction. (4 refs.)

104522 Total ozone measurements derived from TOVS radiances. S.Muller, F.R.Cayla (Etablissement d'Etudes et de Recherches Meteorologiques, Meteorologie Nationale, Boulogne, France).
Planet. & Space Sci. (GB), vol.31, no.7, p.779-85 (July 1983).
A new method of total ozone retrieval from IR satellite data (NOAA6) is presented. It uses ozone transmittance as a predictor of total ozone. Ozone transmittance at 9.6 μm is deduced from radiance at 9.6 μm surface temperature measured at 11 μm, and ozone mean temperature estimated from several channels (among them 9.6 μm) by the radiative transfer equation. A statistical analysis of the retrieved ozone field and a comparison with ground based measurements show that the SE is less than 5% for the considered data set. (10 refs.)

104523 Measurements of total ozone: intercomparison of data from a variety of instruments, June 1981. A.Matthews (Max-Planck-Inst. fur Aeronomie, Katlenburg-Lindau, Germany), P.Marche.
Planet. & Space Sci. (GB), vol.31, no.7, p.787-90 (July 1983).
The total ozone data obtained over southern France from a variety of instruments during the Intercomparison Campaign of June 1981 are presented and intercompared. All the instruments intercompared produced a self-consistent data set in terms of the variations that occurred during the intercomparison period and a discussion of the differences in the absolute values measured is given. (13 refs.)

104524 Measurements of the ozone vertical distribution (0-25 km): comparison of various instruments, Gap—Observatoire de Haute-Provence, June 1981. G.Megie, J.Pelon (CNRS, Verrieres-le-Buisson, France).
Planet. & Space Sci. (GB), vol.31, no.7, p.791-9 (July 1983).
A tentative comparison is made between the various instruments operated at Gap and the Observatoire de Haute-Provence to measure the ozone vertical distribution up to 25 km during the Intercomparison Ozone Campaign. This includes comparison of the three ozonosondes carried on the same payload during the stratospheric open air balloon flights on 19 June and 25/26 June 1981, comparison between Brewer Mast sondes and electrochemical concentration cells on 19 and 26 June. A specific comparison has been made between a ground-based lidar and ECC sondes launched at the same location on 20/21 June 1981. (7 refs.)

104525 Ozone profile intercomparison based on simultaneous observations between 20 and 40 km. P.Aimedieu, A.J.Krueger, D.E.Robbins, P.C.Simon (CNRS, Verrieres-le-Buisson, France).
Planet. & Space Sci. (GB), vol.31, no.7, p.801-7 (July 1983).
The vertical distribution of stratospheric ozone has been simultaneously measured by means of five different instruments carried on the same balloon payload. The launches were performed from Gap during the intercomparison campaign conducted in June 1981 in southern France. Data obtained between altitudes of 20 and 40 km are compared and discussed. Vertical profiles deduced from Electrochemical Concentration Cell sondes launched from the same location by small balloons and from short Umkehr measurements made at Mt. Chiran (France) are also included. Systematic differences of the order of 20% between ozone profiles deduced from solar UV absorption and in situ techniques are found. (11 refs.)

104526 Comparison of ozone vertical distributions measured by different techniques at mesospheric altitudes. N.Monnanteuil, J.De La Noe, P.Marche (Univ. des Sci. et Techniques de Lille, Villeneuve d'Ascq, France).
Planet. & Space Sci. (GB), vol.31, no.7, p.809-10 (July 1983).
The ozone vertical profiles obtained by a microwave technique at the Bordeaux Observatory and by a short Umkehr method at the Chiran station of the Observatoire de Haute-Provence, on 19 June 1981 are compared. There is a good agreement between the results obtained by both methods in spite of the distance between both sites. (4 refs.)

104527 A statewide screening for acid rainfall in Iowa. J.O.Kennedy, A.E.Granston,Jr., R.C.Splinter (Univ. Hygienic Lab., Univ. of Iowa, Iowa City, IA, USA).
Proc. Iowa Acad. Sci. (USA), vol.90, no.2, p.41-3 (June 1983).
From April through October 1980, a statewide screening for acid rainfall was conducted in Iowa. Ninety-seven National Weather Service observers were provided with pH color-indicating strips and measured and recorded the pH of every precipitation sample. Results of the screening indicate pH values of rainfall ranged from a low of 4.0 to a high of 7.0. The pH values 5.7 and 5.9 were observed most often and represented 66% of the 4,197 values measured. Approximately 80% of the rainfall pH values fell in the 5.7 to 7.0 range and 20% in the acid rainfall range (5.6 or less). (5 refs.)

104528 A variability index of wind direction from daily records. F.Valero, E.Hernandez (Catedra de Fisica del Aire, Facultad de Ciencias Fisicas, Univ. Complutense, Madrid, Spain).
Rev. Geofis. (Spain), vol.38, no.2, p.113-19 (1982). In Spanish.
A consistency index of daily direction has been computed by averaging hourly values which were obtained discretising the continuous wind direction records throughout. Such an index has been introduced in order to characterise, with an accuracy higher than that usually employed in wind roses, the direction where winds come from. It has been seen that, when applied to iron aerosol concentrations, it can show effects different from those found without applying a selective criterion for wind direction consistency. (3 refs.)

104529 Climatic anomalies in the tropical Pacific Ocean and corn yields in the United States. P.Handler, E.Handler (Coordinated Sci. Lab., Univ. of Illinois, Urbana, IL, USA).
Science (USA), vol.220, no.4602, p.1155-6 (10 June 1983).
The association between climatic anomalies in the tropical Pacific Ocean, often called El Nino events, and annual corn production in the United States was investigated. Temperature and atmospheric pressure in parts of the United States have been correlated with El Nino events. This research suggests that in years in which an El Nino event causes surface temperatures in the tropical Pacific to become warmer than normal, there is a higher probability of an above-average corn crop in the United States. For years when sea surface temperatures are average or cool, no significant association is observed. (13 refs.)

104530 Sighting of El Chichon sulfur dioxide clouds with the Nimbus 7 total ozone mapping spectrometer. A.J.Krueger (NASA Goddard Space Flight Center, Greenbelt, MD, USA).
Science (USA), vol.220, no.4604, p.1377-9 (24 June 1983).
The eruptions of El Chichon volcano on 28 March and 3 and 4 April 1982 were observed by the Nimbus 7 total ozone mapping spectrometer due to strong absorption by volcanic gases at 312.5 and 317.5 nm. These ultraviolet pictures permit a measurement of the volume, dispersion, and drift of volcanic gas clouds. A preliminary estimate of the mass of sulfur dioxide deposited in the stratosphere by the large eruptions on 3 and 4 April is 3.3×10^{6} tons. (5 refs.)

104531 Solar climates of the United States based on long-term monthly averaged daily insolation values. R.C.Balling,Jr., M.J.Vojtesak (Dept. of Geography, Univ. of Nebraska, Lincoln, NE, USA).
Sol. Energy (USA), vol.31, no.3, p.283-91 (1983).
The paper develops and analyses an objective classification and regionalization scheme of solar climates for the conterminous United States. The use of principal components analysis and Euclidean distance cluster analysis generates 18 solar climatic types based upon long-term mean monthly data. Two of the resultant regions contain 76 per cent of the 221 stations used in this study. The results are shown to vary significantly from the previously published maps of solar climates in the United States. (42 refs.)

104532 Harmonic analysis of monthly insolation levels in the United States. R.C.Balling,Jr. (Dept. of Geography, Univ. of Nebraska, Lincoln, NE, USA).
Sol. Energy (USA), vol.31, no.3, p.293-8 (1983).
The purpose of this paper is to analyze independent temporal variance structures in long-term mean monthly insolation data for the conterminous United States. Harmonic analysis is applied to the annual march of insolation levels at 221 stations, and nearly all variance in the data is explained by one harmonic fit. The statistics from the harmonic analysis display coherent spatial patterns that reveal the extent to which radiation levels are affected by synoptic climatological phenomena. The results suggest a method for accurately interpolating insolation estimates using as few as three parameters. (46 refs.)

104533 Simple models for hourly to daily radiation ratio correlations. T.A.Newell (Dept. of Mech. & Industrial Engng., Univ. of Illinois, Urbana, IL, USA).
Sol. Energy (USA), vol.31, no.3, p.339-42 (1983).
Simple models are derived for expressing hourly to daily ratios of both total and diffuse radiation on a horizontal surface. These models can be useful for use with simplified solar design methods. An important physical condition is the requirement that the ratios integrated over a daylength equal unity. That is, energy must be conserved. The models presented comply with this requirement. Deviation of simplified model results occur in the daily distribution of radiation fractions. The effects of these deviations related to solar system simulation are discussed. (5 refs.)

104534 Perturbations in the two-year rhythm of global atmospheric processes. E.B.Gledzer (Inst. of Atmospheric Phys., USSR).
Sov. Meteorol. & Hydrol. (USA), no.6, p.10-13 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.6, p.16-19 (1982).
The main features of the biennial rhythm in the atmosphere are presented. An interpretation is given of the data on the rhythm in the zonal windspeed in the lower equatorial stratosphere and on the height differences of the 10 mb isobalic surface in two adjacent years (for January in the northern hemisphere) in terms of a cycle with a period of two years and perturbations in the phase of the cycle. The years when perturbations occur are indicated along with the types. (13 refs.)

104535 Estimation of heat transfer between the sea and atmosphere in the intratropical convergence zone. A.A.Sizov (Marine Hydrophys. Inst., USSR).
Sov. Meteorol. & Hydrol. (USA), no.6, p.14-19 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.6, p.20-6 (1982).
Data obtained in the tropical Atlantic under the GATE and FGGE programs are used in analyzing the large-scale thermal interaction of the boundary layers of the atmosphere and ocean in the region of ITCZ. It is concluded that there is a considerable flux of heat into the atmosphere at the south margin of the intertrade counter current. The amplitude of the approximately two-month fluctuation in the heat balance at the surface and in the heat content of the upper quasihomogeneous layer of the ocean in the ITCZ region is estimated. (10 refs.)

104536 Estimation of the temperature at the upper boundary of the clouds over the oceans. O.Avaste, O.Kyarner, S.Keevallik (Inst. of Astrophys. & Atmospheric Phys., Acad. of Sci., Estonian SSR).
Sov. Meteorol. & Hydrol. (USA), no.6, p.41-5 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.6, p.54-9 (1982).
The estimates of Avaste et al. (1981) are used for the amounts of clouds together with climatological mean temperatures for the surface of the ocean and mean monthly fluxes of outgoing radiation. It is assumed that the outgoing flux from the Earth-atmosphere system is proportional to the radiation from a black body with the temperatures of the surface of the oceans and of the upper boundary of the clouds, and corresponding estimates are made of the mean monthly zonal temperatures of the cloud top over the ocean in the belt from 30°N to 30°S. (10 refs.)

104537 The distributions of the total ozone content over the oceans. G.K.Gushchin (Karadag Actinometric Obs., USSR).
Sov. Meteorol. & Hydrol. (USA), no.6, p.46-52 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.6, p.60-7 (1982).
Observations from ships have given mean distributions of the total ozone TO above the oceans, together with the first data on the seasonal variations in the TO distribution, including differences from the distributions on land. (15 refs.)

104538 Atmospheric perturbations in the region of the intratropical convergence zone during GATE. N.A.Romanova, Yu.A.Romanov (Inst. of Oceanology, USSR).
Sov. Meteorol. & Hydrol. (USA), no.6, p.77-81 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.6, p.99-104 (1982).
GATE data are used in examining the changes in wind and sea-level atmospheric pressure when cyclonic perturbations pass over the east of the tropical zone in the North Atlantic. (12 refs.)

104539 A two-dimensional nonstationary microphysical model for low clouds and advective-radiation fogs. V.I.Khvorost'yanov (Central Aerological Obs., USSR).
Sov. Meteorol. & Hydrol. (USA), no.7, p.10-20 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.7, p.16-28 (1982).
A two-dimensional nonstationary model has been constructed for low clouds and fogs, which includes advective transformation, heat transfer by radiation, heat and water exchange with the underlying surface, and microphysical processes. (20 refs.)

104540 An axially symmetrical numerical model for a tropical cyclone. V.E.Zakharov, Yu.T.Sapronov (Inst. of Experimental Meteorology, USSR).
Sov. Meteorol. & Hydrol. (USA), no.7, p.21-6 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.7, p.29-36 (1982).
The model is based on a second-order Lax-Wendroff difference scheme. This avoids artificial-viscosity effects to a considerable extent and permits experiments on the effects of turbulent viscosity on the evolution of a tropical cyclone. (8 refs.)

104541 Dynamic velocity and tangential stress at the surface of the world ocean. N.Z.Ariel, L.A.Strokina (Principal Geophys. Obs., State Hydrological Inst., USSR).
Sov. Meteorol. & Hydrol. (USA), no.7, p.45-9 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.7, p.59-64 (1982).
Use is made of the relationship between the resistance coefficient of the sea surface and wind speed with neutral stratification and also of data on the wind speed probability to calculate the dynamic velocity u_* and the tangential stress τ in the bottom layer of air over the Atlantic, Indian, and Pacific Oceans. Maps have been constructed for the distribution of u_* over the oceans of the world for the winter and summer seasons. The map data have been used to determine the mean zonal values of u_* and τ for individual oceans and for the oceans as a whole. (11 refs.)

104542 Microphysical studies on the origin and growth of hail. V.G.Khorguani (High Mountain Geophys. Inst., USSR).
Sov. Meteorol. & Hydrol. (USA), no.8, p.94-102 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.8, p.118-25 (1982).
Experimental results are presented on the nature of hail nuclei and the role of ice-forming nuclei. It is shown that the hail size distribution is best described by a log-normal curve, while the concentration has an inverse power-law relationship to the size. The trapping coefficient and the thermal conditions for hailstone growth are considered for a supercooled cloud. (28 refs.)

104543 Unusually severe rainstorm in Moscow on 7 July 1981. A.A.Akulinicheva, N.N.Fedorova, I.A.Koroleva (Hydrometeorological Res. Center, USSR).
Sov. Meteorol. & Hydrol. (USA), no.9, p.36-40 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.9, p.49-55 (1982).
The aerosynoptic evidence and data on cloud cover from satellites and meteorological radars have been examined for an unusually severe rainstorm in Moscow. An attempt is made to explain the reasons for the formation of a thick cumulonimbus cloud using actual pluviographic data on the intensity and duration of the rain. An estimate is made of the possible contribution from orographic vertical movements produced by the elevated areas in Moscow for certain wind directions. (5 refs.)

104544 Effect of processes in the surface boundary layer on the formation of large-scale climatic characteristics. V.P.Meleshko, B.E.Shneerov, A.S.Dubov, L.N.Magazenkov (Main Geophys. Obs., USSR).
Sov. Meteorol. & Hydrol. (USA), no.5, p.1-11 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.5, p.5-18 (1982).
The sensitivity of a calculated climate to methods of parameterization of a turbulent regime in the surface boundary layer taken into account in a model of the atmosphere is investigated. Numerical experiments are carried out with an atmospheric general circulation model in which two schemes of the boundary layer are used: the semiempirical scheme proposed by Deardorff (1972) and a scheme based on the use of similarity theory hypotheses. The total amount of heat entering the atmosphere from the under-lying surface over continents and oceans is considered. The redistribution of this heat between sensible and latent forms has a substantial effect on the formation of circulation, thermal regime, and water-vapour cycle of the atmosphere. (23 refs.)

104545 Wave motions at low latitudes. M.R.Radzhapov (Tashkent Polytech. Inst., Tashkent, USSR).
Sov. Meteorol. & Hydrol. (USA), no.5, p.22-30 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.5, p.31-41 (1982).
Three variants of wave solutions of linear equations of dynamics of the atmosphere at low latitudes are examined. The variants differ in the methods of transforming the initial system of equations whose coefficients substantially depend on latitude. It is shown that consideration of the vertical velocity limits the number of wave solutions for long waves to $n=5$. (5 refs.)

104546 Indication of the origin and evolution of radiation fogs by means of lidar. A.E.Tyabotov, A.P.Tikhonov (Central Aerological Obs., USSR).
Sov. Meteorol. & Hydrol. (USA), no.5, p.31-5 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.5, p.42-7 (1982).
A method of determining the predictors of the formation and dissipation of radiation fogs by means of lidars is presented and the possibilities of its practical use are evaluated. It is shown experimentally that the ratio of the scattering coefficients at wavelengths 1.06 and 0.53 μm and the degree of polarization of the lidar radiation backscattered by atmospheric aerosol differ from the values of these characteristics observed during formation and dissipation of fog. (6 refs.)

104547 Effect of mixing on the formation of ice nuclei following cloud seeding with dry ice. P.M.Mushenko (Leningrad Hydrometeorological Inst., Leningrad, USSR).
Sov. Meteorol. & Hydrol. (USA), no.5, p.85-8 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.5, p.103-6 (1982).
Previously the effect of mixing of the evaporation products of CO_2 and air was not taken into account when estimating the number of ice nuclei formed near CO_2 particles. It is shown that the results of calculating the thermodynamic probability of formation of ice nuclei with and without consideration of this effect can differ by several orders of magnitude. Consideration of this circumstance to some extent explains the existing difference between experimental and calculated values of the number of ice particles formed as a result of the effect of dry ice on supercooled clouds and fogs. (7 refs.)

104548 Extreme wind gust speeds in Australia, excluding tropical cyclones. C.M.L.Dorman.
Trans. Inst. Eng. Aust. Civ. Eng. (Australia), vol.CE25, no.2, p.92-106 (May 1983).
A new point of view is derived for Australian wind speeds, in areas not subject to tropical cyclones, which have previously been considered to be properly represented as a N-year wind speed for each station. Attempts to find reduced sampling error by considering daily rather than annual maxima are unsuccessful, and application of the James-Stein estimator, using known sampling error, leads to the conclusion that there is no meaningful difference in extreme wind speeds between one station and another. It is shown that a single Fisher-Tippett Type 1 distribution gives an adequate description of gust speeds for all return periods from 2 days to 2000 years. (16 refs.)

104549 New Zealand—first impressions of a meteorologist and glider pilot. M.P.Garrod (Meteorological Office, Bracknell, England).
Weather (GB), vol.38, no.7, p.194-200 (July 1983).
Discusses the wave and wind formations in the Mt. Cook region of New Zealand from the point of view of a glider pilot and meteorologist. (no refs.)

104550 Circulation type and the spatial distribution of precipitation over central, eastern and southern England. II. J.Stone (West London Inst., London, England).
Weather (GB), vol.38, no.7, p.200-5 (July 1983).
For pt.I see ibid., vol.38, no.6, p.173-7 (1983). In part I, an introduction was given to the study of the relationships between circulation type and spatial distribution of rainfall in central, eastern and southern England, based on data for the period 1961-1975. The distribution for anticyclonic, westerly,

north-westerly, northerly and north-easterly types were covered. In part II the author discusses the rainfall patterns associated with the remaining types, and draws conclusions relating to the whole study. The list of references includes publications referred to in part I. (17 refs.)

104551 New UK 20th century low pressure extreme. S.D.Burt (Meteorological Office, Bracknell, England).
Weather (GB), vol.38, no.7, p.209-13 (July 1983).
During the early hours of the morning of 20 December 1982, the passage of a very intense depression across the north of the British Isles resulted in what would appear to be the lowest atmospheric pressure recorded at any British station since 1886. At 0020 GMT the sea-level pressure at Stornoway in the Hebrides stood at the exceptionally low level of 937.6 mbar, and there is evidence fron the existing pressure gradients to suppose that the pressure on the western side of the Isle of Lewis and at the island of Sule Skerry off Scotland's north coast may have fallen as low as 936 mbar. The synoptic situation is discussed. (1 ref.)

104552 Automobile response to turbulent cross-winds. R.J.Hawks (Tri-State Univ., Angola, IN, USA).
23rd Midwest Symposium on Circuits and Systems, Toledo, OH, USA, 4-5 Aug. 1980 (North Hollywood, CA, USA: Western Periodicals 1980), p.355-9
A linearized three-degree-of-freedom model is used to calculate the power spectral density of the response of an automotive vehicle to a turbulent cross-wind gust. It is found that most of the response occurs at long wavelengths where the turbulent gust energy is small. For some vehicles there may also be significant side-slip and roll responses at wavelengths less than one wheelbase. (9 refs.)

Analysis and Interpretation of Atmospheric CO_2 Data .... See Entry 98631

Proceedings zum Kolloquium WOPHYS '82. Meteorologische Probleme der Wolkenphysik und ihre theoretische und instrumentelle Bearbeitung (Proceedings of Colloquium WOPHYS ' 82. Cloud Physics Meteorological Problems Theoretical Instrumentational Workings) .... See Entry 98638

Statistical comparison of models for estimating solar radiation on inclined surfaces .... See Entry 103656

Air quality network design for Saudi Arabia using long-range transport model .... See Entry 103746

Analysis of the error associated with grid representation of point sources .... See Entry 103747

Intermediate-range grid model for atmospheric sulfur dioxide and sulfate concentrations and depositions .... See Entry 103748

Mathematical modeling of the formation and transport of ammonium nitrate aerosol .... See Entry 103749

Prediction of cloud effects in chimney plumes .... See Entry 103752

Processing the turbulent diffusion problem in the atmospheric boundary layer by use of stochastic differential equations .... See Entry 103753

Tracing bomb ^{14}C in the atmosphere 1962-1980 .... See Entry 103756

Uranium and plutonium isotopes in the atmosphere .... See Entry 103757

Soot carbon and excess fine potassium: long-range transport of combustion-derived aerosols .... See Entry 103758

Release of man-made krypton 85 to the atmosphere .... See Entry 103759

The dispersion of pollution particle coordinates in the ground layer of the atmosphere .... See Entry 103760

Propagation of a heavy pollutant in the boundary layer of the atmosphere with nonstationary penetrating convection .... See Entry 103761

Use of the method of isotope glaciology for studying nuclear explosion products in Antarctica .... See Entry 103763

Electric potential gradient under conditions of industrial air pollution .... See Entry 103764

Atmospheric diffusion experiments performed in October 1980 at the Turbigo ENEL power plant .... See Entry 103765

Eye-safe tracking of oil fog plumes by UV lidar .... See Entry 103770

Determination of ethylene and other reactive hydrocarbons in the atmospheric air at Trombay, Bombay by gas chromatography using a chemiluminescent detector .... See Entry 103771

Structure of ELF electromagnetic fields in the Arctic Ocean .... See Entry 104189

Exhalation of radon and thoron: the question of the effect of thermal gradients in soil .... See Entry 104362

Air and soil temperatures during an intense freeze in Shropshire .... See Entry 104364

A simple dynamic stochastic model for major anomalies in surface water temperature in the oceans .... See Entry 104390

Uptake of excess CO_2 by an Outcrop-diffusion model of the ocean .... See Entry 104398

Methyl halides in and over the eastern Pacific (40°N-32°S) .... See Entry 104399

Gas exchange in the Pee Dee River based on ^{222}Rn evasion .... See Entry 104412

An analysis of periodicities in the 1470 to 1974 Beijing precipitation record .... See Entry 104554

Albedo observations of the Earth's surface for climate research .... See Entry 104555

The effects of cloud cover on the energy balance of a climatic system .... See Entry 104556

Changes in global water exchange .... See Entry 104557

AFGL atmospheric absorption line parameters compilation: 1982 edition .... See Entry 104558

Effects of the El Chichon volcanic cloud in the stratosphere on the intensity of light from the sky .... See Entry 104559

Influence of atmospheric uncertainties on predicting infrared atmospheric attenuation and radiance .... See Entry 104561

Atmospheric transmittance derived from radiance measurements .... See Entry 104563

Telluric spectra from 4690 to 5525 Å in a humid atmosphere .... See Entry 104564

Measuring the climate from space .... See Entry 104569

The Intercomparison Ozone Campaign held in France in June 1981: description of the campaign .... See Entry 104570

Atmospheric water vapor differential absorption measurements on vertical paths with a CO_2 lidar .... See Entry 104571

A separator for obtaining samples of cloud water in aircraft .... See Entry 104574

Experience in operating high-sensitivity humidity sondes using a miniature humidity sensor with barium fluoride—a comparison with a Lyman-α-hygrometer .... See Entry 104577

Proceedings of Workshop I of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 104583

Correlative studies of satellite ozone sensor measurements .... See Entry 104597

An aerosol and gas sampling apparatus for remote observatory use .... See Entry 104602

Specifications for a probe to measure CO_2 fluxes in the atmosphere .... See Entry 104605

On the measurement of total cloud water content with the Ruskin probe: advantages and limitations .... See Entry 104606

A review of Seasat scatterometer data .... See Entry 104615

Contribution to the metrological study of radiometers. A radiometer test-chamber .... See Entry 104619

A tilting bucket automatic rain-gauge .... See Entry 104621

Combined sounding of the atmosphere by aerosol and Raman lidars .... See Entry 104626

NEXRAD—weather radar for the future .... See Entry 104629

Coordinated radar and aircraft observation of turbulence .... See Entry 104630

Latest developments in Doppler weather radar .... See Entry 104631

92.60S Climatology

104553 A warm, equable Cretaceous: the nature of the problem. E.J.Barron.
Earth-Sci. Rev. (Netherlands), vol.19, no.4, p.302-38 (Aug. 1983).
The nature of the problem of warm equable paleoclimates is defined by investigating the mid-Cretaceous period. The problem consists of three components: defining precisely the climatic state during any specified interval of geologic time; specifying the external climatic forcing factors which may have been important; and understanding the climatic response to any specific modifying influence. These components are characterized by limitations of critical importance in understanding paleoclimates. The nature of the problem of a warm Cretaceous is defined both qualitatively and quantitatively within these limits. (110 refs.)

104554 An analysis of periodicities in the 1470 to 1974 Beijing precipitation record. S.Hameed, W.M.Yeh (Lab. for Planetary Atmospheres Res., State Univ. of New York, Stony Brook, NY, USA), M.T.Li, R.D.Cess, W.C.Wang.
Geophys. Res. Lett. (USA), vol.10, no.6, p.439-9 (June 1983).
An analysis of a time series consisting of an annual index of dryness/wetness for the years 1470 to 1974 Beijing, China, is presented. Its power spectrum shows that dominant cycles occur with long periods of the order of 80 years. Cycles with periods of 11 and 22 years are weak or non-existent, but a significant signal at 18.7 years (which is also the period of a component of the lunar tide generating force) is detected. The long term variations in Beijing precipitation appear to lag long term (Gleissberg) variations in solar activity by nearly 75 years. A pattern which spans nearly 150 years in the Beijing record is found to be repeated with notable similarity. (16 refs.)

104555 Albedo observations of the Earth's surface for climate research. A.Henderson-Sellers, M.F.Wilson (Dept. of Geography, Univ. of Liverpool, Liverpool, England).
Philos. Trans. R. Soc. London A (GB), vol.309, no.1508, p.287-96 (1983).
The primary input of energy to the Earth's climate system occurs at the surface and can be highly sensitive to the surface albedo. It is very difficult to establish an agreed global data set with which to initiate comparative climatic simulations. Albedo observations must be spectrally resolved because reflexion of solar radiation is a strong function of wavelength and incident and reflected beams are modified by the atmosphere. Parametrization of system albedos in energy-balance models draws on satellite data. The establishment of a surface albedo data set generally follows one of two approaches: geographical categorization or remote monitoring. This paper reviews the ways in which remotely derived albedo measurements are used now and may, in the future, be improved for climate research. (67 refs.)

104556 The effects of cloud cover on the energy balance of a climatic system. I.I.Mokhov (Inst. of Atmospheric Phys., USSR).
Sov. Meteorol. & Hydrol. (USA), no.8, p.8-12 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.8, p.134-18 (1982).
Empirical data are used to determine the effects of changes in cloud cover on the radiation balance in the upper boundary of the atmosphere. It is found that for the Northern Hemisphere as a whole any change has little effect on the balance. Various data sources on the cloud cover are compared. (23 refs.)

104557 Changes in global water exchange. R.K.Klige (Inst. of Water Problems, USSR).
Sov. Meteorol. & Hydrol. (USA), no.5, p.12-21 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.5, p.19-30 (1982).
An investigation of long-term changes in individual components of the global water balance showed that they are determined mainly by a change in global thermal conditions at the Earth's surface. As a result of contemporary climatic changes and water-exchange processes gradual drying of the continents and replenishment of the World Ocean are occurring. (31 refs.)

Solar climates of the United States based on long-term monthly averaged daily insolation values .... See Entry 104531

Effect of processes in the surface boundary layer on the formation of large-scale climatic characteristics .... See Entry 104544

Measuring the climate from space .... See Entry 104569

Observations of sea-surface temperature for climate research .... See Entry 104614

92.65 ATMOSPHERIC OPTICS

(see also 42.00 Optics)

104558 AFGL atmospheric absorption line parameters compilation: 1982 edition. L.S.Rothman (US Air Force Geophys. Lab., Hanscom Air Force Base, MA, USA), R.R.Gamache, A.Barbe, A.Goldman, J.R.Gillis, L.R.Brown, R.A.Toth, J.-M.Flaud, C.Camy-Peyret.
Appl. Opt. (USA), vol.22, no.15, p.2247-56 (1 Aug. 1983).
The latest edition of the AFGL atmospheric absorption line parameters compilation for the seven most active infrared terrestrial absorbers is described. Major modifications to the atlas for this edition include updating of water-vapor parameters from 0 to 4300 cm^{-1}, improvements to line positions for carbon dioxide, substantial modifications to the ozone bands in the middle to

far infrared, and improvements to the 7- and 2.3-μm bands of methane. The atlas now contains ~181000 rotation and vibration-rotation transitions between 0 and 17900 cm^{-1}. The sources of the absorption parameters are summarized. (80 refs.)

104559 Effects of the El Chichon volcanic cloud in the stratosphere on the intensity of light from the sky. K.L.Coulson (Mauna Loa Obs., NOAA ERL, Hilo, HI, USA).
Appl. Opt. (USA), vol.22, no.15, p.2265-71 (1 Aug. 1983).
This is the second of two papers dealing with the effects of volcanic debris from the eruption of El Chichon on light from the sunlit sky. The polarization of skylight was considered in the first of the two, whereas this one is devoted to skylight intensity. It is shown here that the magnitude of the skylight intensity is modifed very significantly from its clear sky value by the volcanic cloud, as is its change with solar depression angle during twilight and its distribution over the sky during the day. Emphasis is on measurements at a wavelength of 0.07 μm. Generally the volcanic cloud produces a diminution of zenith intensity during twilight with a considerable enhancement of intensity over the sky throughout the main part of the day. The solar aureole is not as sharp as it is in normally clear conditions, but the volcanic cloud causes a very diffuse type of aureole which covers a large portion of the sky. The preferential scattering of the longer wavelengths of sunlight, which is made evident by brilliant red and yellow colors in the sunrise period, causes a pronounced change of longwave/shortwave color ratios during twilight from their values in clear atmospheric conditions. The combination of intensity data shown here with polarization data in the previous paper should give a relatively complete picture of the effects of volcanic debris on solar radiation in the atmosphere and be useful in the verification of radiative models of atmospheric turbidity. (24 refs.)

104560 Problems associated with atmospheric visibility measurement techniques. R.W.Johnson, W.S.Hering (Visibility Lab., Univ. of California, San Diego, CA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.356, p.2-8 (1983). (Field Measurement and Calibration Using Electro-Optical Equipment: Issues and Requirements, San Diego, CA, USA, 24-25 Aug. 1982).
Presents a brief review of the psychophysical relationships which influence an observer's ability to discern barely perceptible changes in apparent contrast with comments related to meteorological observations and instrument calibrations. Examples of how uncertainties in the specification of the atmospheric optical state might influence slant path contrast transmittances are illustrated. (12 refs.)

104561 Influence of atmospheric uncertainties on predicting infrared atmospheric attenuation and radiance. J.E.A.Selby (Res. & Dev. Center, Grumman Aerospace Corp., Bethpage, NY, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.356, p.20-5 (1983). (Field Measurement and Calibration Using Electro-Optical Equipment: Issues and Requirements, San Diego, CA, USA, 24-25 Aug. 1982).
An indication is given of the effect which variations in pressure, temperature, relative humidity, water content, aerosols, and gaseous concentrations have on the attenuation and thermal radiance of the atmosphere in the 2-14 μm region for both horizontal and slant paths. (9 refs.)

104562 Simulation studies and the need for field reflectance studies. M.J.Duggin (Coll. of Environmental Sci. & Forestry, State Univ. of New York, Syracuse, NY, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.356, p.150-7 (1983). (Field Measurement and Calibration Using Electro-Optical Equipment: Issues and Requirements, San Diego, CA, USA, 24-25 Aug. 1982).
There is a need to calibrate satellite data obtained at large polar (i.e. off-nadir) view angles for effects caused by scanner geometry and by the atmosphere. If such effects are not corrected for, then recorded radiance data will contain systematic and random errors which will make accurate target identification and quantification difficult. Adequate calibration of digital radiance data requires both an inductive analysis of digital satellite images and a deductive analysis based upon a priori simulation studies. The inputs to a simulation model (ground reflectance, atmospheric transmission and bandscatter) and their variability are dependent upon (for example) Sun-target-sensor geometry. There is a major need to make accurate ground reflectance measurements to provide calibration information on the anisotropy of ground reflectance. There is also a need to assess atmospheric transmission and backscatter from the image itself. A potential simple, inexpensive method for making ground reflectance measurements in the above context is discussed. (47 refs.)

104563 Atmospheric transmittance derived from radiance measurements. C.M.Randall (Chem. & Phys. Lab., Aerospace Corp., El Segundo, CA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.366, p.60-8 (1983). (Modern Utilization of Infrared Technology VIII, San Diego, CA, USA, 26-27 Aug. 1982).
Determination of the infrared irradiance caused by stars and other objects outside the Earth's atmosphere by means of sensors located within the atmosphere requires correction for atmospheric effects. Subtraction of the path radiance is often inherent in the sensor design. However, determination of the atmospheric transmittance is more difficult, frequently requiring auxiliary measurements of profiles of species concentration, temperature, and pressure along the optical path. A procedure has been developed for determining the atmospheric transmittance, without reference to atmospheric profiles, from the measured path radiance augmented by surface meteorological observations. The dependence of the effective atmospheric radiating temperature on elevation angle for a given sensor band can be described by a function of elevation angle in which the parameters are determined from surface observations. When the effective radiating temperature of the atmosphere is known, the transmittance is obtained from the emissivity defined by the ratio of the observed path radiance to the Planck function for the effective atmospheric temperature. This algorithm, which is useful only for clear conditions in the infrared spectral windows, has reproduced, in test situations, the transmittance computed with models such as LOWTRAN to within 10% for all portions of the sky with elevation angles greater than 10 deg. (26 refs.)

104564 Telluric spectra from 4690 to 5525 Å in a humid atmosphere. A.Rajaratnam, K.T.Lua (Dept. of Phys., Nat. Univ. of Singapore, Kent Ridge, Singapore).
J. Opt. Soc. Am. (USA), vol.73, no.8, p.999-11 (Aug. 1983).
Solar spectra in the region 4690 to 5525 Å have been taken with a 4.5-m high-resolution grating spectrograph for different solar zenith angles. Three-hundred and eighty-five telluric lines were measured, and their wavelengths, half-intensity widths, equivalent widths, and identifications are reported. (12 refs.)

104565 Variation of atmospheric optical depth for remote sensing radiance calculations. S.Aranuvachapun (Dept. of Oceanography, Naval Postgraduate School, Monterey, CA, USA).
Remote Sensing Environ. (USA), vol.13, no.2, p.131-47 (May 1983).
An analysis of the radiative transfer processes in the atmosphere suggests that the ratio between the diffuse radiance flux and the directly transmitted flux may be a useful parameter for investigating the variation of atmospheric optical depth. The radiative parameter is derived for an observer at the top of the atmosphere in the position of a satellite. One of the important variables required in the computations of the radiative parameter is the aerosol phase function which can be satisfactorily fitted by the two-term Henyey-Greenstein function. When the surface reflectance equals zero, representing the atmospheric radiance alone without any influence from an oceanic surface, the study shows that the variation of the optical depth is associated with the changing of aerosol size distribution. The optical depth increases with the presence of large aerosol particles. The results indicate that inhomogeneities in aerosol optical properties, such as the variation of the scattering phase function due to the changes in aerosol size distribution, can affect the magnitude of the optical depth. (16 refs.)

104566 Optimal detector of laser radiation pulses transmitted by a turbulent atmosphere. R.A.Kazaryan, A.V.Oganesyan (Inst. of Phys. Res., Acad. of Sci., Ashtarak, Armenian SSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.144-6 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.272-6 (Feb. 1983).
An analysis is made of the reception of optical signals transmitted by a turbulent atmosphere. A rule for optimal reception of such pulses is obtained in the case when the operation of an optical detector is limited by thermal noise. Numerical modeling on a computer is used to compare optimal and nonoptimal detectors. The results of such modeling a demonstrate that an optimal detector can ensure a much lower probability of false reception than a nonoptimal one. (11 refs.)

104567 Effects of the continental aerosol microstructure on radiation attenuation at 0.4-15 μm. O.A.Lipskaya, V.V.Smirnov (Inst. of Experimental Meteorology, USSR).
Sov. Meteorol. & Hydrol. (USA), no.7, p.27-31 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.7, p.37-41 (1982).
Measurements are reported on the dispersion of atmospheric aerosols of diameter 0.007-30 μm for ground layer air in anticyclones at the center of the European USSR, together with calculations on the attenuation at 0.3-15 μm wavelength. Approximate formulae are given for the size distributions at relative humidities of 40-95% for radiation mists and fogs. Restrictions on some optical models for the troposphere are considered. (17 refs.)

104568 The atmospheric transparency distribution. E.R.Milyutin, Yu.I.Yaremenko (Leningrad Electrochem. Communications Inst., Leningrad, USSR).
Sov. Meteorol. & Hydrol. (USA), no.9, p.83-5 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.9, p.108-10 (1982).
Data on visibility are used to determine the atmospheric transparency for the visible and near-IR. It is found that a modified truncated Weibull distribution is applicable for paths of length >5 km. (5 refs.)

Field Measurement and Calibration Using Electro-Optical Equipment: Issues and Requirements .... See Entry 98622

Modern Utilization of Infrared Technology VIII .... See Entry 98624

Point spread functions in imaging a Lambert surface from zenith through a thin scattering layer .... See Entry 104360

Correlation of optical propagation near the sea surface with bulk meteorological measurements .... See Entry 104436

Increasing backscattered light from the stratospheric aerosol layer after Mt. El Chicon eruption laser radar measurement at Nagoya (35°N, 137°E) .... See Entry 104466

Lidar- and balloon-borne particle counter comparisons following recent volcanic eruptions .... See Entry 104482

Resuspension of volcanic ash from Mount St. Helens .... See Entry 104499

Accelerated precipitation of water fogs due to acoustic action of a CO_2 laser pulse .... See Entry 104501

Global star radiation measurements on 6 August 1981. A day of midday darkness .... See Entry 104508

Total atmospheric ozone measured by ground based high resolution infrared spectra—comparison with Dobson measurements .... See Entry 104512

Tropospheric, stratospheric and mesospheric ozone observed using the Umkehr method .... See Entry 104513

Atmospheric trace species measured above Haute-Provence Observatory .... See Entry 104514

Total ozone intercomparison measurements made with a scanning filter photometer .... See Entry 104515

GSFC optical ozonesonde results during the Gap, France, intercomparisons, June 1981 .... See Entry 104518

NASA-JSC measurements during 'La Campagne d'Intercomparaison d'Ozonometres', GAP, France, June 1981 .... See Entry 104519

Stratospheric ozone measurements by solar ultraviolet absorption .... See Entry 104520

Total ozone measurements derived from TOVS radiances .... See Entry 104522

Sighting of El Chichon sulfur dioxide clouds with the Nimbus 7 total ozone mapping spectrometer .... See Entry 104530

Estimation of the temperature at the upper boundary of the clouds over the oceans .... See Entry 104536

Indication of the origin and evolution of radiation fogs by means of lidar .... See Entry 104546

Albedo observations of the Earth's surface for climate research .... See Entry 104555

Atmospheric water vapor differential absorption measurements on vertical paths with a CO_2 lidar .... See Entry 104571

Techniques for measuring radiance in sea and air .... See Entry 104573

Low resolution atmospheric measurements and data applications .... See Entry 104586

Field system for measurement of atmospheric propagation and radiant signatures .... See Entry 104587

Contribution to the metrological study of radiometers. A radiometer test-chamber .... See Entry 104619

Combined sounding of the atmosphere by aerosol and Raman lidars .... See Entry 104626

92.90 OTHER TOPICS IN HYDROSPHERIC AND ATMOSPHERIC GEOPHYSICS

104569 Measuring the climate from space. B.Burroughs. *New Sci. (GB)*, vol.99, no.1367, p.185-7 (21 July 1983).
Recent weather extremes have highlighted the role of the oceans in determining climate. Satellite observations provide a picture of changing sea surface temperatures, and hope of better forecasts. (no refs.)

Analysis and Interpretation of Atmospheric CO_2 Data ....See Entry 98631

Proceedings zum Kolloquium WOPHYS '82. Meteorologische Probleme der Wolkenphysik und ihre theoretische und instrumentelle Bearbeitung (Proceedings of Colloquium WOPHYS ' 82. Cloud Physics Meteorological Problems Theoretical Instrumentational Workings) ....See Entry 98638

A new low-salinity sea-ice model for UHF radimetry ....See Entry 104366

Origin of the Moon—capture by gas drag of the Earth's primordial atmosphere ....See Entry 104754

Large-scale explosion in the inhomogeneous atmosphere of the Earth with allowance for spectral radiation ....See Entry 104817

93.00 GEOPHYSICAL OBSERVATIONS, INSTRUMENTATION, AND TECHNIQUES

93.30 INFORMATION RELATED TO GEOGRAPHICAL REGIONS

Niagara River-Lake Ontario Pollution Problem ....See Entry 98615

Occurrence of uranium in drinking water in the US ....See Entry 103741

Oil pollution on the Egyptian Red Sea coast ....See Entry 103742

Air quality network design for Saudi Arabia using long-range transport model ....See Entry 103746

Trace gas profiles to 3000 m over Antarctica ....See Entry 103751

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Determination of ethylene and other reactive hydrocarbons in the atmospheric air at Trombay, Bombay by gas chromatography using a chemiluminescent detector ....See Entry 103771

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Regional deformation of the Earth model for the San Diego region, California ....See Entry 104168

Use of the resistivity method in geological mapping-case histories from Raniganj Coalfield, India ....See Entry 104182

Electromagnetic sounding near a large square loop source of current ....See Entry 104183

VLF survey of the weathered layer in southern India ....See Entry 104184

Spectral analysis of long-period variations of the magnetotelluric field on the southeast Siberian Plate ....See Entry 104185

Electromagnetic investigations of secular variation anomalies in the Ural region ....See Entry 104186

Vertical component of the geoelectric field in high latitudes and magnetosphere processes ....See Entry 104188

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93.55 INTERNATIONAL ORGANIZATIONS, NATIONAL AND INTERNATIONAL PROGRAMS

104570 The Intercomparison Ozone Campaign held in France in June 1981: description of the campaign. M.L.Chanin (CNRS, Verrieres-le-Buisson, France).
Planet. & Space Sci. (GB), vol.31, no.7, p.707-15 (July 1983).
An intercomparison balloon and ground-based campaign for measuring ozone from the ground to the mesosphere was performed in the South of France from 9 June to 26 June 1981. Satellite data obtained above the sites from existing ozone experiments have also been used. A total of 11 experimental groups participated in the campaign with 15 different types of instruments. Two large stratospheric balloons were launched on 19 June and 25 June with five experiments on each; on these specific days the comparison included up to 10 types of near simultaneous ozone measurements. (24 refs.)

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93.65 DATA ACQUISITION AND STORAGE

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Continuously time-variable recursive digital band-pass filters for seismic signal processing .... See Entry 104239

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93.85 INSTRUMENTATION AND TECHNIQUES FOR GEOPHYSICAL RESEARCH

104571 Atmospheric water vapor differential absorption measurements on vertical paths with a CO_2 lidar. P.W.Baker (Electronics Res. Lab., Dept. of Defence, Salisbury, Australia).
Appl. Opt. (USA), vol.22, no.15, p.2257-64 (1 Aug. 1983).
Ground based vertical path differential absorption measurements were obtained up to a height of 1.5 km with a CO_2 lidar transmitting alternatively on the $R(20)$ (10.247-μm) and $R(18)$ (10.260-μm) lines during daylight in conditions of both strong and weak temperature inversions. The differential absorption between these lines for a typical middle latitude lower atmosphere water vapor concentrations appears to be well suited to this type of measurement as the power loss on the more absorbed backscattered line [$R(20)$] is not too great as to unduly restrict the operating range, while the power differential is still sufficiently large to be readily measurable. In one set of measurements a strong temperature inversion at a height of 1 km resulted in a rapid vertical lapse in aerosol concentration with a consequent loss of SNR on the returns and severe distortion to the differential absorption profiles at this level. Water vapor profiles were derived from all measurements except in the region of the strong temperature inversion where the atmospheric backscattering cross section decayed rapidly. Reasonable results were obtained through the weak inversion region. The measurement capability of the lidar was found to be restricted by the length of the laser pulse tail and an inadequate signal-to-noise performance in regions of strong temperature inversions due to the associated decreases in aerosol concentration. (7 refs.)

104572 Airborne dual laser excitation and mapping of phytoplankton photopigments in a Gulf Stream warm core ring. F.E.Hoge, R.N.Swift (NASA Goddard Space Flight Center, Wallops Flight Facility, Wallops Island, VA, USA).
Appl. Opt. (USA), vol.22, no.15, p.2272-81 (1 Aug. 1983).
Utilization of a two-color airborne lidar system in the systematic study of a major oceanographic feature is reported here for the first time. An excimer pumped dye laser was optically and electronically integrated into the NASA Airborne Oceanographic Lidar for simultaneous use with a frequency doubled Nd:YAG laser. The output beams exit the laser system along parallel paths after being produced on an alternating pulse basis at a combined rate of 12.5 pps. Results are presented for missions flown over a Gulf Stream Warm Core Ring (WCR) as well as over shelf, slope, Gulf Stream, and Sargasso Sea waters. From the airborne data a high coherence is shown between the two-color chlorophyll *a* data and between the Nd:YAG chlorophyll *a* and phycoerythrin responses within each of these water masses. However, distinct differences in the response patterns of these photopigments are shown to exist between the differing water masses. At certain of the boundaries separating the water masses a sharp transition is seen to occur, while at others a wider transition zone was observed in which the correlation between the photopigments appears to degrade. (16 refs.)

104573 Techniques for measuring radiance in sea and air. W.H.Wells (Tetra Tech Inc., Pasadena, CA, USA).
Appl. Opt. (USA), vol.22, no.15, p.2313-21 (1 Aug. 1983).
Measurements of scattered sunlight often employ simple radiometers that are incapable of scanning azimuth ϕ and zenith angle θ. Instead, they measure integral moments of the radiance. Consider a set of $N+1$ meters designed to measure moments Λ_1 through Λ_{N+1}. If each meter is judiciously designed, the Λ_j may be processed quite simply to deduce inherent properties of the scattering medium, namely, N moments of the volume scattering function. In the optimum design, each meter has an angular response that approximates a polynomial of degree N in $\cos\theta$. The theory of these meters is based on Boltzmann's equation of radiative transfer expressed in terms of spherical harmonics, a form in which this equation is particularly simple. (11 refs.)

104574 A separator for obtaining samples of cloud water in aircraft. P.T.Walters, M.J.Moore, A.H.Webb (Central Electricity Res. Labs., Leatherhead, England).
Atmos. Environ. (GB), vol.17, no.6, p.1083-91 (1983).
In order to study the effect of SO_2 emissions from power stations on the formation of acid rain, cloud water sampled in the presence of the effluent gases is required for analysis. A small axial flow cyclone is described for separating the liquid water from cloud sampled by aircraft to provide these samples. The description covers structural aspects, the installation in the aircraft and a theoretical prediction of its service performance. It is shown that the separator will remove all droplets of greater than 5-μm diameter under the action only of the ram pressure generated by the forward speed of the aircraft. The optimisation of the design in a simple ground based cloud tunnel is then described and test results are given which indicate that adequate cloud water samples for chemical analyses should be obtained when the liquid water content of the sampled cloud exceeds 0.35 g m^{-3}. (9 refs.)

104575 Multiple level finite element analysis and its applications to tidal current flow in Tokyo Bay. M.Kawahara (Dept. of Civil Engng., Chuo Univ., Tokyo, Japan), M.Kobayashi, K.Nakata.
Appl. Math. Modelling (GB), vol.7, no.3, p.197-211 (June 1983).
A finite element method for the analysis of a one level and a multiple level current flow is presented. The basic equations can be derived from the three-dimensional Navier-Stokes equations under the shallow water assumptions. The standard finite element method has been introduced using the linear interpolation function based on a triangular finite element. For each level, the finite element subdivisions are not required to be coincident. The multiple level finite element method is applied to a tidal flow analysis of Tokyo Bay. The multiple level tidal flow analysis is performed at the entrance channel of Tokyo Bay. The density of water is assumed to be constant for each level. The vertical profiles of the numerical velocity are compared with those of the observed velocity. The flow directions and the order of velocity are both well in agreement with the observed data. The tidal flow pattern in Tokyo Bay has been shown to be expressed by the multiple level flow assuming that the density of seawater is level wise constant. The numerical tidal flow computation of Tokyo Bay carried out using a one level model is compared with observed data. The one level numerical values will be used to specify the boundary conditions for the multiple level analysis. Both numerical and observed results correspond extremely well in this computation. The two dominant circulated residual flows have been computed, and they coincide with the observed facts. (22 refs.)

104576 Continuous measurement of radon emanations from soil and groundwaters in southern France (Alpes Maritimes). Preliminary results. A.Oddou, L.Nault, R.Campredon, M.Bernat (Lab. de Geologie-Geochimie, ERA 888, Nice, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.14, p.1081-6 (18 April 1983). In French.
Two types of automated instruments which monitor the emission of radon from rocks and groundwaters are actually being set up in a few localities of the French-Italian Alpes-Maritimes (SE France). The first results are presented. (17 refs.)

104577 Experience in operating high-sensitivity humidity sondes using a miniature humidity sensor with barium fluoride—a comparison with a Lyman-α-hygrometer. H.-J.Schonfeldt (Karl-Marx-Univ. Leipzig, Leipzig, Germany), A.Raabe, H.Piazena.
Z. Meteorol. (Germany), vol.33, no.2, p.116-18 (1983). In German.
A comparison of a highly sensitive miniature humidity sensor with barium fluoride with a Lyman-α-hygrometer shows under natural conditions, rather good agreement. The miniature humidity sensor has a sensitive area of 3 by 4 mm and is well suited to profile measurements. A frequency resolution of 1 Hertz has been obtained. (5 refs.)

104578 Simplified estimation of seismic moment from seismograms. B.A.Bolt (Univ. of California, Berkeley, CA, USA), M.Herraiz.
Bull. Seismol. Soc. Am. (USA), vol.73, no.3, p.735-48 (June 1983).
Proposes a method to estimate the seismic moment of regional and local earthquakes based on simple measurements made directly on Wood-Anderson seismograms. The method parallels the routine estimation of local magnitude in observatory work. Least-squares fits were made to data from 73 Wood-Anderson records of 16 central California earthquakes with seismic moments already evaluated independently from spectral analysis or broadband displacement records. (18 refs.)

104579 A new method for precise astro-azimuths. L.A.Kivioja (Surveying & Mapping, Purdue Univ., West Lafayette, IN, USA).
Bull. Geod. (France), vol.57, no.2, p.146-51 (1983).
The theodolite used in this method is completely leveled by using autocollimation from a free mercury surface. This eliminates the need for striding or

hanging levels which are in conventional use to level the trunnion axis of the theodolite. Mercury leveling is more accurate and can be performed in a much shorter time than leveling by the striding or hanging levels. In addition, this new method removes the unavoidable axis wobbles contaminating the observed horizontal angles between the star and the azimuth mark. The uncontrolled wobble errors affecting azimuths can be up to three arc seconds. The axis wobbles are removed by using autocollimation from an axis mirror which is perpendicular to the trunnion axis of the theodolite. Autocollimation coincidences from the mercury and from the axis mirror can be made within one or two tenths of an arcsecond. This new method and instrumentation surpasses the obtainable precision by the conventional first-order astro azimuth observations by reducing the unknown systematic wobble and level errors by one order of magnitude. (4 refs.)

104580 The Airborne Laser Ranging System, its capabilities and applications. W.D.Kahn, J.J.Degnan (Goddard Space Flight Center, Greenbelt, MD, USA), T.S.Englar,Jr..
Bull. Geod. (France), vol.57, no.2, p.180-94 (1983).
The Airborne Laser Ranging System is a proposed multibeam short pulse laser ranging system on board an aircraft. It simultaneously measures the distances between the aircraft and six laser retroreflectors (targets) deployed on the Earth's surface. Depending on the host aircraft and terrain characteristics, the system can interrogate hundreds of targets distributed over an area as large as 6×10^4 sq. kilometers in a matter of hours. Potentially, a total of 1.3 million individual range measurements can be made in a six hour flight. The precision of these range measurements is approximately ±1 cm. These measurements are then used in a procedure which is basically an extension of trilateration techniques to derive the intersite vector between the laser ground targets. By repeating the estimation of the intersite vector, strain and strain rate errors can be estimated. These quantities are essential for crustal dynamic studies which include determination and monitoring of regional strain in the vicinity of active fault zones, land subsidence, and edifice building preceding volcanic eruptions. (12 refs.)

104581 Determination of iron contents in boreholes by neutron capture method. Xu Fengzeng.
Nucl. Tech. (China), no.2, p.32-3 (April 1983). In Chinese.
The contents of iron and other elements at a mine site are studied experimentally by the neutron capture method. In the investigation a 512-channel pulse height analyser, a NaI(Tl) scintillation detector and an ^{241}Am-Be neutron source are used. The borehole effect has been corrected experimentally by the result obtained in a model borehole. Moreover, the relationship between the 7.64 MeV peak's area and the iron content is measured with an error less than ±10%. Neutron captured γ-ray loggings are made in five wells, and the results indicate that the iron contents are less than that detected from core analysis. The author concludes that the neutron captured γ-ray logging is applicable in geological exploration. (3 refs.)

104582 The relationship of surface γ-ray intensity with groundwater in South Spring area, Chongqing. Sun Shixiong (Chengdu Coll. of Geology, China).
Nucl. Tech. (China), no.2, p.38-9 (April 1983). In Chinese.
The paper deals with the theoretical and practical problems related to the exploration of hot water by γ-ray measurement method in karstified limestone areas of South Spring, Chongqing. It has been discovered that higher values are usually measured in the regions of hot-water-bearing structures, and lower γ values in the regions of karstified cold-water-bearing strata. The factors that influence γ values and the significance of the derived conclusions in the exploration of the terrestrial hot energy and karst water are also discussed. (no refs.)

104583 Proceedings of Workshop I of the COSPAR Twenty-Fourth Plenary Meeting.
Adv. Space Res. (GB), vol.3, no.6 (1983).
Conference held at: Ottawa, Canada. Date 16 May-2 June 1982. Sponsors: COSPAR. High-altitude balloon techniques for atmospheric, telecommunication and astronomical purposes are described. The first set of papers describe the ballon technology itself. Examples of such papers are automatic control of balloon altitude, balloon materials and design, balloon film strain measurement, the Radiation Controlled Balloon and gas replenishment in long duration ballooning. The second set of papers are about telecommunication applications and telecommand and data retrieval problems of geophysical and astronomical balloons. Other balloon operation methods include balloon power supplies and launch methods. The third chapter is of papers presenting the results of submillimetre radiowave and X-ray astronomy. Various phenomena in the stratosphere were examined in several papers, altogether 23 papers were presented.

104584 An estimate of the error in the measurement of a constant electric field by the method of a double Langmuir probe. V.E.Korepanov.
Cosmic Res. (USA), vol.20, no.5, p.486-94 (Sept.-Oct. 1982). Translation of: *Kosm. Issled. (USSR)*, vol.20, no.5, p.690-9 (Sept.-Oct. 1982). [received: June 1983]
A procedure is described for the measurement of an electric field with a double Langmuir probe, and the principal components of the measurement error are estimated. A formula is derived which permits making a preliminary calculation of the error and which can be used to determine both the basic requirements on the individual subassemblies of the measuring system and the minimum possible measurement error by the method in question. (16 refs.)

104585 Intensity of 1356-Å emission as a determinant of F-region parameters. K.B.Serafimov.
Cosmic Res. (USA), vol.20, no.5, p.525-9 (Sept.-Oct. 1982). Translation of: *Kosm. Issled. (USSR)*, vol.20, no.5, p.736-41 (Sept.-Oct. 1982). [received: June 1983]
Proposes some methods of correctly determining the planetary distribution of maximum electron density N_mF (or the corresponding critical frequencies f_oF), the height of these densities h_mF, and one of the most characteristic parameters describing the international reference profile $N_e(h)$ in the F region. With this in mind the author proposes two measurements of naturally occurring optical emissions in the upper atmosphere, and one local measurement of the electron density. The optical emissions are the oxygen lines at λ 1356 Å in the ultraviolet and λ 6300 Å in the red. The author derives accurate expressions for the intensity of the λ 1356 Å line, and points out certain inaccuracies in the methods which have been used up to the present time in determining N_mF and h_mF from measurements of the intensities of the two oxygen lines mentioned above. (19 refs.)

104586 Low resolution atmospheric measurements and data applications. J.R.Moulton (E-OIR Measurements Inc., College. Station, Fredericksburg, VA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.356, p.9-19 (1983). (Field Measurement and Calibration Using Electro-Optical Equipment: Issues and Requirements, San Diego, CA, USA, 24-25 Aug. 1982).
Overviews the application of low resolution transmissometer systems to field measurement of spectral transmission through the atmosphere. A discussion of atmospheric models, such as the Air Force LOWTRAN and the Army E-OSAEL computer Codes is followed by a description of a typical low resolution transmissometer system. The procedure to calibrate the transmissometer in order to produce absolute transmission is presented. Some typical problems associated with field measurement of atmospheric propagation is given. The author also presents spectral transmission results in the 3-5 micrometer region during GRAF I atmospheric trials in Europe. The data analyzed was provided by the Night Vision and Electro-Optics Laboratory. (3 refs.)

104587 Field system for measurement of atmospheric propagation and radiant signatures. S.T.Hanley (OptiMetrics Inc., Las Cruces, NM, USA), K.O.White.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.356, p.76-83 (1983). (Field Measurement and Calibration Using Electro-Optical Equipment: Issues and Requirements, San Diego, CA, USA, 24-25 Aug. 1982).
Describes a large aperture, high precision, simultaneous atmospheric propagation and radiant signature field measurement system. Novel features of the system include: simultaneous multispectral measurement of path radiance and transmission through the same air column, absolute laser calibrated transmissiometery, visible and 8-12 μm imagery with 8-bit dynamic range digital recording, 2-12 μm Fourier Transform Spectroscopy with 0.03 cm^{-1} resolution, and digital data acquisition with real time data reduction through the use of on-line minicomputers. The flexible modular approach of the system will be shown as will its ability to address many atmospheric propagation and/or radiant emission problems in a unified manner, thereby permitting separation of combined physical processes in many cases. Preliminary data acquired by the system will be presented from: SMOKE IV (November 1981, Huntsville, Alabama) showing refractive effects of thermal plumes on laser beam propagation, and SNOW 1A (January 1982, Burlington, Vermont) showing relative transmission of three broad spectral bands through falling and blowing snow utilizing a stable secondary standard IR source. (3 refs.)

104588 New developments in instrumentation for long path atmospheric transmittance and radiance measurements. A.Ben-Shalom, A.D.Devir, S.G.Lipson, U.P.Oppenheim, E.Trahovsky (Dept. of Phys., Technion-Israel Inst. of Technol., Haifa, Israel).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.356, p.98-105 (1983). (Field Measurement and Calibration Using Electro-Optical Equipment: Issues and Requirements, San Diego, CA, USA, 24-25 Aug. 1982).
Instrumentation and procedures for performing absolute spectral transmittance and radiance measurements over very long atmospheric horizontal paths, up to 50 km, are described. A collimated chopped radiation source was developed using a 64 cm diameter optical collimator and an electrically heated graphite element which operated at 2400K. For detection a 20 cm diameter spectro-radiometer was developed and used successfuly in many field measurements of absolute transmittance. The contribution of the measured data towards improving the LOWTRAN propagation model is presented. The successful development of the instrumentation and its operation make it a very powerful tool for obtaining significant absolute atmospheric transmittance data over very long horizontal paths. (5 refs.)

104589 Abyssal temperature measurements with Aanderaa current meters. P.M.Saunders, J.W.Cherriman (Inst. of Oceanographic Sci., Godalming, England).
Deep-Sea Res. Part A (GB), vol.30, no.6A, p.663-7 (June 1983).
Modifications of the Aanderaa RCM5 current meter temperature circuit are described; a sensitivity of 2.5 mC° suitable for abyssal studies is achieved. Pre- and post-cruise calibrations of a group of instruments show remarkable stability and from the internal consistency of the records the absolute accuracy is estimated near 3 mC°. Comparisons with lowered CTD observations suggest that observing climatic changes of ocean temperature of 0.01 C° is a formidable task. (4 refs.)

104590 The simultaneous use of tracers for ocean circulation studies. B.Bolin, A.Bjorkstrom, K.Holmen (Dept. of Meteorology, Univ. of Stockholm, Stockholm, Sweden), B.Moore.
Tellus Ser. B (Sweden), vol.35B, no.3, p.206-36 (July 1983).
A method for the simultaneous use of tracers for oceanic circulation studies is developed. To permit the inclusion of tracers that are subject to biochemical transformation a simple model for photosynthesis, bacterial decomposition and chemical dissolution is formulated based on the use of Redfield ratios for the chemical compounds interaction. The finite difference analogue to the steady state tracer continuity equation, applied to the tracers chosen, leads to a set of simultaneous algebraic equations that in principle can be solved by matrix inversion. The method is applied to a 12-box model of the world oceans by considering the surface water, intermediate water, deep water and bottom water of the Arctic, Atlantic, Antarctic and Pacific/Indian Oceans. (47 refs.)

104591 Compact gravity inversion. B.J.Last, K.Kubik (Inst. for Aerial Survey & Earth Sci., Delft, Netherlands).
Geophysics (USA), vol.48, no.6, p.713-21 (June 1983).
Presents a new criterion for the inversion of gravity data. The principle employed is to minimize the volume of the causative body, which is equivalent to maximizing its compactness. The anomalous density distribution is obtained using an iterative technique which is numerically stable and rapidly convergent. The principle can also be adapted to include modeling of gravity anomalies by single-density sources. (19 refs.)

104592 Composite color images of aerial gamma-ray spectrometric data. J.S.Duval (Denver Federal Center, US Geological Survey, Denver, CO, USA).
Geophysics (USA), vol.48, no.6, p.722-35 (June 1983).
Aerial gamma-ray data provide estimates of the apparent surface concentrations of potassium (K), equivalent uranium (eU), and equivalent thorium (eTh). These data can be expressed as nine radiometric parameters. A technique has been developed which combines any three of these parameters to form a composite color image, which provides a partial synthesis of the radiometric data that can be used to aid geologic mapping and mineral exploration. The sample data set, from the Freer area in south Texas, illustrates the use of the color images. (20 refs.)

104593 Electronic acceleration-sensitive geophone for seismic prospecting. K.B.Klaassen, J.C.L.Van Peppen (Dept. of Electrical Engng., Delft Univ. of Technol., Delft, Netherlands).
Geophys. Prospect. (Netherlands), vol.31, no.3, p.457-80 (June 1983).
The novel geophone described is a light-weight (17 g) acceleration-sensitive transducer which gives good ground coupling and partial correction for the increasing damping in the Earth with increasing frequencies. It employs internal hybrid electronics for a magnetodynamic velocity-nulling feedback system. Velocity nulling makes the movable part of the geophone virtually rigid with respect to the housing. This makes the geophone characteristics independent of the suspension. The springs used are stiff in a transverse and rotational direction so that the suspension resonances are well outside the useful frequency band. This suspension also allows the geophone to be used in any orientation while being only sensitive to the vibration along the main axis. (10 refs.)

104594 Practical application and preliminary interpretation techniques of in-seam seismology. T.Bodoky, E.Cziller (Eotvos Lorand Geophys. Inst. of Hungary, Budapest, Hungary), E.Toros.
Geofiz. Koeslemenyek (Hungary), vol.29, no.2, p.141-54 (June 1983).
By means of two case histories the authors present practical methods applied in Hungarian in-seam seismology and the quick-look methods of preliminary interpretation. (9 refs.)

104595 Optimisation of geological and geophysical prospecting for coal. V.Yu.Zaichenko (Min. of Geology, Moscow, USSR), V.V.Grechukhin, I.T.Kozelski.
Geofiz. Koeslemenyek (Hungary), vol.29, no.2, p.155-61 (June 1983).
New techniques are presented to optimise geological and geophysical prospecting for coal, based on analysis of the petrophysical properties of the coal-bearing formations, on the capabilities of the new techniques of coal geophysics and of their optimum combination. (8 refs.)

104596 A model study of the transient electromagnetic coincident loop technique. R.D.Ogilvy (Appl. Geophys. Unit, Inst. of Geological Sci., Keyworth, England).
Geoexploration (Netherlands), vol.21, no.4, p.231-64 (1983).
A free-space parametric model study of the Transient Electromagnetic coincident loop technique is undertaken to provide a basic scheme for the interpretation of coincident loop anomalies and to provide insight on the important survey design parameters. Experiments are carried out to investigate the effects of changing geometrical relationships, target conductance, lateral resolution in the case of multiple thin dykes, and the masking influence of conductive overburden. (15 refs.)

104597 Correlative studies of satellite ozone sensor measurements. J.E.Lovill, J.S.Ellis (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
Geophys. Res. Lett. (USA), vol.10, no.6, p.447-50 (June 1983).
Comparisons are made between total ozone measurements made by four satellite ozone sensors (TOMS, SBUV, TOVS and MFR). The comparisons were made during July 1979 when all sensors were operating simultaneously. The TOMS and SBUV sensors were observed to measure less total ozone than the MFR sensor, 10 and 15 Dobson units (DU) respectively. The MFR and TOMS sensors measured less ozone than the TOVS sensor, 19 and 28 DU, respectively. Latitudinal variability of the total ozone comparisons is discussed. (7 refs.)

104598 Construction of M_{max} earthquake maps based on a method of approximating spaced expert estimates. V.G.Gitis, M.A.Mironov, V.T.Bune (O.Yu. Schmidt Inst. of Phys. of Earth, Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.4, p.264-73 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.4 (1982).
The initial information consists of geological, geophysical, and seismological maps characterising potential seismic danger, expert estimates for the M_{max} values for sampling points, and information on the maximum recorded magnitudes of earthquakes. A class of functions is assigned in which a relationship is sought between M_{max} and the characteristics being measured. The mathematical stipulation developed permits the most informative characteristics for prediction to be selected, a prediction function to be calculated, a prediction map to be constructed for M_{max}, and the results to be presented in a form suitable for analysis. Two variants are described for constructing an M_{max} map for earthquakes in Bulgaria. (10 refs.)

104599 Deep ocean temperature profile measurements. T.M.Dauphinee (Div. of Phys., Nat. Res. Council, Ottawa, Ontario, Canada).
IEEE J. Oceanic Eng. (USA), vol.OE-8, no.3, p.184-95 (July 1983).
The ocean temperature range is narrow, −2 to 35°C, but measurement is complicated by the harsh ocean environment, the necessity of remote hands off readings, power limitations due to the cable, and the fast response required to obtain a profile in a reasonable length of time. Platinum and copper thermometers are used for most precision measurements with thermistors or thermocouples used in some cases to improve speed of response and for lesser accuracy. A number of very different circuits have been used successfully in salinity, temperature, and depth profiling systems and achieve millidegree accuracies in laboratory measurements. However, very careful precautions and many checks are required to achieve that accuracy in the field, and to achieve the correlation of conductivity, pressure, and temperature readings required for equivalent accuracy in the salinity and density measurements. (18 refs.)

104600 Multifrequency remote acoustic sensing of suspended materials in water. Y.Ma, V.K.Varadan, V.V.Varadan, K.W.Bedford (Dept. of Engng. Mech., Ohio State Univ., Columbus, OH, USA).
J. Acoust. Soc. Am. (USA), vol.74, no.2, p.581-5 (Aug. 1983).
A multifrequency acoustic technique is employed as an oceanographic tool to infer the characteristic information e.g., concentration, size distribution, and mean size, about suspended materials in the deep ocean environment. The technique employs the single scattering theory which is valid for a sparse distribution of scatterers in water. Theoretical results are presented as the acoustic response versus frequencies for different size distributions. (15 refs.)

104601 An objective procedure for detecting and correcting errors in geophysical data. II. Multidimensional applications. H.E.Fleming, M.L.Hill (Nat. Environmental Satellite Data, & Information Service, NOAA, Washington, DC, USA).
J. Geophys. Res. (USA), vol.88, no.C6, p.3859-67 (20 April 1983).
For pt.I, see ibid., vol.87, C9, p.7312-24 (1982). The one-dimensional objective procedure for detecting and then correcting errors arising in geophysical data, developed in the previous paper of this series, is extended to higher dimensions. The data again must be sampled at equal increments of time or distance, but the spacings can be different in each dimension. Of interest are only those errors larger in magnitude than the background noise level. Underlying the success of the error detection and correction procedure is the alternating subset method, which is extended to higher dimensions. Complete step-by-step instructions are given for the two-dimensional procedure. (4 refs.)

104602 An aerosol and gas sampling apparatus for remote observatory use. W.D.Komhyr (Air Resources Labs., NOAA, Boulder, CO, USA).
J. Geophys. Res. (USA), vol.88, no.C6, p.3913-18 (20 April 1983).
An air sampling apparatus is described which standardizes sampling height at a field station at 10 m or more above ground level and which minimizes loss of particles and destruction and contamination of sampled trace atmospheric gases as air is conducted through the apparatus to various monitoring instruments. Basic design features render the apparatus useful for air sampling under widely varying climate conditions, and at station altitudes ranging from sea level to more than 4 km. Four systems have been built, and have been used successfully since 1977 at the NOAA Geophysical Monitoring for Climatic Change program baseline stations. (13 refs.)

104603 Sea floor measurement of geomagnetic field using newly developed ocean bottom magnetometers. J.Segawa (Ocean Res. Inst., Univ. of Tokyo, Tokyo, Japan), T.Yukutake, Y.Hamano, T.Kasuga, H.Utada.
J. Geomagn. & Geoelectr. (Japan), vol.34, no.10, p.571-85 (1982).
An ocean bottom magnetometer is developed. It is a fluxgate type magnetometer with a triaxial ring-core sensor suspended by a gimbal, and capable of recording the three geomagnetic components in a cassette tape in digital form for more than two months when the sampling interval is 3 min. The resolution is 0.8 nT in this case. A pop-up system is adopted for recovery, mechanically releasing a weight at a preset time by explosion of gas. Two sets of magnetometers were used at two sea floor stations on the continental shelf east of northeast Honshu in 1981. One was a prototype and the other was an improved instrument. The details of the improved instrument (named OBM-C2) as well as the data obtained from the measurements are reported. (7 refs.)

104604 Application of lasers in oceanographic investigations (review). A.P.Ivanov, I.I.Kalinin, A.I.Kolesnik.
J. Appl. Spectrosc. (USA), vol.37, no.4, p.1097-103 (Oct. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.4, p.533-40 (Oct. 1982).
The creation of lasers led to the development of a new effective method for studying the environment: laser sounding. This method demonstrated the extensive possibilities in studying the atmosphere by different methods: aerosol, resonance and Raman scattering, and fluorescence. This approach can be applied to studying the ocean environment, although a number of difficulties arise related to the greater turbidity, smaller scales of inhomogeneities, effect of the water-air interface, overlapping of the spectral characteristics of the components of the medium, etc. The purpose of the paper is to review the foreign (i.e. non-Soviet) publications concerned with the use of fluorescence and RS for studying pollution by petroleum and petroleum products, the concentration of chlorophyll *a*, temperature, and salinity of the water. (28 refs.)

104605 Specifications for a probe to measure CO_2 fluxes in the atmosphere. P.Mestayer, J.P.Barboux, M.Coantic (Inst. de Mecanique Statistique de la Turbulence, Marseille, France).
J. Rech. Atmos. (France), vol.17, no.1, p.13-31 (Jan.-March 1983). In French.
The characteristic parameters (sampling volume, frequency response and signal-to-noise ratio) of a probe to measure the turbulent fluctuations of a passive scalar contaminant in order to estimate its fluxes can be deduced from the atmospheric surface layer semi-empirical universal relationship. This method is applied to predict the characteristics of a probe to estimated CO_2 fluxes in the atmospheric surface layer over the ocean and in the IMST simulation tunnel. (24 refs.)

104606 On the measurement of total cloud water content with the Ruskin probe: advantages and limitations. J.P.Pinty, R.Rosset (Univ. de Clermont-Ferrand II, Aubiere, France).
J. Rech. Atmos. (France), vol.17, no.1, p.67-76 (Jan.-March 1983). In French.
Performances of the Ruskin probe for the measurement of total cloud water contents have been studied both theoretically and experimentally for several field experiments performed by LAMP: Moussafrica 1977, Wamex 1979, PEP 1979. After a previous study about clouds with only small droplets present, the intercomparison between the Ruskin, PMS and Johnson-Williams probes is extended to clouds with large drops and ice particles. (7 refs.)

104607 A technique for studying density gradients and motions of plasmaspheric irregularities. D.Jones (British Antarctic Survey, NERC, Univ. of Cambridge, Cambridge, England).
J. Geophys. (Germany), vol.52, no.3, p.158-66 (1983). (European Geophysical Society Symposium on Plasma and Energetic Particles in the Magnetosphere, Leeds, England, 23-27 Aug. 1982).
Terrestrial myriametric radiation (TMR) is received by spacecraft in the magnetospheric cavity beyond the plasmasphere. There is now general agreement that the radiation emanates mainly from the plasmapause. A technique is under development which allows information on the source regions to be extracted. The method is based on the theory that the radiation has passed through a radio window, this being one mechanism for producing TMR which is receiving considerable attention at present. It is shown how the radial and local-time positions of the TMR sources can be determined, thereby allowing the tracking of plasmapause irregularities and regions of detached plasma which move around from the night side. It is shown how it may also be possible to determine the latitudinal positions of sources. (29 refs.)

104608 The frequency domain and the linear filtering of gravity and magnetic data. A.Mesko.
Magy. Geofiz. (Hungary), vol.24, no.2, p.43-76 (1983). In Hungarian.
The application of two-dimensional digital filters to the transformation of gravity and magnetic data has become a standard tool of routine processing in the last decade. The purpose of the present paper is to review the role of the frequency domain in describing, designing and implementing two-dimensional filters. Starting with basic principles, such as the two-dimensional Fourier transform, two-dimensional digital Fourier transform (DFT), two-dimensional cyclic non-cyclic convolutions, it describes the techniques, to be used in filtering in the frequency domain. A large class of transformations, routinely used in the processing of gravity and magnetic data can be considered two-dimensional filters. The transfer functions of these transformations are derived, including continuations upwards and downwards, vertical and horizontal derivatives, reduction to the magnetic pole and transformations and magnetic field vector and components to other components. The necessity of modifications for practical applicability is pointed out. (26 refs.)

104609 An apparatus for the measurement of radon in sea water. T.Okubo, M.Michijima (Dept. of Nuclear Engng., Kobe Univ. of Mercantile Marine, Kobe, Japan).
Oyo Buturi (Japan), vol.52, no.5, p.437-42 (May 1983). In Japanese.
For the determination of the low concentration of ^{222}Rn in sea water, an improved ^{222}Rn extraction and counting system was developed. The ^{222}Rn in a 20 *l* sample bottle was extracted from sea water with helium and collected in a charcoal trap cooled with dry ice and alcohol. The ^{222}Rn extraction is accomplished by two circulation loops in a closed system: one is the rapid extraction loop of ^{222}Rn from sample water by violent gas bubbling and strong agitation, and the other is the adsorption loop of ^{222}Rn with a cooled charcoal trap. Sucessively, the ^{222}Rn was desorbed from the trap by heating and transferred to a scintillation cell coated with ZnS(Ag). Following these procedures one can process a sample in 100 min with an overall efficiency (extraction-transfer-counting) of 57%. Some results in ^{222}Rn and ^{226}Ra concentrations in coastal sea water are reported. (25 refs.)

104610 The use of multispectral satellite imagery in the exploration for petroleum and minerals. E.R.Peters (Hunting Geology & Geophys. Ltd., Borehamwood, England).
Philos. Trans. R. Soc. London A (GB), vol.309, no.1508, p.243-55 (1983).
Reviews the application of multispectral satellite imagery to mineral and petroleum exploration, from the stage when satellite imagery first became

available, with the launch of ERTS-1 (Landsat) just over 10 years ago, to the present day. The operation of Landsat is briefly described, and it is noted that the continuing success of this system for geological application has been in part due to the development of a worldwide network of receiving stations and the application of sophisticated data-processing techniques. Current research into the measurement of infrared spectra for the discrimination of rocks and minerals is discussed. Interpretation techniques are important but their success depends largely upon the experience of the interpreters as geologists. Examples of the use of Landsat imagery in exploration are given, and interpretational techniques are reviewed. (39 refs.)

104611 Synthetic aperture radar observations of ocean and land. R.K.Raney (Canada Centre for Remote Sensing, Dept. of Energy, Mines & Resources, Ottawa, Canada).
Philos. Trans. R. Soc. London A (GB), vol.309, no.1508, p.317-23 (1983).
A brief history of synthetic aperture radar (SAR) from early radar ideas to recent satellite systems is presented. Properties of electromagnetic radar measurement that are fundamental to SAR systems are presented and discussed by the use of example SAR images derived from airborne and Seasat satellite sources. The next decade of activity in radar satellites is outlined. (5 refs.)

104612 Detection of large-scale ocean circulation and tides. D.E.Cartwright (Inst. of Oceanographic Sci., Bidston Obs., Birkenhead, England).
Philos. Trans. R. Soc. London A (GB), vol.309, no.1508, p.363-72 (1983).
The prospect of nearly continuous recording of ocean-surface topography by satellite altimetry with suitable supporting measurements might make basin-wide dynamics monitoring possible. The associated identification of the geocentric oceanic tidal signal in the data would be an additional bonus. The few weeks of altimetry recorded by Seasat gave a glimpse of the possibilities, but also clarified the areas where better precision and knowledge are needed. Further experience will be gained from currently projected multi-purpose satellites carrying altimeters, but serious knowledge of ocean circulation will result only from missions that are entirely dedicated to the precise measurement of ocean topography. (23 refs.)

104613 Observation of ocean waves. M.J.Tucker (Inst. of Oceanographic Sci., Taunton, England).
Philos. Trans. R. Soc. London A (GB), vol.309, no.1508, p.373-82 (1983).
The European Space Agency plans to launch an Earth Resources Satellite (ERS-1) in a few years' time with a view to establishing an operational system of such satellites. It will carry two microwave devices giving information on waves: a precision altimeter and a synthetic aperture radar (SAR). In the precision altimeter, the leading edge of the returned radar pulse is smeared by the rough sea surface. The degree of smearing is highly correlated with the significant waveheight. The main fundamental limitation to operational use comes from the sampling variability, which necessitates long averaging times. The SAR gives pictures of the sea surface that often show wave patterns, but their precise interpretation is an exceedingly complex problem. The small number of satellites planned will mean that coverage of coastal areas will be poor. (9 refs.)

104614 Observations of sea-surface temperature for climate research. J.E.Harries, D.T.Llewellyn-Jones, P.J.Minnett, R.W.Saunders, A.M.Zavody (Rutherford Appleton Lab., Didcot, England).
Philos. Trans. R. Soc. London A (GB), vol.309, no.1508, p.383-96 (1983).
The measurement of global sea-surface temperature (SST) from space, with high absolute accuracy, is one of the important requirements of the World Climate Research Programme (WCRP). This paper considers the definition of measurement aims based on considerations of specific types of scientific problem, and gives as examples discussion of two particular problems, first the possible influence of Pacific SST on the lower stratosphere, and second the role of SST in the cloud-climate feedback process. Following this, a brief review is presented on current status in satellite measurements of SST with both infrared and microwave techniques, and the paper concludes with a description of a future SST-measuring instrument, the Along-Track Scanning Radiometer (ATSR). (25 refs.)

104615 A review of Seasat scatterometer data. T.H.Guymer (Inst. of Oceanographic Sci., Godalming, England).
Philos. Trans. R. Soc. London A (GB), vol.309, no.1508, p.401-16 (1983).
A microwave scatterometer operating at 14.6 GHz was one of several sensors on Seasat that provided data of the sea surface. The technique by which estimates of the near-surface wind velocity can be obtained is described and studies to assess the accuracy of such data are reviewed. With few exceptions wind speed can be retrieved to ± 1.6 m s^{-1} and direction to $\pm 17°$ for winds between 3 and 16 m s^{-1}, and the technique is useful up to at least 25 m s^{-1}. The ability to measure wind on a near-global basis with a spatial resolution of 50 km is of great importance for meteorology and oceanography. (70 refs.)

104616 Satellite observations of ocean colour. I.S.Robinson (Dept. of Oceanography, Univ. of Southampton, Southampton, England).
Philos. Trans. R. Soc. London A (GB), vol.309, no.1508, p.417-32 (1983).
Ocean colour is unique among the properties of the sea that can be measured from satellites because visible wavelength radiation penetrates below the surface skin and contains direct information about the bulk water quality in the upper few metres of the sea. With reference to Nimbus CZCS and Landsat MSS data, this review examines three aspects of ocean-colour monitoring: the removal of atmospheric effects, which make up a large proportion of the visible signal reaching the satellite; the calibration of the ocean colour signal in terms of more useful ocean parameters such as sediment load, chlorophyll concentration, water depth or the depth of the euphotic zone; and the potential applications of colour-monitoring satellites to oceanography. (76 refs.)

104617 Application of microwave remote sensing to studies of sea ice. P.E.Gudmandsen (Electromagnetics Inst., Tech. Univ. of Denmark, Lyngby, Denmark).
Philos. Trans. R. Soc. London A (GB), vol.309, no.1508, p.435-47 (1983).
Microwave remote sensing is the only technique that may deliver reliable and timely data irrespective of light, weather and cloud conditions. In the polar regions, this feature is of utmost importance in sea ice studies. All known microwave remote-sensing techniques have demonstrated their applicability in polar regions, in particular in connection with observations of sea ice. It has also been shown that a combination of simultaneously acquired data from different sensors may be of advantage in parameter retrieval. This paper reviews the monitoring requirements and the microwave techniques available for this purpose with a view to snow and sea ice research and applications. (22 refs.)

104618 Satellite observations of polar ice fields. G.deQ.Robin, D.J.Drewry, V.A.Squire (Scott Polar Res. Inst., Univ. of Cambridge, Cambridge, England).
Philos. Trans. R. Soc. London A (GB), vol.309, no.1508, p.449-63 (1983).
Outlines the research needed to advance the knowledge of polar ice masses that could be or has been provided by satellite techniques. Inland ice sheets, ice shelves and pack ice on polar oceans are discussed in separate sections. Because a satellite radar altimeter can cover wide areas of polar ice economically and rapidly, the interpretation of altimeter results is discussed in detail. Theoretical considerations are used to explain various characteristics of pulse shapes recorded over Antarctica by Seasat. Over inland ice, surface undulations cause the pulse shape to change rapidly with location, and the leading edge to migrate rapidly. Altimetry over ice shelves should be accurate to better than ± 1 m and provide new methods for studying their mass balance. (42 refs.)

104619 Contribution to the metrological study of radiometers. A radiometer test-chamber. H.Boyen.
Publ. Inst. R. Meteorol. Belg. Ser. A (Belgium), no.108, p.1-25 (1981). [received: Aug. 1983]
A test-chamber especially equipped to study the dynamic behaviour of radiometers and to calibrate pyrradiometers is described. To simulate environmental conditions, temperature as well as humidity and, to some extent, also ventilation speed inside of the test-chamber can be preset within fixed limits. Short-wave radiometers response may be controlled against a Xenon illuminator. The characteristics of two kinds of thermal radiators, viz. a cylindrical cavity and a large area cavity array, are discussed. An Eppley spectral precision pyranometer and a pyrradiometer of the shielded type have been tested to bring out the capabilities of the test-chamber. (6 refs.)

104620 Generalised study of the suppression principle and its associate equivalence for the three-layer case. Detectability of a stratum by the VES method. M.C.Hernandez (Catedra de Geofisica, Univ. Complutense, Madrid, Spain).
Rev. Geofis. (Spain), vol.38, no.2, p.121-31 (1982). In Spanish.
A generalisation of the suppression's principle and its associate equivalence for the three-layer case in vertical electrical soundings (Schlumberger array) is described. This generalisation may be applied to those beds whose resistivities are not intermediate between those immediately above and below and that may be missed in the interpretation. The ranges of thickness and resistivities for which the presence of an intermediate layer can be established, allowing for a maximum error of 5% in the apparent resistivity field curve, are discussed. The results are shown graphically. (7 refs.)

104621 A tilting bucket automatic rain-gauge. M.Puigcerver, S.Alonso, J.Lorente (Dept. de Fisica de la Tierra y del Cosmos, Univ. de Barcelona, Barcelona, Spain).
Rev. Geofis. (Spain), vol.38, no.2, p.139-48 (1982). In Spanish.
A state-of-rainfall gauge has been constructed using as far as possible commercially available parts. The collector is of the tilting-bucket type, an electrical impulse being sent each time the bucket tilts. This is received by a control unit with a logic circuit and a quartz clock with LED display connected to a printer through a BCD interface. Each time an impulse is received from the collector, the control unit commands the printer to record the clock display. The printout is thus just time, and the rainfall rate can be easily derived once the bucket volume is known. Some recorded examples are presented. The operating characteristics of the system are discussed. (24 refs.)

104622 Note on the detectability of a layer by the VES method. E.Orellana (Catedra de Geofisica, Univ. Complutense, Madrid, Spain).
Rev. Geofis. (Spain), vol.38, no.2, p.149-54 (1982). In Spanish.
The conditions in which a layer, located at certain depth in a geoelectrical section, should satisfy in order to be detectable by means of a VES (Vertical Electrical Sounding) are studied. There are three possibilities regarding the detectability of a layer of assumed parameters: (a) the layer presence can be affirmed, making allowance for equivalence; (b) the VES curve is incompatible with the existence of the layer; (c) the curve is compatible with the layer, but the presence of it cannot be asserted. After studying several selected cases it is concluded that the detectability of a layer does not depend only on its relative thickness, but also on its resistivity contrast with the upper and lower layers on its relative parameters of Dar Zarrouk and on the accepted margin of error. (5 refs.)

104623 Numerical inversion method for application to the interpretation of seismic profiles. E.Surinach (Catedra de Geofisica, Univ. Complutense, Madrid, Spain).
Rev. Geofis. (Spain), vol.38, no.2, p.155-66 (1982). In Spanish.
The application of numerical inversion techniques to interpretation of data of seismic soundings allows one to obtain models of the crustal structure and their errors bounds. Two inversion techniques are presented, one for layered media with constant velocities and another for continuous variation of velocity with depth. In the first case, the Lanczos generalised inverse is utilised and in the second case extremal inversion and Tau methods. Both techniques are applied to the interpretation of a seismic profile through the Iberian Meseta and their results compared and discussed. (17 refs.)

104624 New techniques [in geodesy]. V.L.Pisacane (Appl. Phys. Lab., Johns Hopkins Univ., Laurel, MD, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.585-92 (April 1983).
Reviews developments in positioning, terrain contouring, gravity and time measurement techniques during the period 1979-82. (129 refs.)

104625 New method of laser probing of the atmosphere, based on reception of echo signal at the laser. A.P.Godlevskii, V.E.Zuev, A.K.Ivanov, Yu.D.Kopytin (Inst. of Atmospheric Optics, Acad. of Sci., Tomsk, USSR).
Sov. Phys.-Dokl. (USA), vol.27, no.11, p.935-7 (Nov. 1982). Translation of: *Dokl. Akad. Nauk SSSR*, vol.267, no.1-3, p.343-7 (Nov. 1982).
Laser methods of probing the atmosphere are in wide use. The known methods all have a typical functional separation of the transmitting and receiving units. The authors describe a new, highly sensitive method of laser probing of the atmosphere, based on effects in the intraresonator laser reception of the echo signals (the LR lidar method) when a mirror or natural diffusive reflector (a cloud layer, local topographical features, etc.) is used. (3 refs.)

104626 Combined sounding of the atmosphere by aerosol and Raman lidars. Yu.F.Arshinov, Yu.S.Balin, S.M.Bobrovnikov, I.A.Razenkov (Inst. of Atmospheric Optics, Acad. of Sci., Tomsk, USSR).
Sov. J. Quantum Electron. (USA), vol.13, no.2, p.217-21 (Feb. 1983). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.10, no.2, p.390-7 (Feb. 1983).
A combined sounding of the atmosphere was carried out using aerosol and Raman lidars. It was found that in the case of a moderate mist the variations in the echo signal, determined in a time interval of 25 sec, were within the range 3-15%, whereas in the case of a dense mist and during rain such variations reached 50%. An increase in the relative humidity resulted in both an increase and a decrease in the echo signal due to the aerosol scattering. A calculation was made of the coefficients representing mutual correlation of the echo signals with one another and with meteorological parameters. The precision of the recording channel of the aerosol lidar was estimated using the Raman lidar as a control device. It was established that the relative error in

the determination of the echo signal by the aerosol lidar was within the range 3-6%. (5 refs.)

104627 Calculation of maximum discharges in a multiflood regime. B.Ya.Kagan.
Sov. Meteorol. & Hydrol. (USA), no.5, p.65-73 (1982). Translation of: *Meteorol. & Gidrol. (USSR),* no.5, p.80-90 (1982).
A method is proposed for calculating maximum discharges in a multiflood regime based on the use of information about all practically significant floods, plotting probability curves of each flood, and converting these curves to maximum discharge probability curves for increasing the reliability of hydrologic substantiation of the designs of hydraulic structures. (11 refs.)

104628 On the least squares solution to optimisation equations arising in problems of terrestrial photogrammetry. H.-U.Schulz (Tech. Univ. Dresden, Dresden, Germany).
Wiss. Z. Tech. Univ. Dresden (Germany), vol.31, no.5, p.182-6 (1982). In German. [received: May 1983]
The work described arises out of the part played by improvements in software, in optimising the performance of photogrammetric apparatus and in achieving maximum economy of computer capacity and time. It deals with numerical processes applied to concrete smoothing problems in terrestrial photogrammetry which provide a mean square solution to the linear system of optimisation equations without calculation of the normal equations. The orthogonalisation process of Schmidt and the methods of conjugated gradients of Hestenes-Stiefel are examined, their advantages and disadvantages discussed, and the accuracy achieved in practical examples analysed. (6 refs.) *C.J.O.G.*

104629 NEXRAD—weather radar for the future. J.D.Bonewitz (Nexrad, Silver Spring, MD, USA).
Electro/81 Conference Record, New York, USA, 7-9 April 1981 (El Segundo, CA, USA: Electron. Conventions 1981), p.4/1/1-7
Currently, aging weather radars and air traffic control radars are being used to obtain information concerning the location, intensity, and movement of hazardous weather activity. However the present weather radars lack the capability to detect wind-related weather phenomena and have increasingly severe maintenance problems. The air traffic control radars also lack wind related detection capability and, because they are not optimized for weather detection, have limited reflectivity (precipitation) related capability as well. As a result the author proposes a common new Next Generation Weather Radar (NEXRAD) System. This national system will meet requirements for hazardous weather information within limitations imposed by cost and technical feasibility. It represents a major upgrading of existing capability, primarily through application of the Doppler principle, the use of solid-state technology, and improved communication, display, and data processing devices. (13 refs.)

104630 Coordinated radar and aircraft observation of turbulence. M.Labitt (Lincoln Lab., MIT, Lexington, MA, USA).
Electro/81 Conference Record, New York, USA, 7-9 April 1981 (El Segundo, CA, USA: Electron. Conventions 1981), p.4/2/1-11
Lincoln Laboratory, under a program sponsored by the Federal Aviation Administration, has undertaken to measure and correlate radar- and aircraft-sensed turbulence in rainstorms. The author presents interim results of these measurements. Results of the measurements are expected to provide guidance in the design of equipment that will display areas of hazardous turbulence with confidence. Plots of turbulence levels measured simultaneously by a ground radar and an aircraft are shown to illustrate the correlation. Comparisons of the turbulence levels with the rain reflectivity are also made. (5 refs.)

104631 Latest developments in Doppler weather radar. R.A.Dill (Equipment Div., Raytheon Co., Wayland, MA, USA).
Electro/81 Conference Record, New York, USA, 7-9 April 1981 (El Segundo, CA, USA: Electron. Conventions 1981), p.4/4/1-6
Doppler weather radar has made significant advances since Smith and Holmes' initial experiments (1961). The most recent of these are discussed. They generally fall into three categories: waveform; display; and signal processing. In addition, there are significant advances being made in hardware technology that will permit faster, better or lower cost implementation of some of the above and they are touched on briefly as an indication of future techniques applicable to radar in general that might find their way into Doppler weather radars. (19 refs.)

104632 The dynamic least square algorithm and its application to the location of seismic events. B.R.Suresh, R.K.Aggarwal (Honeywell Systems & Res. Center, Minneapolis, MN, USA).
1983 IEEE International Symposium on Circuits and Systems, Newport Beach, CA, USA, 2-4 May 1983 (New York, USA: IEEE 1983), p.1384-7 vol.3
The time difference of arrival (TDOA) between two waveforms is quite useful in range and bearing estimation of seismic events. The TDOA can be calculated by cross-correlating the two waves and locating the peak in the cross-correlation. However, when a seismic signal is cross-correlated, multiple spurious peaks occur in the cross-correlation function due to seismic multimode and multipath progagation. The authors propose the dynamic least square (DLS) algorithm, which is a technique for isolating the genuine peak from the spurious ones in a computationally efficient manner. (2 refs.)

Proceedings of Symposium 1 and Workshop V of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 98617

Field Measurement and Calibration Using Electro-Optical Equipment: Issues and Requirements .... See Entry 98622

Proceedings zum Kolloquium WOPHYS '82. Meteorologische Probleme der Wolkenphysik und ihre theoretische und instrumentelle Bearbeitung (Proceedings of Colloquium WOPHYS ' 82. Cloud Physics Meteorological Problems Theoretical Instrumentational Workings) .... See Entry 98638

Ninth International Symposium on Machine Processing of Remotely Sensed Data with Special Emphasis on Natural Resources Evaluation .... See Entry 98645

Sixth ESA Symposium on European Rocket & Balloon Programmes & Related Research (ESA SP-183) .... See Entry 98654

Magnetic field measurements near a steel plate .... See Entry 98702

Compact, pulsed laser Doppler anemometer for airborne and wind-tunnel applications .... See Entry 101361

The computation and reporting of dissolved gas levels .... See Entry 103744

Use of the method of isotope glaciology for studying nuclear explosion products in Antarctica .... See Entry 103763

Eye-safe tracking of oil fog plumes by UV lidar .... See Entry 103770

Determination of ethylene and other reactive hydrocarbons in the atmospheric air at Trombay, Bombay by gas chromatography using a chemiluminescent detector .... See Entry 103771

The measurement of fluorine concentration in environmental samples by using $^{19}F(p,\alpha\gamma)^{16}O$ prompt nuclear reaction analysis .... See Entry 103773

On filtering and compressing LAGEOS laser range data .... See Entry 104159

Numerical calculation of covariances between area means .... See Entry 104160

An efficient short-arc orbit computation .... See Entry 104161

A practical method for the inversion of magnetotelluric data for a layered Earth .... See Entry 104179

A comparison of adjustment procedures for leveling aeromagnetic survey data .... See Entry 104180

Werner deconvolution for automated magnetic interpretation and its refinement using Marquardt's inverse modeling .... See Entry 104181

Use of the resistivity method in geological mapping-case histories from Raniganj Coalfield, India .... See Entry 104182

Electromagnetic sounding near a large square loop source of current .... See Entry 104183

VLF survey of the weathered layer in southern India .... See Entry 104184

Deep magnetotelluric profiling using the vertical component of geomagnetic variations .... See Entry 104195

The use of Walsh filters in geoelectric investigations .... See Entry 104196

Three-dimensional ray tracing and the method of principal curvature for geometric spreading .... See Entry 104222

Generalized linear inversion of reflection seismic data .... See Entry 104236

Migration with the full acoustic wave equation .... See Entry 104237

Seismic shear-wave observations in a physical model experiment .... See Entry 104238

Continuously time-variable recursive digital band-pass filters for seismic signal processing .... See Entry 104239

Migration by extrapolation of time-dependent boundary values .... See Entry 104240

A study of the importance of nonlinearity in the inversion of earthquake arrival time data for velocity structure .... See Entry 104266

Teleseismic detection in the Aleutian Island Arc .... See Entry 104267

Moment and duration of shallow earthquakes from Love-wave modelling for regional distances .... See Entry 104269

Inversion and deconvolution: foreplay and interplay .... See Entry 104274

Calculations on the thermal conditions around a salt diapir .... See Entry 104283

Eruption age of a Pleistocene basalt from ^{40}Ar-^{39}Ar analysis of partially degassed xenoliths .... See Entry 104294

Delineation of New Zealand ultramafic rocks by computer processing of digital data from satellite imagery .... See Entry 104298

Error analysis for the determination of tectonic rotation from paleomagnetic data .... See Entry 104323

Diffusion between olivine and spinel: application to geothermometry .... See Entry 104339

A model for the high-frequency electrical response of wet rocks .... See Entry 104340

A semiempirical method for analysis of the reflectance spectra of binary mineral mixtures .... See Entry 104347

Dynamic-stochastic calculations of seasonal geostrophic surface water circulation in the eastern tropical zone of the Indian Ocean .... See Entry 104395

Estimation of the daily global solar irradiation at Corvallis, Oregon (USA) from the hours of bright sunshine, the daily temperature range and relative humidity .... See Entry 104447

Lidar- and balloon-borne particle counter comparisons following recent volcanic eruptions .... See Entry 104482

Measurement of the vertical ozone distribution by means of an in situ gas phase chemiluminescence ozonometer during the Intercomparison Ozone Campaign, Gap, France, June 1981 .... See Entry 104517

GSFC optical ozonesonde results during the Gap, France, intercomparisons, June 1981 .... See Entry 104518

Stratospheric ozone measurements by solar ultraviolet absorption .... See Entry 104520

Total ozone measurements derived from TOVS radiances .... See Entry 104522

Measurements of total ozone: intercomparison of data from a variety of instruments, June 1981 .... See Entry 104523

Measurements of the ozone vertical distribution (0-25 km): comparison of various instruments, Gap—Observatoire de Haute-Provence, June 1981 .... See Entry 104524

Comparison of ozone vertical distributions measured by different techniques at mesospheric altitudes .... See Entry 104526

Estimation of the temperature at the upper boundary of the clouds over the oceans .... See Entry 104536

Indication of the origin and evolution of radiation fogs by means of lidar .... See Entry 104546

Comparison of decameter-wave propagation times calculated by adiabatic and ray methods .... See Entry 104651

94.00 AERONOMY AND SPACE PHYSICS

94.10 PHYSICS OF THE NEUTRAL ATMOSPHERE

(for planets, see 96.30)

104633 Upper atmosphere density derived from Interkosmos 10 data. L.Sehnal (Astron. Inst., Czechoslovak Acad. of Sci., Ondrejov, Czechoslovakia).
Bull. Astron. Inst. Czech. (Czechoslovakia), vol.34, no.3, p.178-84 (June 1983).
Densities of the upper atmosphere at 272 km are derived from the analysis of the mean daily motion of the Interkosmos 10 satellite (1973-82A) within the interval of MJD 42457 to MJD 43280. The observed densities are compared to three different models (DTM, MSIS, and C) and the ballistic coefficient is computed. (6 refs.)

104634 Use of incoherent-scatter data for determination of aeronomic quantities at F_2 altitudes; annual variations in atomic oxygen. A.V.Mikhaylov, G.I.Ostrovskiy (Inst. of Appl. Geophys., State Committee on Hydrometeorology, USSR).
Geomagn. & Aeron. (USA), vol.22, no.1, p.44-8 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.1 (1982).
A method is proposed for determining aeronomic quantities at altitudes corresponding to the F_2 layer from incoherent-scatter data. It is concluded that there are significant variations in the amount of atomic oxygen in the upper atmosphere over the course of a year and from day to day. These variations are not described by existing models. Additional factors must therefore be incorporated in the models for the neutral composition of the upper atmosphere. (22 refs.)

104635 Effect of ionospheric plasma on the general circulation in the upper atmosphere. II. A.G.Khantadze, A.I.Gvelesiani (Inst. of Geophys., Acad. of Sci., Georgian SSR).
Geomagn. & Aeron. (USA), vol.22, no.1, p.49-51 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.1 (1982).
For pt.I see Geomagn. & Aeron. (USSR), vol.21, no.6, p.988 or Geomagn. & Aeron (USA), vol.21, no.6, p.733-5 (1981). A global pattern of the general circulation at ionospheric altitudes is derived through a numerical solution of the equations of motion. A model ionosphere and the Jacchia-70 model for the neutral atmosphere are used. (5 refs.)

104636 Perturbation of the neutral atmosphere by the spherical terminator. V.M.Somsikov (Acad. of Sci., Kazakh SSR).
Geomagn. & Aeron. (USA), vol.22, no.1, p.56-9 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.1 (1982).
Linearized equations of gas dynamics are analyzed in a spherical coordinate system fixed with respect to the Sun. The effect of the temperature gradient in the atmosphere on the natural wave spectrum is analyzed. A model for the terminator is derived in the spherical coordinate system and used to determine perturbations of the atmospheric pressure. The terminator contribution to the overall perturbation caused by the solar heating of the atmosphere is analyzed. (8 refs.)

104637 Regular vertical motions in the lower thermosphere near the mesopause. Yu.I.Portnyagin, T.V.Solov'yeva (Inst. of Experimental Meteorology, State Committee on Hydrometeorology, USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.196-8 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
The latitude profile of the average annual departure from the geostrophic wind is plotted for a height $\sim$95 km. The latitude profile of the average annual vertical wind is calculated from the conservation of angular momentum flux. It is concluded that there is a regular vertical transport of masses of air in the meteor zone of the atmosphere. This vertical transport can be described by several global circulation cells in the meridional plane. (8 refs.)

104638 Mathematical modelling and analysis of the fluid dynamics of upper atmosphere dumbbell satellites. M.G.Zavattaro Chiado Piat (Dipartimento di Matematica, Politechnico Torino, Torino, Italy).
Mech. Res. Commun. (GB), vol.10, no.3, p.157-62 (May-June 1983).
The study of the physics of the interactions between a free molecule hyperthermal stream and a convex body plays an important role in upper atmosphere fluid dynamics. The author presents the calculation of the aerodynamic coefficients for satellites consisting of two spheres connected by a tether of variable length. This geometry is relevant for gravity oriented satellites. (8 refs.)

104639 Altitude-latitude structure of the mean annual zonal wind in the mesopause-lower thermosphere region. Yu.I.Portnyagin (Inst. of Experimental Meteorology, USSR).
Sov. Meteorol. & Hydrol. (USA), no.9, p.24-9 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.9, p.34-41 (1982).
Considers the zonal wind speed in the mesopause-lower thermosphere region for 34 radio meteor and ionospheric stations in high, temperature, and low latitudes in both hemispheres. An altitude-latitude section of the mean annual zonal wind can be constructed for heights of 70-110 km in the mean zonal approximation. A characteristic feature of this section is that there is a certain degree of asymmetry between the zonal-circulation structures in the northern and southern hemispheres. (32 refs.)

The delta band dissociation of nitric oxide: a potential mechanism for coupling thermospheric variations to the mesosphere and stratosphere ....See Entry 104488

Solitary internal gravity wave in the ionospheric F region .....See Entry 104654

Emission of high-energy albedo particles from the atmosphere into outer space ....See Entry 104691

A study of the disintegration of meteoric particles moving in the atmospheres of the Earth, Mars, and Venus ....See Entry 104812

94.10Q Airglow and nightglow

Measurements of temporal variations of the brightness of the aurora and emission layers from the orbiting space station Salyut-6 ....See Entry 104643

94.10S Aurora

104640 Celestial winds, polar lights. F.Reddy.
Astronomy (USA), vol.11, no.8, p.6-15 (Aug. 1983).
Describes the magnetosphere, the aurora, the radiation belts, solar particle streams, IGY results, the auroral oval, the Dynamics Explorer mission and observations of the theta arc. (no refs.)

104641 Effect of solar wind velocity on the position and structure of auroras in the midnight sector. V.G.Vorob'yev, V.L.Zverev (Polar Geophys. Inst., Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.1, p.60-3 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.1 (1982).
The effect of the solar wind velocity on the boundaries of the auroral oval near midnight is studied. At negative values of the B_z component of the interplanetary magnetic field, an increase in the velocity of the solar wind shifts the boundary of the auroral zone on the polar side to a higher latitude and that on the equatorial side to a lower latitude (with respect to their average positions). If $B_z>0$, an increase in the solar wind velocity is accompanied by an expansion of the auroral band and a shift toward lower latitudes. (10 refs.)

104642 Generation of a quiet auroral arc. S.V.Leont'yev, V.B.Lyatskiy (Polar Geophys. Inst., Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.199-202 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
A new model is proposed for the generation of an auroral arc. This model has a system of oblique currents appearing above the arc as the magnetospheric plasma drifts in the direction across the arc. (11 refs.)

104643 Measurements of temporal variations of the brightness of the aurora and emission layers from the orbiting space station Salyut-6. S.V.Avakyan, G.A.Dolgopolov, L.S.Yevlashin, A.S.Ivanchenkov, V.V.Kovalenok, G.M.Kolesnikov, T.A.Kornilova, G.M.Kravchenko, A.I.Lazarev, A.N.Svirskiy, G.V.Starkov, S.A.Chernous (Polar Geophys. Inst., Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.203-5 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
Results of observations of auroras and emission layers from the orbiting station Salyut-6, made in 1978, are reported. A comparison of the variations of the emissions from these two sources demonstrates their synchroneity. (10 refs.)

104644 Altitudinal distribution of hydrogen luminescence in auroras, as measured by geophysical rockets launched from Franz-Josef Land. T.M.Tarasova, O.I.Yagodkina, L.S.Yevlashin, A.I.Lazarev, M.V.Orlova (Polar Geophys. Inst., Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.206-9 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
The results of four rocket launches from Heiss Island, Franz-Josef Land, at various levels of geomagnetic activity and MLT are discussed. It is shown that the hydrogen emission, generated by injected protons, has its maximum at the altitude of 120 to 140 km, which is above the emission generated by precipitating electrons. (13 refs.)

104645 Radioaurora altitudes. E.E.Timofeyev, Yu.G.Miroshnikov, T.N.Khor'kova, T.V.Miroshnikova (Polar Geophys. Inst., Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.210-12 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
Measurements of vertical characteristics of auroral backscattering above the Kola Peninsula, using a double vertical interferometer, are presented. The authors find differences in radioauroral altitudes in the zones of the eastern and western electrojets, a correlation between the altitudes of auroral inhomogeneities and of the auroral E_{sr} layer, and a vertical stratification structure of the auroral backscattering. (12 refs.)

Dynamics of the lower ionosphere during auroral disturbances according to VLF data .... See Entry 104653

Eddy intrusion of hot plasma into the polar cap and formation of polar-cap arcs ....See Entry 104657

Relationships among the ring current, the precipitated electrons, and the aurora in the morning magnetosphere, from data of the Kosmos-900 satellite ....See Entry 104664

94.20 PHYSICS OF THE IONOSPHERE

(for planets, see 96.30)

104646 Geophysical invariance of the lower part of the F region of the ionosphere. G.S.Ivanov-Kholodnyy, Yu.K.Kalinin (Inst. of Appl. Geophys., State Office of Hydrology & Meteorology, USSR).
Geomagn. & Aeron. (USA), vol.22, no.1, p.17-20 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.1 (1982).
The idea of invariant properties of the lower region of the *F*-region is introduced based on electron concentration profiles in the altitude range 150 to 200 km. The observed stability of the delay of round-the-world signals is treated. (10 refs.)

104647 Structure of the daytime equatorial ionosphere. G.F.Dyominova (Inst. of Terrestrial Magnetism, Ionosphere & Radiowave Propagation, Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.1, p.21-4 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.1 (1982).
The altitudinal distribution of the concentration and temperature of charged particles above the magnetic equator in the altitude range 100 to 2000 km at midday under quiet geomagnetic conditions and different levels of solar activity is obtained by solving analytically the system of equations for the ionospheric plasma. The electron temperature has a maximum near 250 km, which agrees with observations. The isothermal region ($T_e \approx T_n$) is located in the altitude range 380 to 500 km in the case of low, and 380 to 650 km in high solar activity. (14 refs.)

104648 Nonstationary processes accompanying the perturbation of the nighttime polar ionosphere by radio waves. I.N.Bardeyev, A.V.Gurevich, Ya.S.Dimant, I.N.Kapustin, A.M.Royzen, A.A.Ul'Yanchenko (Inst. of Terrestrial Magnetism, Ionosphere & Radiowave Propagation, Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.1, p.25-8 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.1 (1982).
Plasma motion in the *F*-layer of the nighttime polar ionosphere, induced by the action of strong radio waves, is investigated. A Doppler shift in the frequency of the probing radio signal passing through the perturbed region is observed. The theory of the effect is derived, and the results computed show adequate agreement between the theory and observations. (9 refs.)

104649 Current excitation in the geomagnetic pulsation range by strong radiowaves. N.D.Borisov, I.P.Zolotarev (Inst. of Terrestrial Magnetism, Ionosphere & Radiowave Propagation, Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.1, p.29-32 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.1 (1982).
The structure of the additional current system and the structure of concentration perturbations produced under the action of strong modulated HF radiation on the ionosphere, are investigated. It is shown that when the modulation frequency lies in the geomagnetic pulsation range, concentration perturbations can be generated in the conjugate part of the ionosphere in the other hemisphere and the external electric field can induce transport of plasma out of the heated region. (7 refs.)

104650 Generation of acoustical gravitational waves by auroral electrojets. V.V.Kulikov (Inst. of Terrestrial Magnetism, Ionosphere & Radiowave Propagation, Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.1, p.33-6 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.1 (1982).
Analytical solutions are obtained for the linearized problem of the generation of AGW by two auroral electrojets. The dimensions of the region with the most efficient AGW generation by the ponderomotive force and by Joule heating are estimated. Working equations are obtained both for a source that

varies harmonically with time, and for a nonperiodic source that acts in the form of a series of pulses with different amplitude and duration. (6 refs.)

104651 Comparison of decameter-wave propagation times calculated by adiabatic and ray methods. I.B.Yegorov, N.I.Manayenkova, Ye.Ye.Tsedilina (Inst. Terrestrial Magnetism, Ionosphere & Radiowave Propagation, Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.1, p.37-40 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.1 (1982).
A detailed comparison is made of the adiabatic-invariant and ray methods for calculating the propagation time of short radiowaves in the ionosphere. Some characteristics of the 'error' of the adiabatic method are established. The maximum error of this method is less than 1.5%. (10 refs.)

104652 One type of phase anomaly of VLF signals on auroral routes. G.P.Beloglazova, M.I.Beloglazov (Polar Geophys. Inst., Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.1, p.41-3 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.1 (1982).
The anomalous phase variations of VLF waves which occur against a quiet geophysical background on Norway-Apatity routes are discussed. The duration of these variations ranges from a few minutes to 0.5 to 1.0 h, and their typical magnitude is 3 to 6 μs. Their most probable cause is shown to be an injection of relativistic electrons. (14 refs.)

104653 Dynamics of the lower ionosphere during auroral disturbances according to VLF data. G.F.Remenets, M.I.Beloglazov (Inst. of Phys., Univ. of Leningrad, Leningrad, USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.177-81 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
The coefficients for the reflection of the first two ionospheric rays from the 'quiet' auroral ionosphere and during several auroral disturbances are determined from the three-frequency relative variations of VLF signals (10-16 kHz) detected for a source in the intermediate zone. (14 refs.)

104654 Solitary internal gravity wave in the ionospheric F region. F.G.Deminova, M.G.Deminov, L.M.Yerukhimov, O.N.Savina, L.A.Yudovich (Inst. of Terrestrial Magnetism, Ionosphere & Radio Wave Propagation, Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.182-5 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
The propagation of a solitary internal gravity wave in the upper atmosphere can be described in the approximation of a weak nonlinearity. An experimental determination of one of the characteristics of a disturbance makes it possible to learn about all the parameters of a solitary internal gravity wave and of its plasma wake. Solitons of this sort may be observed in substorms with an energy discharge $p \gtrsim 10^{18}$ erg/sec in the auroral zone. (12 refs.)

104655 Model for the distribution of the ionospheric electric field caused by the azimuthal component of the interplanetary magnetic field. V.M.Uvarov (Arctic & Antarctic Inst., State Hydrometeorological Committee, USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.186-8 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
A model is constructed for the distribution of the electric field caused by the B_y component of the interplanetary magnetic field. The theoretical results agree well with direct measurements at the polar caps and at the cusps. (8 refs.)

104656 Fluctuations in the delay of a short-wave signal during oblique sounding. A.V.Gurevich, E.E.Tsedilina (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.189-91 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
The effect of multiple scattering of radio waves in the ionosphere on the mode broadening on oblique-sounding ionograms is analyzed in the adiabatic approximation. A method for determining the effective ray diffusion coefficient has been developed from a study of the model broadening. (9 refs.)

104657 Eddy intrusion of hot plasma into the polar cap and formation of polar-cap arcs. Y.T.Chiu, D.J.Gorney (Space Sci. Lab., Aerospace Corp., Los Angeles, CA, USA).
Geophys. Res. Lett. (USA), vol.10, no.6, p.463-6 (June 1983).
Presents plasma and electric field data obtained by the S3-3 satellite over the polar caps. It is demonstrated that: (1) plasma signatures in the polar cap arc formation region near 5000 km altitude show clear intrusions of plasma sheet (~keV) and magnetosheath (~100 eV) plasma into a background of low-energy polar cap plasma; (2) the combined plasma and electric field signatures (electron inverted-V, ion beam and $\nabla.E<0$) are exactly the same as in the evening discrete arc. This equivalence of polar cap and evening discrete arc signatures is interpreted as indication that their formation processes are identical. The spatial structures of polar cap electric fields and the associated plasma signatures are consistent with the hypothesis that plasma intrusion into the polar cap takes the form of multiple cellular eddies. (16 refs.)

104658 Electrojet boundaries and electron injection boundaries. A.Grafe (Central Inst. for Solar-Terrestrial Phys., Acad. of Sci., Berlin-Adlershof, Germany).
J. Geomagn. & Geoelectr. (Japan), vol.35, no.1, p.1-15 (1983).
From observations of the magnetic field along several magnetometer chains motions of the boundaries of auroral electrojets during the active substorm phase are derived. It turned out that for both electrojets (westward and eastward electrojet) the equatorward boundary is more stable than the poleward one. For both electrojets, however, this boundary correlates quite well with *Kp*. The *Kp* dependence of the equatorward electrojet boundary was compared with that of the electron injection boundary after Kivelson et al. (1980). It turned out that the equatorward boundary of the westward electrojet—but not of the eastward electrojet—coincides quite well with that of the electron injection boundary. (22 refs.)

104659 Global pattern of auroral ion precipitation: a review of the results from the AUREOLE-1 and AUREOLE-2 satellites. J.Crasnier, J.A.Sauvaud, F.Cambou (Centre d'Etude Spatial des Rayonnements, Toulouse Univ., Toulouse, France), V.A.Gladyshev, R.A.Kovrazhkin, Y.I.Galperin.
J. Geophys. (Germany), vol.52, no.3, p.150-7 (1983). (European Geophysical Society Symposium on Plasma and Energetic Particles in the Magnetosphere, Leeds, England, 23-27 Aug. 1982).
The ion measurements (0.2-30 keV) made on board the AUREOLE-1 and 2 polar orbiting satellites are reviewed in order to construct a synthetic global pattern of the auroral ion precipitation. The more prominant features of the picture obtained are summarized. The global pattern is discussed in the context of the distribution of the various plasma domains in the outer magnetosphere. (42 refs.)

104660 Analysis of some ionospheric parameters of the South Atlantic geomagnetic anomaly by means of VLF waves. A.H.Cardoso (Dept. de Fisica do Setor de Ciencias Exatas, Univ. Federal do Parana, Curitiba, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.2, p.229-46 (June 1982). In Portuguese.
The author has characterised a small diurnal variation of the height of the ionospheric 'D' region which is associated with the South Atlantic Geomagnetic Anomaly (SAGA), using VLF waves. The result was achieved with a privileged trajectory by using the diurnal phase variation. The simultaneous use of the experimental data of the diurnal variation of the amplitude and Wait's theory (1981) with usually accepted parametrized values, however, gives results which are physically inconsistent. (16 refs.)

Sixth ESA Symposium on European Rocket & Balloon Programmes & Related Research (ESA SP-183) .... See Entry 98654

Study of daytime peak frequency and bandwidth of atmospherics as a function of azimuth .... See Entry 104467

The effects of energetic particle precipitation on the atmospheric electric circuit .... See Entry 104492

An estimate of the error in the measurement of a constant electric field by the method of a double Langmuir probe .... See Entry 104584

Intensity of 1356-Å emission as a determinant of F-region parameters .... See Entry 104585

A technique for studying density gradients and motions of plasmaspheric irregularities .... See Entry 104607

Use of incoherent-scatter data for determination of aeronomic quantities at F_2 altitudes; annual variations in atomic oxygen .... See Entry 104634

Effect of ionospheric plasma on the general circulation in the upper atmosphere. II .... See Entry 104635

Generation of a quiet auroral arc .... See Entry 104642

Altitudinal distribution of hydrogen luminescence in auroras, as measured by geophysical rockets launched from Franz-Josef Land .... See Entry 104644

Radioaurora altitudes .... See Entry 104645

Relationship between amplitude of equatorial SC(−+) and electrojet strength .... See Entry 104661

Relationships among the ring current, the precipitated electrons, and the aurora in the morning magnetosphere, from data of the Kosmos-900 satellite .... See Entry 104664

Whistler trapping near the plasmapause .... See Entry 104666

The effect of solar wind parameters of geomagnetic activity .... See Entry 104667

Evolution of density inhomogeneities in auroral plasma injected from the plasma sheet .... See Entry 104668

On the dynamics of the ring current .... See Entry 104679

94.30 PHYSICS OF THE MAGNETOSPHERE

(for planets, see 96.30)

104661 Relationship between amplitude of equatorial SC(−+) and electrojet strength. J.Hanumath Sastri (Indian Inst. of Astrophys., Bangalore, India).
Curr. Sci. (India), vol.52, no.9, p.419-20 (5 May 1983).
Storm sudden commencements (SC or SSC) manifest at low and equatorial latitudes most commonly in two forms denoted as SC(+) and SC(−+) or SC*. A fascinating aspect of SC at equatorial latitudes is the conspicuous enhancement of its magnitude during day time in the vicinity of the dip equator. This characteristic feature is observed in the amplitude of both the preliminary reverse impulse (PRI) and main impulse (MI) of SC(−+) and MI of SC(+); the rate of dip equator enhancement is, however, larger for SC(−+) than for SC(+). The origin of the occurrence of SC(−+) with enhanced magnitude at day time dip equator is not yet well understood. A study of the relationship of the amplitude of the constituent components of SC(−+) at the dip equator to the electrojet strength at the time of its occurrence is presented. (16 refs.)

104662 Electrons with energies of hundreds of megaelectron volts in near-Earth space. N.L.Grigorov.
Cosmic Res. (USA), vol.20, no.5, p.498-506 (Sept.-Oct. 1982). Translation of: *Kosm. Issled. (USSR)*, vol.20, no.5, p.705-13 (Sept.-Oct. 1982). [received: June 1983]
The results of measurements of high-energy electron fluxes in the Earth's vicinity at heights of ~200-500 km carried out on the Proton-3 and -4 and Kosmos-490 Earth satellites are discussed. Energy spectra measured under different observing conditions are presented. The experimental data are compared with theoretical calculations. It is shown that the $\pi \rightarrow \mu \rightarrow e$ decay mechanism explains the measurement results well. (15 refs.)

104663 Magnetic field of a plasma flow past a blunt body [Earth magnetosphere]. S.I.Alimarin, B.A.Tverskoy (Inst. of Nuclear Phys., Univ. of Moscow, Moscow, USSR).
Geomagn. & Aeron. (USA), vol.22, no.1, p.1-3 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.1 (1982).
An analytic expression is derived for the magnetic field of a given flow of incompressible plasma past a blunt semi-infinite body similar to the Earth's magnetosphere. Approximate equations are presented for this field far away from the body and near it surface. (9 refs.)

104664 Relationships among the ring current, the precipitated electrons, and the aurora in the morning magnetosphere, from data of the Kosmos-900 satellite. A.V.Dronov, M.I.Panasyuk, E.N.Sosnovets, L.V.Tverskaya, V.I.Tulupov, O.V.Khorosheva (Inst. of Nuclear Phys., Univ. of Moscow, Moscow, USSR).
Geomagn. & Aeron. (USA), vol.22, no.1, p.64-7 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.1 (1982).
Data obtained by Kosmos-900 are used in the analysis of the magnetic storm of 1 to 2 December 1977 ($D_{st} \approx -100_{\gamma}$). Data on the protons of the ring current, the precipitated electrons, and the auroral emission in the line at 3914 Å are reported. (8 refs.)

104665 Simulation of VLF wave propagation in the Earth's magnetosphere. O.A.Molchanov, O.A.Mal'tseva (Inst. of Terrestrial Magnetism, Ionosphere & Radiowave Propagation, Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.1, p.72-7 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.1 (1982).
A method is proposed for determining the path and amplitude characteristics of VLF waves propagating in the Earth's magnetosphere. The results are used to interpret satellite and ground-based experimental data. (22 refs.)

104666 Whistler trapping near the plasmapause. S.S.Sazhin, S.P.Varshavskiy (Univ. of Leningrad, Leningrad, USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.192-5 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
A qualitative analysis of whistler propagation near the plasmapause shows that whistlers propagating at a small angle from the magnetic field are effectively trapped in the region adjacent to the inner edge of the plasmapause.

This type of trapping occurs primarily under moderately disturbed conditions, with $K_p=2$. (9 refs.)

104667 The effect of solar wind parameters of geomagnetic activity. V.G.Vorobyev, V.L.Zverev (Polar Geophys. Inst., Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.217-20 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
The effect of solar wind velocity v and polarity of the B_y component on the geomagnetic activity in the aurora zone was studied. It is shown that at any B_z direction, the v increase is followed by an increase in geomagnetic activity. Both at $B_z<0$ and $B_z>0$ substorm intensities are greater during summer at the negative B_y, while during winter they are greater at $B_y>0$. (16 refs.)

104668 Evolution of density inhomogeneities in auroral plasma injected from the plasma sheet. A.P.Kropotkin (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.221-3 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
The plasma parameter in the plasma sheet and the particle-ring current is $\beta \gtrsim 1$, so that a flute (interchange) instability may be driven. The evolution of this instability is analyzed, with allowance for effects of the finite ion Larmor radius and the saturation due to nonlinearity. The electric fields of the perturbations and the longitudinal currents are estimated. The results are in accordance with experiment. (11 refs.)

104669 Phase observations of geomagnetic pulsations. M.B.Gokhberg, O.A.Pokhotelov, Yu.G.Khabazin (Inst. of Phys. of Earth, Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.224-7 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
The azimuthal wave numbers measured for hydrodynamic waves near the equatorial plane of the magnetosphere should differ from the numbers measured for the corresponding waves of geomagnetic pulsations at the Earth's surface. The difference arises because of an azimuthal dependence of the time required for a hydromagnetic perturbation to propagate from the equatorial plane to the Earth's surface. (10 refs.)

104670 Dielectric currents in the low-altitude boundary layer and geomagnetic tail. K.D.Cole (Lab. for Planetary Atmospheres, NASA/Goddard Space Flight Center, Greenbelt, MD, USA).
Geophys. Res. Lett. (USA), vol.10, no.6, p.467-70 (June 1983).
Considers a collisionless plasma with E (the electric field) parallel to the y-axis of a cartesian frame of reference and B (the magnetic induction) parallel to the z-axis. When there is a gradient, orthogonal to B, of the quantity ϵE^2, where $\epsilon=1+4\pi\rho_m c^2/B^2$, where ρ_m is the plasma mass density and c the speed of light, there is driven a (dielectric) current (j) given in the following two cases, by $j=[\nabla(\epsilon E^2)]c/B$. (i) When $\nabla(\epsilon E^2)$ is parallel to E, j is in the direction of $E\times B$, and (ii) and $\nabla(\epsilon E^2)$ is in the direction $E\times B$, j is in the direction of E. In the former case it follows that, in a steady state, $p_\perp+B^2/8\pi-\epsilon E^2/8\pi=\text{constant}$, along a line in the y-direction, and in the latter case $p_\perp+B^2/8\pi+\epsilon E^2/8\pi=\text{constant}$, on a line in the x-direction where $p_\perp$ is the pressure perpendicular to B. The currents related to ϵE^2 are geophysically significant in the region of interaction of the solar wind and geomagnetic field in the low latitude boundary layer and geomagnetic tail. The last written equation enables a realistic estimate of the cross-tail electric field to be made. (12 refs.)

104671 Collisionless dissipation processes in quasi-parallel shocks. K.B.Quest, D.W.Forslund, J.U.Brackbill, K.Lee (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Geophys. Res. Lett. (USA), vol.10, no.6, p.471-4 (June 1983).
The evolution of collisionless, quasi-parallel shocks ($\theta_B dn<45°$, where θ_{Bn} is the angle between the shock normal and the upstream magnetic field), is examined using two dimensional particle simulations. Reflected ions upstream from the shock are observed with average guiding centre velocity and gyrational energy which agree well with the prediction of simple specular reflection. Strong ion heating through the shock ramp is apparently caused by large amplitude whistler turbulence. A flux of suprathermal electrons is also observed upstream with increased flux oblique to the magnetic field direction. Much stronger ion heating occurs in the shock than electron heating. The relevance of this work to the Earth's bow shock is discussed. (16 refs.)

104672 Hall current effect on tearing mode instability. T.Terasawa (Inst. of Geophys. & Planetary Phys., Univ. of California, Los Angeles, CA, USA).
Geophys. Res. Lett. (USA), vol.10, no.6, p.475-8 (June 1983).
From a linear 2-D eigenmode analysis, it was found that the Hall current effect on collisional tearing mode instability becomes important for the thin magnetic reversal layer whose width is comparable to the ion inertia length; Hall currents produce a three-dimensional field structure and increase the reconnection (growth) rate. Since the magnetic reversal layer widths both in the magnetopause and in the magnetotail are reported to become as thin as the ion inertial length (several hundred km) when the reconnection process is supposed to occur, the Hall current effect would have an observational significance. The Hall current effect may explain the appearance of the dawn-dusk component of the magnetic field in the magnetotail reconnection region. (17 refs.)

104673 Large-amplitude ion bounce wave in the magnetosphere near L=3. L.J.Lanzerotti, L.V.Medford, A.Hasegawa (Bell Labs., Murray Hill, NJ, USA), D.L.Lin.
Geophys. Res. Lett. (USA), vol.10, no.6, p.479-81 (June 1983).
Large amplitude (~30 nT), high frequency (~0.14 Hz) geomagnetic field oscillations were observed superimposed on lower frequency ones (~0.008 Hz) at L~3 during a large magnetic storm. These are the largest amplitude oscillations ever reported in the Pc2 frequency band (0.1-0.5 Hz). Measurements at two stations spaced in azimuth by ~240 km show the higher frequency waves to occur at the same time at both locations. The higher frequency oscillations, which have larger amplitudes at the station close to local midnight, are consistent with a wave excited by the bounce motion of protons with a peak in the energy distribution at ~100 keV. The longer-period variations, which are highly non-correlated between the two locations, could be evidence of a surface 'wave' on the plasmapause. (21 refs.)

104674 Computer simulation of auroral kilometric radiation. J.S.Wagner (Inst. for Fusion Studies, Univ. of Texas, Austin, TX, USA), L.C.Lee, C.S.Wu, T.Tajima.
Geophys. Res. Lett. (USA), vol.10, no.6, p.483-6 (June 1983).
Studies the generation of auroral kilometric radiation (AKR) using relativistic, electromagnetic, particle simulations. The AKR source region is modeled by two electron populations in the simulation: a cold (200 eV) Maxwellian component and a hot (5-20 keV) population possessing a loss-cone feature. The loss-cone distribution is found to be unstable to the cyclotron maser instability. The fast extraordinary (X-mode) waves dominate the radiation and saturate when resonant particles diffuse into the loss-cone via turbulent scattering of the particles by the amplitude X-mode radiation. This paper studies the linear amplification and nonlinear saturation of electromagnetic waves associated with two components of electrons which consist of a weakly relativistic population of electrons possessing a loss-cone distribution, and a cold Maxwellian background. The motivation is to understand the mechanism responsible for the production of auroral kilometric radiation. (11 refs.)

104675 Heavy ion plasmas in the outer magnetosphere. D.T.Young (Los Alamos Nat. Lab., Los Alamos, NM, USA).
J. Geophys. (Germany), vol.52, no.3, p.167-75 (1983). (European Geophysical Society Symposium on Plasma and Energetic Particles in the Magnetosphere, Leeds, England, 23-27 Aug. 1982).
Discusses heavy ions (below 30 keV/Q) in magnetospheric plasmas from two points of view: heavy ions as minor species or 'tracers, and heavy ions as major plasma constituents. At present some 12 species of heavy ions have been detected in concentrations ranging from nearly 100% of the total ion density to $<10^{-2}$%. Tracer ions detected thus far include $^4He^{2+}$, O^{2+}, N^+ and N^{2+}; whereas the species O^+ and $^4He^+$ very often appear as major ions. Still other ion species, such as higher charge state solar wind oxygen or ionospheric molecular species, may be present in the high altitude magnetosphere but have not yet been detected. Some discussions of future prospects in this field is included. (40 refs.)

104676 Energetic particle signatures near magnetospheric boundaries. M.Scholer (Max-Planck-Inst. fur Phys. und Astrophys., Inst. fur Extraterrestrische Phys., Garching, Germany).
J. Geophys. (Germany), vol.52, no.3, p.176-89 (1983). (European Geophysical Society Symposium on Plasma and Energetic Particles in the Magnetosphere, Leeds, England, 23-27 Aug. 1982).
Two aspects of magnetospheric energetic particles have gained increasing attention in recent years: firstly their signatures, in particular the anisotropy, have been used in order to study the behaviour of magnetospheric boundaries, and secondly the particles themselves have been analyzed in order to determine their acceleration mechanisms. The author presents a review of recent ISEE observations of energetic ions and electrons near the magnetopause and near the boundary of the plasma sheet. (36 refs.)

104677 Recent ISEE observations of the magnetopause and low latitude boundary layer: a review. M.A.Saunders (Blackett Lab., Imperial Coll., London, England).
J. Geophys. (Germany), vol.52, no.3, p.190-8 (1983). (European Geophysical Society Symposium on Plasma and Energetic Particles in the Magnetosphere, Leeds, England, 23-27 Aug. 1982).
ISEE-1 and 2 satellite observations at the dayside magnetopause have enabled important progress to be made on the solar wind/magnetosphere coupling problem. The ISEE results emphasize the significance of reconnection and indicate that the process can occur both in a quasi-steady form in an unsteady (flux transfer event (FTE)) manner. The detection of FTEs on open field lines within the magnetosphere, the discovery of reverse polarity FTEs, and the observation that FTEs can be associated closely with intervals of quasi-steady reconnection flow, all support further the view that FTEs are reconnection phenomena. Indeed, a sharp distinction need not exist between FTEs and the type of reconnection event described as quasi-steady. (39 refs.)

104678 Motion of flux transfer events on 10 November 1977 determined by energetic particles in ISEE 2. P.W.Daly, E.Keppler (Max-Planck-Inst. fur Aeronomie, Katlenburg-Lindau, Germany).
J. Geophys. (Germany), vol.52, no.3, p.199-202 (1983). (European Geophysical Society Symposium on Plasma and Energetic Particles in the Magnetosphere, Leeds, England, 23-27 Aug. 1982).
The medium energy particle spectrometer on board ISEE 2 has been used to measure the orientation and motion of the flux transfer events (FTEs) seen at the inbound magnetopause crossing on 10 November 1977. The method used is a simple version of the remote sensing technique using azimuthal asymmetries of ion intensities, that has previously been used to sound the magnetopause. During these events, the particle intensity was high enough that the secondary detectors, looking out of the ecliptic plane, could also be used. The FTEs instructions are consistent with the picture of FTEs as isolated flux tubes in the magnetosheath connected to the magnetosphere which then move poleward to release magnetic tension. (18 refs.)

104679 On the dynamics of the ring current. B.Hultqvist (Kiruna Geophys. Inst., Kiruna, Sweden).
J. Geophys. (Germany), vol.52, no.3, p.203-14 (1983). (European Geophysical Society Symposium on Plasma and Energetic Particles in the Magnetosphere, Leeds, England, 23-27 Aug. 1982).
The present knowledge of the ring-current population is briefly summarized, with emphasis on the lower energies. It is shown that in the February 1979 magnetic storm, O^+ ions of ≤17 KeV energy contributed considerably to the energy density of the ring current in its entire altitude range. They probably dominated by dayside ring current, from an energy density point of view, in the early phase of the storm. It is argued that these O^+ ions, observed in the dayside magnetosphere in the early phase of the storm, were extracted directly from the dayside ionosphere over a wide latitude interval. The likely importance, from an energy density point of view, of O^+ ions in the ring current at higher energies (>17 keV) where the composition has not, as yet, been investigated, is discussed. (47 refs.)

104680 Ionic composition of the Earth's radiation belts. W.N.Spjeldvik (Cooperative Inst. of Res. in Environmental Sci., Univ. of Colorado, Boulder, CO, USA).
J. Geophys. (Germany), vol.52, no.3, p.215-38 (1983). (European Geophysical Society Symposium on Plasma and Energetic Particles in the Magnetosphere, Leeds, England, 23-27 Aug. 1982).
Several different ion species have been positively identified in the Earth's radiation belts. European, American and Soviet Space experimenters have reported ion composition measurements over wide ranges of energies: at tens of keV (ring-current energies) and below, and at hundreds of KeV and above. Three is still a gap in the energy coverage from several tens to several hundreds of keV where little observational data are available. Emphasis is placed on the radiation belt ionic structure above 100 keV. Both quiet time conditions and geomagnetic storm periods are considered. (133 refs.)

104681 Energy and charge distribution of energetic helium ions in the outer radiation belt of the Earth. B.Klecker, D.Hovestadt, M.Scholer (Max-Planck-Inst. fur Phys. und Astrophys., Inst. fur Extraterrestrische Phys., Garching, Germany).
J. Geophys. (Germany), vol.52, no.3, p.239-46 (1983). (European Geophysical Society Symposium on Plasma and Energetic Particles in the Magnetosphere, Leeds, England, 23-27 Aug. 1982).
Reports the first direct determination of the charge states of energetic helium ions in the outer radiation belt. The measurements, in the range $L=3$-4, revealed unexpected high fluxes of singly ionized helium below 1 MeV/nucleon. The data were obtained with the MPE/UoMd experiment aboard the ISEE-1 spacecraft during a near equator ($iB/B_0<1.025$) perigee pass on 17 Nov 1977. The observations suggest that fast cross-L transport during magnetic storms and non-adiabatic motion may play an important role

for the distribution of helium ions at MeV energies in the outer radiation belt. (30 refs.)

104682 High energy electrons at altitudes 500 km near the equator. L.Just, K.Kudela (Inst. of Experimental Phys., Slovak Acad. of Sci., Kosice, Czechoslovakia), A.A.Gusev, G.I.Pugacheva.
J. Geophys. (Germany), vol.52, no.3, p.247-50 (1983). (European Geophysical Society Symposium on Plasma and Energetic Particles in the Magnetosphere, Leeds, England, 23-27 Aug. 1982).
Measurements provided by a high-energy electron spectrometer on board a low altitude polar orbiting satellite allowed the determination of fluxes of electrons with energy above 100 MeV which were stably trapped or quasi-trapped in the radiation belt at L-1.13-1.16. Relatively high fluxes of trapped electrons at minimum-B-equator are reported. The shape of the pitch angle distribution, together with the relatively high fluxes of electrons, supports the assumption that they are generated due to the decay of particles produced in interaction of high energy protons trapped in the inner radiation belt with the residual atmosphere. (11 refs.)

European Geophysical Society Symposium on Plasma and Energetic Particles in the Magnetosphere ....See Entry 98635

Vertical component of the geoelectric field in high latitudes and magnetosphere processes ....See Entry 104188

Solar wind velocity and changes in the geomagnetic moment ....See Entry 104190

A technique for studying density gradients and motions of plasmaspheric irregularities ....See Entry 104607

Effect of solar wind velocity on the position and structure of auroras in the midnight sector ....See Entry 104641

Generation of a quiet auroral arc ....See Entry 104642

Altitudinal distribution of hydrogen luminescence in auroras, as measured by geophysical rockets launched from Franz-Josef Land ....See Entry 104644

Solitary internal gravity wave in the ionospheric F region .....See Entry 104654

Model for the distribution of the ionospheric electric field caused by the azimuthal component of the interplanetary magnetic field ....See Entry 104655

Eddy intrusion of hot plasma into the polar cap and formation of polar-cap arcs ....See Entry 104657

Electrojet boundaries and electron injection boundaries ....See Entry 104658

Global pattern of auroral ion precipitation: a review of the results from the AUREOLE-1 and AUREOLE-2 satellites ....See Entry 104659

Characteristics of solar-flare proton fluxes in the auroral oval at various magnetospheric disturbance levels ....See Entry 104689

Emission of high-energy albedo particles from the atmosphere into outer space ....See Entry 104691

On determining magnetohydrodynamic shock parameters θ_{Bn} and M_A ....See Entry 104726

Paradigm transition in cosmic plasma physics ....See Entry 104727

94.40 COSMIC RAYS

94.40C Origin and propagation outside the solar system

104683 Messengers from outer space [cosmic rays]. A.Watson (Dept. of Phys., Leeds Univ., Leeds, England).
New Sci. (GB), vol.99, no.1368, p.257-61 (28 July 1983).
Particles of very high energies continually bombard our planet's atmosphere, but they are exceedingly difficult to detect and few examples have been observed. They apparently originate beyond our Galaxy and are very young in cosmic terms. (no refs.)

Study of the fluxes of electrons with E_e=40-500 keV in quiet periods of solar activity by the methods of correlation and spectral analysis ..See Entry 104685

A search for superheavy nuclei tracks in extraterrestrial olivine crystals ....See Entry 104694

Some recent developments in the study of the elements and isotopes of the cosmic radiation ....See Entry 104697

Neutron oscillation and the primordial magnetic field ....See Entry 104983

94.40E Interplanetary propagation and effects

104684 Cosmic-ray anistropy in interplanetary space. L.I.Dorman, M.E.Katz, Yu.I.Fedorov.
Astrophys. & Space Sci. (Netherlands), vol.93, no.1, p.97-126 (June 1983).
The kinetic equation describing cosmic-ray propagation in interplanetary space has been used to construct a consistent theory of cosmic-ray anisotropy including the second spherical harmonic of particle angular distribution. The amplitude and phase of semi-diurnal cosmic-ray variation have been calculated. Expressions describing the relationships of the semi-diurnal variation parameters to helio-latitude distribution of cosmic rays have been derived. The results obtained are compared with observational data. (50 refs.)

104685 Study of the fluxes of electrons with E_e=40-500 keV in quiet periods of solar activity by the methods of correlation and spectral analysis. M.A.Zel'dovich, G.A.Trebukhovskaya.
Cosmic Res. (USA), vol.20, no.5, p.494-8 (Sept.-Oct. 1982). Translation of: *Kosm. Issled. (USSR)*, vol.20, no.5, p.700-4 (Sept.-Oct. 1982). [received: June 1983]
Considers the background fluxes of low energy electrons (E_e=40-500 keV) which are observed in interplanetary space at times when there are no solar cosmic rays from flares. The data were obtained by the Prognoz-3 satellite in the years 1973-1974. The authors calculate the fluctuation power spectra and correlation functions of simultaneous series of fluxes of these electrons, galactic cosmic rays, and also certain parameters which characterize solar activity and the condition of the interplanetary medium. This analysis indicates that the background fluxes of low energy electrons are possibly solar in origin, but they are not from flares. (6 refs.)

104686 Coefficient of diffusion of galactic cosmic rays in interplanetary space. V.Kh.Babayan (Inst. of Terrestrial Magnetism, Ionosphere, & Radio Wave Propagation, Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.1, p.11-13 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.1 (1982).
An analytic expression is derived for the dependence of the diffusion of galactic cosmic rays on the heliocentric distance, assuming that the solar wind velocity depends on distance and transforming the Fokker-Planck equation to a differential equation for the diffusion coefficient. (6 refs.)

104687 Second harmonic of the cosmic-ray distribution function for the case of a strong magnetic field. L.L.Kichatinov, Yu.G.Matyukhin (Inst. of Terrestrial Magnetism, Ionosphere & Radio Wave Propagation, Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.168-70 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
A drift kinetic equation is derived which incorporates multiple scattering of particles by random inhomogeneities of the interplanetary magnetic field. A transport equation and the first and second spherical harmonics of the particle distribution function are derived for the case of a strong magnetic field. The relationships between the current, the density, and the second harmonic of the particles on the one hand and current, density, and second harmonic of the Larmor circles on the other are found. (6 refs.)

94.40H Energetic solar particles and photons

104688 Determination of the proton spectral index from data on solar microwave bursts. I.V.Chertok (Inst. of Terrestrial Magnetism, Ionosphere & Radio Wave Propagation, Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.159-62 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
A method is developed for using data on solar radio bursts to make short-term predictions of the energy-spectrum index γ of the fluxes of protons with energies on the order of 10 MeV near the Earth. The ratio of the maximum intensities of the solar radio bursts at the frequencies 9 and 15.4 GHz (S_9/S_{15}) is used. The relationship between S_9/S_{15} and γ is determined for radio bursts on the western half of the solar disk from data on 35 proton events. A heliolongitude correction for protons arriving at the Earth from bursts on the eastern half has also been determined. (13 refs.)

104689 Characteristics of solar-flare proton fluxes in the auroral oval at various magnetospheric disturbance levels. N.A.Nikirova, N.K.Pereyaslova (Inst. of Appl. Geophys., State Committee on Hydrometeorology, USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.163-7 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
The spatial distributions of the fluxes of protons with energies $Ep>5$ and >90 MeV in the high-latitude magnetosphere have been studied for the period 1969-1978. The temporal and spectral characteristics of the solar cosmic rays in the auroral oval have been determined as functions of the local time, the anisotropy of the solar cosmic rays, and the geomagnetic disturbance level. (4 refs.)

Study of the fluxes of electrons with E_e=40-500 keV in quiet periods of solar activity by the methods of correlation and spectral analysis ..See Entry 104685

Interaction of solar neutrinos with the cosmic background ....See Entry 104827

94.40K Solar modulation and geophysical effects

104690 A possible scheme for an eleven-year modulation cycle of cosmic rays in light of the latest radio-astronomical data. V.I.Shishov, V.I.Vlasov, I.V.Chashey (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.1, p.7-10 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.1 (1982).
It is shown that one can determine the distribution of the diffusion coefficient of cosmic rays (including the distribution at high heliolatitudes) at distances $R\leq1$ AU, from radio-astronomical data on the turbulence of the interplanetary plasma. Results of radioastronomical observations are presented. It is concluded that the eleven-year modulation cycle of the cosmic-ray flux is due to the effect of the high heliolatitudes. (10 refs.)

104691 Emission of high-energy albedo particles from the atmosphere into outer space. N.L.Grigorov (Inst. of Nuclear Phys., Univ. of Moscow, Moscow, USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.171-6 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
The particle motion in a dipole magnetic field in the vicinity of the particle production point in the upper atmosphere is analyzed. The initial conditions of the motion (the pitch angle and the geomagnetic coordinates of the starting point) are varied. Approximate expressions are derived for the amount of material which is traversed by the particle between the starting point and and the top of the atmosphere in the course of its emission into outer space. (8 refs.)

104692 Periodicity of about 13 days in the cosmic-ray intensity in the solar cycles no.18, 19 and 20. O.Filisetti, V.Mussino (Istituto di Fisica Sperimentale, Politecnico di Torino, Torino, Italy).
Rev. Bras. Fis. (Brazil), vol.12, no.4, p.599-610 (Dec. 1982).
The quasi-periodical variations of the cosmic-ray intensity, with a period of about 13 days, have been studied in the data recorded through shielded ionization chambers at Huancayo and at Cheltenham-Fredericksburg during the solar cycles no.18, 19 and 20 (1944-74). The temporal variation of the annual average amplitudes of the oscillation of about 13 days for both stations is compared with the behaviour of the Wolf number R of sunspot. For the cycles no.18 and 19, these amplitudes present, like 27-day oscillations, two maxima, while for the cycle no.20 there is only one clear maximum. The negative correlation between the annual mean cosmic-ray intensity and the amplitude of the 13-day oscillation is also presented. (9 refs.)

Characteristics of solar-flare proton fluxes in the auroral oval at various magnetospheric disturbance levels ....See Entry 104689

94.40L Composition and energy spectra

104693 Particle acceleration during the development of a tearing instability. L.M.Zelenyi, A.S.Lipatov, A.L.Taktakishvili.
Cosmic Res. (USA), vol.20, no.5, p.506-15 (Sept.-Oct. 1982). Translation of: *Kosm. Issled. (USSR)*, vol.20, no.5, p.714-24 (Sept.-Oct. 1982). [received: June 1983]
The energy spectrum of particles accelerated in the vicinity of the X-point of the magnetic field during the development of a tearing instability in a current sheet is investigated. The dynamics of the spectrum in the linear and nonlinear stages of development of the instability is studied. Allowance is made for the contribution to the energy spectrum of particles flowing into the vicinity of the X-point of the magnetic field owing to drift in crossed electric and magnetic fields; the dynamics of particle acceleration is modeled numerically and the calculated results are compared with the theoretical model. (7 refs.)

104694 A search for superheavy nuclei tracks in extraterrestrial olivine crystals. J.S.Yadav (Tata Inst. of Fundamental Res., Bombay, India), A.P.Sharma, G.N.Flerov, V.P.Perelygin, S.G.Stetsenko, P.Pellas, C.Perron, R.Antanasijevich, B.Jakupi, Y.Topdorovich.
Pramana (India), vol.20, no.4, p.287-92 (April 1983).
A study is made for the search of superheavy nuclei in Marjalahti, Eagle Station and in other pallasite olivines. The olivine crystals are calibrated for heavy ion track lengths by using heavy ion beams from cyclotrons. The calibration for ultra heavy ions which are presently not available with sufficient energy to produce volume tracks in olivine crystals, is based on Katz and Kobetich (1968) model of track formation. The length spectrum of volume tracks, revealed by puncturing them with focused Nd-glass laser beam, is measured and the abundances of different nuclei groups are calculated. During the scanning 4 cm^3 olivine crystals, about 360 long tracks of uranium group as well as two very long tracks have been found. If these tracks belong to superheavy nuclei, the relative abundance of super heavies is found to be 6×10^{-11} in galactic cosmic rays. (14 refs.)

104695 Spectral observations of atmospheric γ-ray background. U.B.Jayanthi, F.G.Blanco, O.D.De Aguiar, J.O.D.Jardim, J.L.Benson, I.M.Martin, K.R.Rao (Inst. de Pesquisa Espaciais, Conselho Nacional de Desenvolvimento Cientifico e Tecnologico, Sao Paulo, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.3, p.431-42 (Sept. 1982).
Based on the results of two balloon flights, made at Sao Jose dos Campos and at Juazeiro do Norte in Brazil, using omnidirectional gamma ray detectors, the different aspects of atmospheric gamma rays at equatorial latitudes in the energy interval of 0.3 to 4.5 MeV are investigated. The energy loss spectrum in this energy band consists of a continuum and a photopeak at 0.51 MeV in agreement with previous observations. A discussion of the spectral nature of this background and the observed lower intensities of both the continuum and the 0.51 MeV line with reference to observations at other latitudes is presented. (14 refs.)

104696 Low energy gamma ray enhancement observed during a stratospheric balloon flight. K.R.Rao, I.M.Martin, J.O.D.Jardim, U.B.Jayanthi (Inst. de Pesquisas Espciais, Conselho Nacional de Desenvolvimento Cientifico e Tecnologico, Sao Paulo, Brazil).
Rev. Bras. Fis. (Brazil), vol.12, no.3, p.501-15 (Sept. 1982).
An omnidirectional gamma ray detector was flown on a stratospheric balloon on December 15, 1978 from Sao Jose dos Campos, Brazil. After reaching ceiling, an increase in the count rate was observed. After considering the probable sources causing this increase, it is suggested that this increase might be due to the supernova, first observed optically in May 1978 in galaxy MCG-4-32-23. The energy spectrum of this supernova shows a flattening of slope above 1.5 MeV. (42 refs.)

104697 Some recent developments in the study of the elements and isotopes of the cosmic radiation. D.O'Sullivan (Dublin Inst. for Advanced Studies, Dublin, Ireland).
Vistas Astron. (GB), vol.26, pt.2, p.87-105 (1982).
Studies of the charge, mass and energy spectra of cosmic ray nuclei have benefited greatly from advances in detector technology and the availability of high altitude balloons and Earth orbiting satellites. The relative abundances of these nuclear particles are useful indicators of the nuclear reactions that take place at the source and provide information on interstellar propagation processes. Several experiments carried out since the late nineteen seventies have provided some new insights into their composition, age and origin. However, many uncertainties are still unresolved. (87 refs.)

Electrons with energies of hundreds of megaelectron volts in near-Earth space .... See Entry 104662

Determination of the proton spectral index from data on solar microwave bursts .... See Entry 104688

Characteristics of solar-flare proton fluxes in the auroral oval at various magnetospheric disturbance levels .... See Entry 104689

94.40R High-energy interactions

Possible explanation for scaling violation in hadron interactions above 10^3 TeV .... See Entry 99487

94.40T Muons and neutrinos

104698 Coherent interaction of galactic neutrinos with material targets. P.F.Smith, J.D.Lewin (Rutherford Appleton Lab., Didcot, England).
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.185-90 (28 July 1983).
The authors obtain expressions for the first and second order forces arising from the coherent interaction of galactic neutrinos with finite-thickness material targets. For any geometry, a uniform flux gives only a second order force, of typical magnitude 10^{-23} dyn/g, but artificially-produced neutrino density gradients could, in principle, add a significant first order contribution. Some preliminary comments on future detection feasibility are included. (25 refs.)

The shape of the beta strength function and consequences for nuclear physics and astrophysics .... See Entry 99548

Interaction of solar neutrinos with the cosmic background .... See Entry 104827

94.40V Cosmic-ray effects in meteorites and terrestrial matter

Coherent interaction of galactic neutrinos with material targets .... See Entry 104698

Galactic cosmic rays and N_2 dissociation on Titan .... See Entry 104786

Cosmogenic records in Antarctic meteorites .... See Entry 104816

94.60 INTERPLANETARY SPACE

(see also 96.60 Solar physics)

104699 Quasistationary electromagnetic field in the solar wind. I.I.Alekseyev, I.S.Veselovskiy, A.P.Kropotkin (Inst. of Nuclear Phys., Univ. of Moscow, Moscow, USSR).
Geomagn. & Aeron. (USA), vol.22, no.1, p.4-6 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.1 (1982).
Parker's kinematic model with ideal conductivity is improved. It is shown that, in general, none of the three components of the nonstationary and stationary interplanetary magnetic field $\mathbf{B}(B_r, N_\theta, B_\phi)$ vanish. (7 refs.)

104700 Study of the statistical properties of the relationship between the interplanetary and geomagnetic fields by means of multiple-coherence functions. L.B.Volkomirskaya, A.N.Zaytsev, S.V.Panfilov (Inst. of Terrestrial Magnetism, Ionosphere & Radiowave Propagation, Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.1 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.1, p.68-71 (1982).
Some intervals in which the relationship is most stable are identified. The effect of a reversal of the azimuthal component of the interplanetary field on the correlation spectrum is evaluated. (10 refs.)

104701 Scintillation dispersion analysis for an extended medium. N.A.Lotova, I.V.Chashey (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).
Geomagn. & Aeron. (USA), vol.22, no.2, p.155-8 (1982). Translation of: *Geomagn. & Aeron. (USSR)*, vol.22, no.2 (1982).
The effect of the depth of the medium on the dispersion relation for interplanetary scintillations is studied. Two models for the motion of the medium are considered: a spherically symmetric solar wind and a fast stream superimposed on a spherically symmetric wind. The high-frequency part of the dispersion relation is determined primarily by the velocities in the parts of the medium close to the observer. (9 refs.)

Proceedings of the Workshop on 'Cosmic Magnetic Fields' in Honour of Giorgio Abetti .... See Entry 98636

Solar wind velocity and changes in the geomagnetic moment .... See Entry 104190

Model for the distribution of the ionospheric electric field caused by the azimuthal component of the interplanetary magnetic field .... See Entry 104655

The effect of solar wind parameters of geomagnetic activity .... See Entry 104667

Collisionless dissipation processes in quasi-parallel shocks .... See Entry 104671

Second harmonic of the cosmic-ray distribution function for the case of a strong magnetic field .... See Entry 104687

A possible scheme for an eleven-year modulation cycle of cosmic rays in light of the latest radio-astronomical data .... See Entry 104690

Evidence for helical kink instability in the Venus magnetic flux ropes .... See Entry 104759

Can solar wind induce the luminescence emission in zodiacal grains? .... See Entry 104799

Mass loss rate of the zodiacal dust cloud .... See Entry 104800

94.80 AEROSPACE FACILITIES AND TECHNIQUES; SPACE RESEARCH

(see also 87.65 Aerospace biophysics and medical physics)

104702 Orbit determination program, application to Earth observation satellite. M.Grimard, A.M.Mainguy (ONERA, Catillon, France).
Acta Astronaut. (GB), vol.10, no.3, p.117-24 (March 1983). In French.
Presents an orbit determination program based on two algorithms: Kalman filtering and Rauch smoothing. Novel adaptation of these algorithms allows one to obtain a posteriori statistical estimations of evolution and measurement noises and their standard deviation. Analysis of results about these noise estimations allows one to regulate optimally the a priori levels of noise standard deviations and detect eventually model errors. An application is presented for Earth observation satellites, at first with simulated data, then with real data (TIROS N satellite). (7 refs.)

104703 The analysis of the methods for computing the perturbations caused by solar and lunar gravitational influence on artificial satellite motion. I.Wytrzyszczak (Obs. Astron., Uniwersytetu im. A. Mickiewicza, Poznan, Poland).
Postepy Astron. (Poland), vol.31, no.1, p.3-17 (Jan.-March 1983). In Polish.
Presents a short review of the perturbational function expansion methods of computing the perturbations caused by the solar and lunar gravitational influence on the motion of artificial satellites. (11 refs.)

104704 Position stability of a geostationary satellite. J.Vrba.
Slaboproudy Obz. (Czechoslovakia), vol.44, no.7, p.339-42 (July 1983). In Czech.
Discusses the effects of the inaccuracies in the orbit of a satellite on its geostationary character. Expressions are derived for the accurate and simplified calculations of the real position of a geostationary satellite with respect to an Earth-based observer. The conclusions can be applied to the design of an equipment enabling the antenna of an Earth-based station to be rotated towards a communications satellite. (2 refs.)

104705 The Dutch instrument package on board IRAS. K.J.Wildeman (Rijksuniv., Groningen, Netherlands).
Tijdschr. Ned. Elektron.- & Radiogenoot. (Netherlands), vol.48, no.1, p.3-6 (1983). In Dutch.
The Dutch instrument package built into the IRAS telescope is briefly described. Some aspects of the cooled telescope are also described. (no refs.)

Proceedings of the Topical Meeting of the COSPAR Interdisciplinary Scientific Commission B and Symposium 6 of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 98616

Sixth ESA Symposium on European Rocket & Balloon Programmes & Related Research (ESA SP-183) .... See Entry 98654

Satellite positioning .... See Entry 104178

Nimbus 7 Total Ozone Mapping Spectrometer (TOMS) data during the GAP, France, ozone intercomparisons of June 1981 .... See Entry 104521

Total ozone measurements derived from TOVS radiances ...... See Entry 104522

Proceedings of Workshop I of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 104583

Upper atmosphere density derived from Interkosmos 10 data .... See Entry 104633

Mathematical modelling and analysis of the fluid dynamics of upper atmosphere dumbbell satellites .... See Entry 104638

Measurements of temporal variations of the brightness of the aurora and emission layers from the orbiting space station Salyut-6 .... See Entry 104643

Venus: global surface radio emissivity .... See Entry 104761

94.90 OTHER TOPICS IN SPACE PHYSICS

Proceedings of Workshop I of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 104583

95.00 FUNDAMENTAL ASTRONOMY AND ASTROPHYSICS, INSTRUMENTATION AND TECHNIQUES AND ASTRONOMICAL OBSERVATIONS

95.10 FUNDAMENTAL ASTRONOMY

104706 Tokyo Astronomical Observatory. Time and Latitude Bulletins [October-December 1982].
Tokyo Astron. Obs. Time & Latitude Bull. (Japan), vol.56, no.4, p.53-128 (Oct.-Dec. 1982). [received: July 1983] (no refs.)

Time and latitude results of observations made at Merate Observatory with the astrolabe for the year 1982 .... See Entry 104157

Third Greenwich catalogue of stars, Sun, planets and Moon for 1950.0 .... See Entry 104749

Occultation of 14 Piscium by (51) Nemausa on 1983 Sept. 11 .... See Entry 104771

1983 LB .... See Entry 104772

1983 LC .... See Entry 104773

Minor Planet Circulars .... See Entry 104775

Minor Planet Circulars 7875-7980 .... See Entry 104776

Minor Planet Circulars 7981-8024 .... See Entry 104777

Periodic Comet Wolf (1983m) .... See Entry 104803

Periodic Comet Crommelin (1983n) .... See Entry 104804

Comet Cernis (1983l) .... See Entry 104805

Comet Cernis (1983l) .... See Entry 104807

Periodic Comet Russell 3 (1983i) .... See Entry 104808

Broad-band, high-resolution photograph of the solar corona February 16, 1980 .... See Entry 104833

Astrometry of the low-luminosity stars VB8 and VB10 .... See Entry 104856

VLA observations of MWC 349 at 15 and 23 GHz .... See Entry 104864

Novalike object in Libra .... See Entry 104893

Micrometric measurements of southern double stars .... See Entry 104922

The planetary system of Barnard's star .... See Entry 104931

Proper motions of Herbig-Haro objects. III. HH-7 through -11, HH-12, and HH-32 .... See Entry 104938

95.10C Celestial mechanics

(for dynamics and kinematics of stellar systems, see 98.10)

104707 Stability and integrability in the planar general three-body problem. T.-Y.Huang, K.A.Innanen (Dept. of Phys., York Univ., Toronto, Ontario, Canada).
Astron. J. (USA), vol.88, no.7, p.1064-73 (July 1983).
The Kolmogorov entropy is applied to discuss the stability and integrability of the planar general three-body problem with equal masses. The numerical experiments show that the entropy is a useful and sensitive tool to investigate the stability problem. Stability boundaries for initial semimajor axis are given for different values of initial eccentricities, and are compared with those in Hill stability. In particular, the evolution of the elements and the difference between direct and retrograde orbits are explored. The integrability of this system is also discussed. The authors argue that there exist local additional integrals when the initial elements are situated inside the stable region, or far outside the stability boundary. The reliability of the check of numerical accuracy by use of the energy integral is examined. The authors find that this check is unreliable when the initial elements are close to the stability boundary. (29 refs.)

104708 Expansion theory for the elliptic motion of arbitrary eccentricity and semi-major axis. V. Elliptic expansions in terms of the sectorial variables for the first four categories. M.Adel Sharaf (Dept. of Astron., Univ. of Cairo, Cairo, Egypt).
Astrophys. & Space Sci. (Netherlands), vol.93, no.2, p.377-401 (June 1983).
For pt.IV see ibid., vol.84, no.1, p.73-87 (1982). Elliptic expansions in terms of the sectorial variables $\theta_j^{(i)}$ introduced in Sharaf (1982) to regularise highly oscillating perturbation force of some orbital systems are explored for the first four categories. For each of the elliptic expansions belonging to a category, literal analytical expressions for the coefficients of its trigonometric series representation are established. Moreover, some recurrence formulae satisfied by these coefficients are also established to facilitate their computations, numerical results are included to provide test examples for constructing computational algorithms. (2 refs.)

104709 Periodic solutions of the restricted problem that are analytic continuations of periodic solutions of Hill's problem for small $\mu>0$. L.M.Perko (Dept. of Math., Northern Arizona Univ., Flagstaff, AZ, USA).
Celestial Mech. (Netherlands), vol.30, no.2, p.115-32 (June 1983).
Establishes the existence and first order perturbation approximation of an infinite number of one-parameter families of symmetric periodic solutions of the restricted three body problem that are analytic continuations of symmetric periodic solutions of Hill's problem for small values of the mass ratio $\mu>0$. (20 refs.)

104710 Rotational dynamics with geometric algebra. D.Hestenes (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
Celestial Mech. (Netherlands), vol.30, no.2, p.133-49 (June 1983).
A new spinor formulation of rotational dynamics is developed. A general theorem is established reducing the theory of the symmetric top to that of the spherical top. The classical problems of Lagrange and Poinsot are treated in detail, along with a modern application to the theory of magnetic resonance. (7 refs.)

104711 Celestial mechanics with geometric algebra. D.Hestenes (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
Celestial Mech. (Netherlands), vol.30, no.2, p.151-70 (June 1983).
Geometric algebra is introduced as a general tool for celestial mechanics. A general method for handling finite rotations and rotational kinematics is presented. The constants of Kepler motion are derived and manipulated in a new way. A new spinor formulation of perturbation theory is developed. (13 refs.)

104712 Geometry of spinor regularization. D.Hestenes (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA), P.Lounesto.
Celestial Mech. (Netherlands), vol.30, no.2, p.171-9 (June 1983).
The Kustaanheimo (1964) theory of spinor regularization is given a new formulation in terms of geometric algebra. The Kustaanheimo-Stiefel (1965) matrix and its subsidiary condition are put in a spinor form directly related to the geometry of the orbit in physical space. A physically significant alternative to the KS subsidiary condition is discussed. Derivations are carried out without using coordinates. (8 refs.)

104713 Elimination of the nodes in problems of n bodies. A.Deprit (NBS, Washington, DC, USA).
Celestial Mech. (Netherlands), vol.30, no.2, p.181-95 (June 1983).
In application of the reduction theorem to the general problem of n (≥ 3) bodies, a Mathieu canonical transformation is proposed whereby the new variables separate naturally into (i) a coordinate system on any reduced manifold of constant angular momentum, and (ii) a quadruple made of a pair of ignorable longitudes together with their conjugate momenta. The reduction is built from a binary tree of kinetic frames. Explicit transformation formula are obtained by induction from the top of the tree down to its root at the variable frame; they are based on the unit quaternions which represent the finite rotations mapping one vector base onto another in the chain of kinetic frames. (12 refs.)

104714 A second fundamental model for resonance. J.Henrard, A.Lemaitre (Dept. of Math., Facultes Univ. N.D. de la Paix a Namur, Namur, Belgium).
Celestial Mech. (Netherlands), vol.30, no.2, p.197-218 (June 1983).
Analyses a simple one degree of freedom Hamiltonian system depending upon a parameter $H=-3(\delta+1)R+R^2-2\sqrt{2R}\cos r$. This model is much closer to resonance problems arising in celestial mechanics than the pendulum. The authors deduce from it the conditions of capture into resonance or escape from resonance for systems drifting slowly. The authors apply this analysis to the Enceladus-Dione resonance. (20 refs.)

104715 Collisions in self-gravitating clouds of planetesimals. K.A.Hameen-Anttila (Dept. of Astron., Univ. of Oulu, Oulu, Finland).
Moon & Planets (Netherlands), vol.28, no.3, p.267-303 (June 1983).
A theory of partially elastic collisions is constructed for frictionless planetesimals in an arbitrary gravitational field. The non-zero size of the particles and the influence of gravitational encounters are included. The equations for a self-gravitating rotationally symmetric disk or ring are written in an explicit form. Such systems turn out to be bimodal in the same sense as the Keplerian systems, i.e. there are two kinds of stable configurations which may co-exist in adjacent regions without disturbing the mechanical equilibrium. (22 refs.)

104716 Dirichlet-Weierstrass-Poincare problem. S.Kasperczuk (Katedra Fizyki, Politech. Swietokrzyskiej, Kielce, Poland).
Postepy Astron. (Poland), vol.31, no.1, p.35-43 (Jan.-March 1983). In Polish.
The theory of dynamical systems descends from celestial mechanics and H. Poincare, one of the most outstanding mathematicians, is considered as its creator. One of the most important problems for the progress of the theory of dynamical systems is discussed. The attempts at solving the problem have lead to the rise of two branches of the theory: ergodic theory and KAM-theory. (4 refs.)

104717 Some mechanical invariants of elliptical orbits. Yu.K.Gulak (V.G. Korolenko Pedagogical Inst., Poltavsk, USSR).
Sol. Syst. Res. (USA), vol.16, no.4, p.198-203 (Oct.-Dec. 1982). Translation of: *Astron. Vestn. (USSR)*, vol.16, no.4, p.247-51 (Oct.-Dec. 1982).
Some mechanical invariants of transformations of elliptical orbits, which reveal some properties of the motion about an attracting center, are obtained on the basis of the energy integral of the two-body problem. It is shown that Kepler's third law and the virial theorem are contained harmoniously in the final equalities. (2 refs.)

104718 On the periodic orbits of the Contopoulos Hamiltonian. M.Grau (Facultat de Matematiques, Univ. de Barcelona, Barcelona, Spain), J.Llibre, R.M.Ros.
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.284-6
Looking for a third integral in the motion of a particle in a galactic potential with cylindrical symmetry, Contopoulos was led to the Hamiltonian $H(x,y)={}^1/_2(y_1{}^2+y_2{}^2)+{}^1/_2(x_1{}^2+x_2{}^2)-x_1x_2{}^2$, where the position is given by $x=(x_1,x_2)$ and the momentum by $y=(y_1,y_2)$. The Hamiltonian system x_H is $\dot{x}_1=y_1$, $\dot{x}_2=y_2$, $\dot{y}_1=-x_1+x_2{}^2$, $\dot{y}_2=-x_2+2x_1x_2$. This system has the origin $Q_1(0,0,0,0)$ as a critical point at energy level $h=0$ with repeated eigenvalues $\pm i$, and two additional critical points $Q_2=(2^{-1},-2^{-1/2},0,0)$ and $Q_3=(2^{-1},2^{-1/2},0,0)$ at energy level $h=1/8$ with eigenvalues ± 1 and $\pm 2^{1/2}i$. The authors survey and state results on the simple periodic orbits of x_H which start in their critical points. (11 refs.)

A dynamic model for the demonstration of planetary motions or 'celestial mechanics on the desk' .... See Entry 98698

On periodic orbits of two spheroidal rigid bodies .... See Entry 98742

On the indirect influence of the planets on nutation. I. Effects of planetary perturbations in lunar orbit .... See Entry 104164

Upper atmosphere density derived from Interkosmos 10 data .... See Entry 104633

Orbit determination program, application to Earth observation satellite .... See Entry 104702

The analysis of the methods for computing the perturbations caused by solar and lunar gravitational influence on artificial satellite motion .... See Entry 104703

The effect of orbital element variations on the mean seasonal daily insolation on Mars .... See Entry 104765

A second order Jupiter-Saturn planetary theory. II .... See Entry 104788

Weak dynamical effects in the Uranian ring system .... See Entry 104793

The elimination of the critical terms of a first order Uranus-Neptune theory by Hori's method. II. .... See Entry 104796

Photographic data on the Traunstein fireball (EN 290181, Jan. 29, 1981) and suspected meteorite fall .... See Entry 104811

95.30 FUNDAMENTAL ASPECTS OF ASTROPHYSICS

104719 Emission mechanism of extragalactic X-ray and radio sources. V.Krishan (Indian Inst. of Astrophys., Bangalore, India).
Astrophys. Lett. (GB), vol.23, no.3, p.133-8 (1983).
The processes of stimulated Raman scattering (SRS) and stimulated Compton scattering (SCS) are investigated in order to provide a possible emission

mechanism for the extragalactic X-rays and radio sources. The system proposed is a relativistic plasma beam propagating transverse to a static periodic magnetic field. The role of the incident pump radiation is replaced by the static spatially periodic magnetic field. It is shown that by varying the spatial periodicity of the magnetic field, one could generate X-rays to radio waves by a single mechanism of SRS and/or SCS. (28 refs.)

104720 Self-similar propagation of axisymmetric radiative magnetogasdynamic shocks with increasing energy. II. J.B.Singh (Dept. of Math., SGR Postgraduate Coll., Jaunpur, India).
Astrophys. & Space Sci. (Netherlands), vol.93, no.1, p.15-23 (June 1983).
Self-similar solutions have been investigated for the propagation of axisymmetric radiative gasdynamic shocks caused by an explosion into an inhomogeneous ideal gas permeated by a current free azimuthal magnetic field. The effects of radiation flux and magnetic field together have been seen in the region of interest on the other flow variables. The total energy of the flow between the inner expanding surface and the shock is taken to be dependent on shock radius obeying a power law. The radiative pressure and energy have been neglected. (9 refs.)

104721 Charged particle motion on and off the equatorial plane of a magnetic star in Rosen's bimetric gravity. A.R.Prasanna (Phys. Res. Lab., Navrangpura, Ahmedabad, India), V.M.Raval.
Astrophys. & Space Sci. (Netherlands), vol.93, no.1, p.25-36 (June 1983).
Studies in detail (numerically) the trajectories of charged particles in a magnetic field (dipolar at infinity) associated with a static star in the framework of Rosen's bimetric theory of gravity. Potential wells that allow possible trapping of particles in stable orbits are shown to exist both on and off the equatorial plane. (3 refs.)

104722 Radiation spectrum of optically thin relativistic electron-positron plasma. F.A.Aharonian, A.M.Atoyan, R.A.Sunyaev (Yerevan Phys. Inst., Yerevan, Armenia, USSR).
Astrophys. & Space Sci. (Netherlands), vol.93, no.2, p.229-45 (June 1983).
The annihilation spectrum of isotropically distributed monoenergetic electrons and positrons is analysed. For the annihilation spectrum of Maxwellian electron-positron plasma the convenient analytical expressions in the case of relativistic as well as nonrelativistic temperatures are obtained. A comparison of the results with those based on up-to-date numerical investigations is carried out. (22 refs.)

104723 Self-similar flows behind cylindrical shock waves in magnetogasdynamics. J.B.Singh, P.R.Vishwakarma (Dept. of Maths., SGR Postgraduate Coll., Dobhi, Jaunpur, India).
Astrophys. & Space Sci. (Netherlands), vol.93, no.2, p.423-9 (June 1983).
A comparative study has been made between the effects of transverse and axial components of the magnetic field on the self-similar flow variables of the field behind the cylindrical shock waves propagating into a nonuniform atmosphere at rest. The total energy of the wave is constant. (4 refs.)

104724 Discovery of s-process Nd in Allende residue. D.D.Clayton (Dept. of Space Phys. & Astron., Rice Univ., Houston, TX, USA).
Astrophys. J. Lett. Ed. (USA), vol.271, no.2, pt.2, p.L107-9 (15 Aug. 1983).
New interpretation is given to the isotopic anomalies detected by Lugmair et al. (1983) in an acid-resistant residue of the Allende meteorite. If the ^{142}Nd excess is due to ^{146}Sm decay, as the discoverers proposed, the decay has probably occurred in interstellar grains, so that the conclusion that ^{146}Sm (1.03×10^8 yr) was alive in the solar system is premature. It is shown that the discovery is likely to be *s*-process Nd, confirming the survival of red-giant stardust in carbonaceous interstellar dust. (15 refs.)

104725 Line radiation from a hot, optically thin plasma: collision strengths and emissivities. T.J.Gaetz, E.E.Salpeter (Center for Radiophys. & Space Res., Cornell Univ., Ithaca, NY, USA).
Astrophys. J. Suppl. Ser. (USA), vol.52, no.2, p.155-68 (June 1983).
Theoretical and experimental data for collision strengths of the strongest multiplets between 1 and 3000 Å in a hot, optically thin plasma are presented. The elements included are H, He, C, N, O, Ne, Mg, Si, S and Fe. Simple power-law fits, as a function of gas-kinetic electron temperature, are provided for the collision strengths of the strongest multiplets for temperatures between 4×10^4 and 10^8K. These collision strengths are used to calculate the multiplet emissivities for a plasma in steady-state collisional ionization equilibrium. The total steady-state emissivity (including continuum) and the emissivities in selected energy bins are also presented. (91 refs.)

104726 On determining magnetohydrodynamic shock parameters θ_{Bn} and M_A. J.K.Chao (Nat. Central Univ., Chungli, Taiwan), K.C.Hsieh.
Bull. Geophys. (Taiwan), no.24, p.93-100 (March 1983).
In a collisionless plasma, the shock structures, the associated waves and turbulence depend strongly on the shock parameters θ_{Bn} and M_A where θ_{Bn} is the angle between the upstream magnetic field and the shock normal and M_A is the upstream Alfven Mach-number. A method is given to determine θ_{Bn} and M_A and their estimated errors for all types of shocks without knowing the shock normals. The only measured quantity needed to determine θ_{Bn} and M_A are the plasma density and magnetic field on both sides of the shock. Its simplicity and ability to handle quasi-parallel shocks as well as quasi-perpendicular and oblique shocks are illustrated. This method should be useful for studying MHD shocks found in space. (20 refs.)

104727 Paradigm transition in cosmic plasma physics. H.Alfven (Dept. of Electrical Engng. & Computer Sci., Univ. of California, San Diego, La Jolla, CA, USA).
Geophys. Res. Lett. (USA), vol.10, no.6, p.487-8 (June 1983).
During the 1970s in situ measurements in the magnetospheres, including the solar wind region ('solar magnetosphere') drastically changed our understanding of the properties of cosmic plasmas. Further, it has been learned how to generalize results from plasma investigations in one region to other regions. This means that laboratory investigations of plasmas of the size of, say, 10 cm can be used to achieve better understanding of cosmic plasmas of magnetospheric dimensions; say, 10^{10} cm. By another step of 10^9 laboratory and magnetospheric results can be transferred to galactic plasmas of, say, 10^{19} cm. A third jump of 10^9 leads to the Hubble distance 10^{28} cm and hence to cosmological problems. (7 refs.)

104728 ^{25}Mg(α,n)^{28}Si and ^{26}Mg(α,n)^{29}Si as neutron sources in explosive neon burning. M.R.Anderson, L.W.Mitchell, M.E.Sevior, D.G.Sargood (School of Phys., Univ. of Melbourne, Parkville, Victoria, Australia).
Nucl. Phys. A (Netherlands), vol.A405, no.1, p.170-8 (22 Aug. 1983).
The yields of neutrons from the reaction ^{25}Mg(α,n)^{28}Si and of γ-rays from the reaction ^{25}Mg(α,nγ)^{28}Si have been measured as a function of bombarding energy over the range 1.8-6.3 MeV, and the yield of neutron from ^{26}Mg(α,n)^{29}Si has been measured over the range 1.8-6.0 MeV. Cross sections for ^{25,26}Mg(α,n)^{28,29}Si were extracted from the data and compared with global statistical-model calculations. Thermonuclear reaction rates under stellar conditions appropriate for explosive neon burning are calculated and their significance for the nucleosynthesis of rare neutron-rich nuclei is discussed. (21 refs.)

104729 Neutrino astrophysics and the rest mass of the neutrino. T.Kirsten (Max-Planck-Inst. fur Kernphys., Heidelberg, Germany).
Phys. Bl. (Germany), vol.39, no.7, p.233-8 (July 1983). In German.
There is a possibility that neutrinos are the dominant form of matter in the Universe. While there is no definite experimental evidence for a rest mass of the neutrino which is not zero, present theories allow for a rest mass of ≤ 6 eV. In the 1 MeV region the interaction cross-section of the neutrino with matter is only 10^{-44} cm^2. It increases fast with the energy of the neutrino and is of the order of 10^{-36} cm^2 at 100 GeV. In spite of the high flux of 10^{13}/cm^2 s, low energy neutrinos cannot be detected experimentally. There are, however, speculations based on a neutrino impulse transfer on gravity wave antennae by coherent scattering which are of cosmological interest. (12 refs.) *R.S.*

104730 Nuclei with an extra quark, stellar burning, and the solar neutrino problem. R.N.Boyd, R.E.Turner, M.Wiescher, L.Rybarcyk (Dept. of Phys., Ohio State Univ., Columbus, OH, USA).
Phys. Rev. Lett. (USA), vol.51, no.7, p.609-12 (15 Aug. 1983).
Possible modes of nucleosynthesis involving nuclei with an extra quark have been considered. It is found that such nuclei can contribute significantly to stellar burning even at an abundance level of less than 1 nucleus with an extra quark in 10^{15} nuclei. Consideration of the beta-decay properties of nuclei with an extra quark also suggests that their contribution could solve the solar neutrino problem. (19 refs.)

104731 Nonlinear interaction of magnetogravity waves with Alfven and sound waves. S.Hinata (Dept. of Phys., Auburn Univ., Auburn, AL, USA).
Plasma Phys. (GB), vol.25, no.8, p.883-9 (Aug. 1983).
The convection motions generate magnetogravity, Alfven, and sound waves in the late type stars. They may play an important role in the atmospheric heating, and the interior structure through chemical mixing. Because of this potential importance, the author derives the nonlinear wave kinetic equation for three wave coupling. (11 refs.)

104732 Magnetic fields in the cosmos. E.N.Parker (Univ. of Chicago, Chicago, IL, USA).
Sci. Am. (USA), vol.249, no.2, p.36-46 (Aug. 1983).
The dynamo mechanism for the generation of magnetic fields explains why Venus has no field, why the Sun has an oscillating field and why the dominant galactic field is parallel to the plane of the galactic disk. (no refs.)

104733 Oscillations of a spin in a circular orbit in the Schwarzschild and Lense-Thirring metrics. O.B.Karpov (Moscow Inst. of Chem. Engng., Moscow, USSR).
Sov. Phys. J. (USA), vol.25, no.11, p.1034-7 (Nov. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.11, p.68-70 (Nov. 1982).
A gyroscope in motion along a circular geodesic line oscillates with respect to a reference body because of the variability of the inclination of its orbit. Due to precession of the spin vector, these oscillations have the appearance of beats whose frequency is close to that of the orbital motion, and whose amplitude changes with a large period, so that the amplitude increases linearly during a long time. This phenomenon can be detected using symmetrical oscillations of gyroscopes with opposite spin vectors in an orbit around the Earth, or by observing the evolution of a planet orbit in the solar system. (6 refs.)

104734 Astrophysics, cosmology and high energy physics. M.J.Rees (Inst. of Astron., Cambridge Univ., Cambridge, England).
Proceedings of the 1982 CERN School of Physics (CERN 83-05), Cambridge, England, 5-18 June 1982 (Geneva, Switzerland: CERN 1983), p.281-300
A brief survey is given of some topics in astrophysics and cosmology, with special emphasis on the inter-relation between the properties of the early Universe and recent ideas in high energy physics, and on simple order-of-magnitude arguments showing how the scales and dimensions of cosmic phenomena are related to basic physical constants. (29 refs.)

Symposium uber Kosmologie und Relativistische Astrophysik (**Symposium on Cosmology and Relativistic Astrophysics**) .... See Entry 98639

Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop .... See Entry 98651

Astrophysical Jets. Proceedings of an International Workshop .... See Entry 98661

An inhomogeneous cosmological solution of Einstein's equations .... See Entry 98867

A new self-consistent solution of the Einstein equations with one-loop quantum-gravitational corrections .... See Entry 98882

A note on electromagnetism and the new cosmology .... See Entry 98894

Spontaneous symmetry breaking near a black hole .... See Entry 98912

Thermodynamic potential of grand unified gauge theories .... See Entry 99379

The shape of the beta strength function and consequences for nuclear physics and astrophysics .... See Entry 99548

A new system for astrophysical nuclear reaction studies with radioactive ion beams .... See Entry 99920

Compressible, conductive, steady MHD flow in a gravitational field .... See Entry 101404

Network to cell contrast at microwaves .... See Entry 104834

Spectral analysis of the optical continuum in the 24 April 1981 flare .... See Entry 104837

Purely coronal flare-like variations .... See Entry 104839

Magnetohydrodynamic simulation of the coronal transient associated with the solar limb flare of 1980, June 29, 18:21 UT .... See Entry 104841

Dissipation of thick accretion disks .... See Entry 104846

An approximate solution to the equation $\epsilon XY(dY/dX)=X-Y(Y+1)$ .... See Entry 104848

Star formation within OB subgroups: implosion by multiple sources .... See Entry 104850

Nuclear β-decays of highly ionized heavy atoms in stellar interiors .... See Entry 104852

Electron capture rates during collapse of the supernova core .... See Entry 104897

On the collapse of neutron stars and stellar cores to pion-condensed stars .... See Entry 104903

Quark-abnormal neutron stars .... See Entry 104904

Detection of $H^{15}NN^+$ and $HN^{15}N^+$ in interstellar clouds .... See Entry 104946

Interstellar C_2 molecules in a Taurus dark cloud .... See Entry 104948

Observations of interstellar C_2 toward three heavily reddened stars .... See Entry 104949

The variability of the spectrum of Arakelian 120 .... See Entry 104957

Hydrodynamic and turbulent motions in the galactic disk .... See Entry 104960

Positron annihilation radiation from Seyfert nuclei and the cosmic diffuse γ-ray background .... See Entry 104962

Are black holes necessary? .... See Entry 104969

Determination of the properties of magnetic turbulence in radio sources .... See Entry 104973

X-ray emission associated with gamma-ray bursts .... See Entry 104977

Neutron oscillation and the primordial magnetic field .... See Entry 104983

Primordial quantum fluctuations and the origin of galaxies .... See Entry 104985

Primordial nucleosynthesis and scale-covariant cosmology .... See Entry 104987

On the general vacuum solution with a cosmological constant for Bianchi type-VI_0 .... See Entry 104989

The motion of test particles in black-hole backgrounds with non-zero cosmological constant .... See Entry 104990

The stability of general relativistic cosmological theory .... See Entry 104995

Vacuum field, modified cosmical term and non-singular cosmology .... See Entry 104996

Newtonian cosmology (problems of didactics of cosmology) .... See Entry 104997

Mechanism of generating isothermal perturbation by a strong *CP* nonconservation .... See Entry 104998

Irregularities formed by a cosmological axion field .... See Entry 105000

The anthropic principle .... See Entry 105002

Energy, stability and cosmological constant .... See Entry 105003

Phase transitions in the early Universe .... See Entry 105004

Complete cosmological theories .... See Entry 105005

The cosmological constant and the weak anthropic principle .... See Entry 105006

95.55 ASTRONOMICAL INSTRUMENTS

104735 A pulse-compensation radio spectrometer. V.G.Grachev, N.F.Ryzhkov.
Bull. Spec. Astrophys. Obs.-North Caucasus (USA), vol.13, p.34-40 (1981). Translation of: *Astrofiz. Issled.-Izv. Spets. Astrofiz. Obs. (USSR)*, vol.13, p.43-51 (1981).
Experimental studies have been performed on the pulse-compensation method of Grachev and Ryzhkov (1980) with one of the radio spectrometers in the RATAN 600 as specially modified to increase the flexibility. Under the new conditions, the device is operated by periodic gating of the analyzer input in combination with pulse compensation of the signals at the output of the square-law detectors. The sensitivity realized in observations on the Centaurus A radio galaxy at a wavelength of 21 cm in the neutral-hydrogen line is only 30% less than the limiting value. Standard output devices for modulation type radiometers are used in the pulse-compensation state. (7 refs.)

104736 On the compensation of deformations of radio telescopes by the secondary reflector's control. E.E.Gasanov, M.M.Vainbrand, B.G.Karasik.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.6, p.105-9 (1982). In Russian.
Two methods of determining the secondary reflector's motion parameters for the compensation of deformations of a reflector are described. In the first method the average phase error is used as a criterion of optimization, in the second one directive efficiency is used. (7 refs.)

104737 A balloon-borne far-infrared telescope with a new azimuth stabilization system. N.Hiromoto, T.Maihara, N.Oda, H.Okuda, H.Shibai (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
Mem. Fac. Sci. Kyoto Univ. Ser. Phys. Astrophys. Geophys. Chem. (Japan), vol.36, no.2, p.281-9 (March 1983). In Japanese.
A small telescope control system was developed for balloon-borne far-infrared scanning observations with medium angular resolution. The stabilization of a balloon gondola was performed by a reaction wheel-based servomechanical system driven by a torque motor, realizing pointing accuracy better than 0.1°. The method employed in this system is unique in that only the internal frame which the telescope is attached to is stabilized around a vertical axis of the gondola, while the outer gondola being oriented separately by the so-called twist-rewinding servo-system. The performance of the whole system is presented including the three-color far-infrared photometer actually used in the last observation. (5 refs.)

104738 An autoguider system for the 40 cm Schmidt telescope. H.Ohtani, T.Ichikawa, T.Sasaki, K.Saito, T.Tsujimura (Dept. of Astron., Univ. of Kyoto, Kyoto, Japan).
Mem. Fac. Sci. Kyoto Univ. Ser. Phys. Astrophys. Geophys. Chem. (Japan), vol.36, no.2, p.291-303 (March 1983). In Japanese.
An autoguider system was constructed for the 40 cm Schmidt telescope at the Ouda Station. The sensor of the guider, a type ITT FW 130 image dissector, is attached to the guiding telescope. A microprocessor is introduced for processing the sensor output and for correcting the guiding error of the telescope. This enables the broadening of the objective prism spectra by a simple software. The microprocessor is used also for other auxiliary functions for the telescope control. (7 refs.)

Proceedings of Workshop I of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 104583

The Dutch instrument package on board IRAS .... See Entry 104705

95.65 AUXILIARY AND RECORDING INSTRUMENTS

104739 Low light level detectors in astronomy. M.J.Eccles, M.E.Sim, K.P.Tritton.
Cambridge, England: Cambridge (1983), xii+187 pp. [0 521 24088 3]
This book deals with the detectors of optical radiation used in astronomy, for example photographic, television and electronic detectors. The different types of detector are compared, and the characteristics of each type of detector which fit it for work in some specialised area are explained. The range of available detectors is comprehensively covered, and much space is devoted to modern electronic detectors, for example charge-coupled devices of CCDs. The book is intended for astronomy students at MSc level and professional observational astronomers. (32 refs.)

A pulse-compensation radio spectrometer .... See Entry 104735

95.70 OTHER INSTRUMENTATION AND TECHNIQUES

(inc. clocks, frequency standards)

Messengers from outer space [cosmic rays] .... See Entry 104683

95.75 TECHNIQUES OF OBSERVATION AND REDUCTION

104740 Comparison of the Mt. Stromlo/AAO and Caltech/Tololo infrared photometric systems. J.H.Elias, J.A.Frogel (Cerro Tololo Inter-American Obs., La Serena, Chile), A.R.Hyland, T.J.Jones.
Astron. J. (USA), vol.88, no.7, p.1027-30 (July 1983).
The transformations between the Mt. Stromlo/AAO and the Caltech/Tololo infrared photometric systems have been determined by means of observations of 21 stars with both systems. A small zero-point difference but no color term is found at *K*; color terms are found for the $J-K$, $J-H$, and $H-K$ colors. All scatter in the transformations can be attributed to the random errors in the observations. (11 refs.)

104741 The O IV infrared and ultraviolet flux ratios as temperature and density diagnostics. M.A.Hayes, H.Nussbaumer (Inst. of Astron., ETH Zentrum, Zurich, Switzerland).
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.279-82 (Aug. 1983).
Fine-structure collision strengths for transitions among the levels of the first two terms of O^{+3} are presented. The density sensitivity of the intensity ratios of the components of the intercombination multiplet at 1401 Å is re-evaluated for densities and temperatures applicable to planetary nebulae. The authors also show that the intensity ratio of the fine-structure line at 25.9 μm to the 1401 Å multiplet provides a diagnostic for electron temperature. The effect of radiation fields on the intensity ratios is investigated. (11 refs.)

104742 Small-scale fluctuations in the relict radio radiation. V.K.Dubrovich.
Bull. Spec. Astrophys. Obs.-North Caucasus (USA), vol.13, p.31-3 (1981). Translation of: *Astrofiz. Issled.-Izv. Spets. Astrofiz. Obs. (USSR)*, vol.13, p.40-2 (1981).
The origin of spectral and spatial fluctuations in the relict radio radiation is considered when remote galaxies move with respect to the background. The scatterers are considered to be the atoms and ions of the commoner elements (carbon and nitrogen) together with certain molecules. It is shown that this is the most promising way of locating galaxies for red shifts $z \geq 3$ since it is not related to the energy considerations for the galaxy. The distortion of the background temperature is determined only by the peculiar velocity and by the optical thicknesses in the fine-structure lines of C and N. (3 refs.)

104743 Raster equidensitometry applied to processing photographs from the 6 m telescope. M.F.Shabanov, V.V.Popov.
Bull. Spec. Astrophys. Obs.-North Caucasus (USA), vol.13, p.69-78 (1981). Translation of: *Astrofiz. Issled.-Izv. Spets. Astrofiz. Obs. (USSR)*, vol.13, p.85-97 (1981).
A raster equidensitometry method is developed for constructing isophots for astronomical objects that is 3-4 times more effective than ordinary equidensitometry. Measurements of noise and contrast transitions together with the number of objectively distinguishable gradations for 103aO and 111aJ emulsions provide quantitative estimates of the photometric accuracy in constructing isodenses and relating them to real isophots. The method is used to construct isophots and in morphological analysis of four interacting galaxies from Vorontsov-Vel'yaminov's atlas: VV 51, VV 243, VV 528, and VV 711. (14 refs.)

104744 Direct conversion of LOS acceleration data to vertical gravity anomalies: a new approach. A.W.G.Kunze (Dept. of Geology, Univ. of Akron, Akron, OH, USA).
Moon & Planets (Netherlands), vol.28, no.3, p.259-65 (June 1983).
Most of the existing lunar and planetary gravity data are in the form of LOS (line-of-sight) components which cannot be used for conventional geophysical modelling. A new methof od inverting LOS data is presented. It utilizes the fact that three non-coplanar LOS acceleration vectors determined at different times at some point of observation uniquely define the total acceleration vector at that point. Vector analysis shows that the local Cartesian components g_i of the total gravity anomaly vector may be obtained by inversion of the system $a_{ij}g_j = A_i^2$, where the a_{ij} and A_is are the local Cartesian components and scalar magnitudes of the three required LOS acceleration vectors. (15 refs.)

Atmospheric transmittance derived from radiance measurements .... See Entry 104563

The analysis of the methods for computing the perturbations caused by solar and lunar gravitational influence on artificial satellite motion .... See Entry 104703

Low light level detectors in astronomy .... See Entry 104739

An estimation of the fluctuations in the extreme limb of the Sun .... See Entry 104830

Broad-band, high-resolution photograph of the solar corona February 16, 1980 .... See Entry 104833

A physical study of the Ursa Major cluster (with special attention to peculiar A stars) .... See Entry 104934

95.80 ASTRONOMICAL OBSERVATIONS (LISTED BY TECHNIQUES OF OBSERVATION)

1983d: May's surprise comet .... See Entry 104810

Purely coronal flare-like variations .... See Entry 104839

95.80D Radio and radar

Determination of the proton spectral index from data on solar microwave bursts .... See Entry 104688

Medium size radio continuum loops and their association with H I shells .... See Entry 104745

Venus: global surface radio emissivity .... See Entry 104761

Is Titan wet or dry? .... See Entry 104791

RATAN 600 observations on the radio characteristics of the quiet Sun in the range 2-4 cm .... See Entry 104825

Type I noise storms and the structure of the extreme ultraviolet corona .... See Entry 104835

X-ray and microwave observations of active regions ...... See Entry 104836

Dependence of radio emission in large Hα flares 1967-1970 upon the orientation of the local solar magnetic field ...... See Entry 104840

Flux density monitoring of radio stars observable by Hipparcos at S-band and X-band ...... See Entry 104849

The discovery of a hot stellar wind ...... See Entry 104861

VLA observations of MWC 349 at 15 and 23 GHz ...... See Entry 104864

Bright, rapid, highly polarized radio spikes from the M dwarf AD Leonis ...... See Entry 104870

Discovery of a 6.1-ms binary pulsar PSR 1953+29 ...... See Entry 104898

Radio observations of compact H II regions ...... See Entry 104937

G296.05−0.50−a large-diameter supernova remnant ...... See Entry 104944

Detection of $H^{15}NN^+$ and $HN^{15}N^+$ in interstellar clouds ...... See Entry 104946

The distribution of 6 centimeter H_2CO in Orion Molecular Cloud 1 ...... See Entry 104947

The H I extent and deficiency of spiral galaxies in the Virgo cluster ...... See Entry 104955

The precision of velocity measurements from H I profiles ...... See Entry 104959

A survey of galaxy redshifts. IV. The data ...... See Entry 104966

A search for microwave background diminution towards the cluster 0016+16 ...... See Entry 104971

Ammonia toward DR 21: a weak maser in ortho-NH_3? ...... See Entry 104972

Discovery of a redshift $z=1.2$ quasar with a flat radio spectrum in the field of the gamma-ray source CG 195+04 ...... See Entry 104978

95.80G Far infrared (bolometric, photoconductive)

Comparison of the Mt. Stromlo/AAO and Caltech/Tololo infrared photometric systems ...... See Entry 104740

Infrared (*JHK*) photometry of asteroids. II ...... See Entry 104766

The R asteroids reconsidered ...... See Entry 104770

Titan: discovery of carbon monoxide in its atmosphere ...... See Entry 104790

The Uranian satellites: surface compositions and opposition brightness surges ...... See Entry 104795

Additional *UBVRI* and *JHKL* photometry of T Tauri stars in the Taurus region ...... See Entry 104854

Speckle interferometry of IRC+10216 in the fundamental vibration-rotation lines of CO ...... See Entry 104869

Infrared magnitudes (JHKLM) for 105 chemically peculiar A and B-stars ...... See Entry 104875

Variable infrared radiation from X-ray sources 4U 0115+634 and A 0535+262 ...... See Entry 104908

Properties of young clusters near reflection nebulae ...... See Entry 104932

95.80J Photographic region (near infrared, visible, and normal ultraviolet)

Time and latitude results of observations made at Merate Observatory with the astrolabe for the year 1982 ...... See Entry 104157

Tokyo Astronomical Observatory. Time and Latitude Bulletins [October-December 1982] ...... See Entry 104706

Groups of galaxies. III. The CfA survey ...... See Entry 104747

A catalog of spectral classification and photometry of barium stars ...... See Entry 104748

Third Greenwich catalogue of stars, Sun, planets and Moon for 1950.0 ...... See Entry 104749

Venera 13 and Venera 14: sedimentary rocks on Venus? ...... See Entry 104762

The large C-type asteroids 146 Lucina and 410 Chloris, and the small S-type asteroids 152 Atala and 631 Philippina: rotation periods and lightcurves ...... See Entry 104767

Lightcurves and rotation periods for the asteroids 70 Panopaea and 235 Carolina ...... See Entry 104768

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Absolute spectrophotometry of Neptune: 3390 to 7800 Å ...... See Entry 104794

Periodic Comet Wolf (1983m) ...... See Entry 104803

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Photoelectric *UBV* photometry of southern and equatorial dwarf novae ...... See Entry 104872

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Photoelectric photometry of Ap stars in IC 2602, NGC 6281 and in the Scorpio-Centaurus group: preliminary results ...... See Entry 104884

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Search for variability of the Sr-Cr-Eu star HD 8783 ...... See Entry 104886

A study of the magnetic star HD 215441. I ...... See Entry 104887

A search for lines of heavy elements in the 3170-3700 Å region for the Ap stars 21 Per, 53 Cam, and β CrB ...... See Entry 104888

A search for rapid variability in magnetic stars from the core of the H_γ hydrogen line ...... See Entry 104889

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A photometric and spectroscopic study of the short-period eclipsing binary BV Eridani ...... See Entry 104907

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Spectroscopic orbit of the star HR 96 ...... See Entry 104920

YZ Cassiopeiae and the Utrecht photometric system ...... See Entry 104921

Micrometric measurements of southern double stars ...... See Entry 104922

Photoelectric observations of ϵ Aurigae during the ingress ...... See Entry 104923

New photoelectric times of minima of VW Cephei ...... See Entry 104924

ϵ Aurigae ...... See Entry 104926

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The planetary system of Barnard's star ...... See Entry 104931

Positions, magnitudes, and colors for stars in the globular cluster M92 ...... See Entry 104933

A physical study of the Ursa Major cluster (with special attention to peculiar A stars) ...... See Entry 104934

NGC 6256, a galactic globular cluster ...... See Entry 104935

Proper motions of Herbig-Haro objects. III. HH-7 through -11, HH-12, and HH-32 ...... See Entry 104938

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Interstellar C_2 molecules in a Taurus dark cloud ...... See Entry 104948

Observations of interstellar C_2 toward three heavily reddened stars ...... See Entry 104949

Search for Wolf-Rayet features in the spectra of giant H II regions. I. Observations in NGC 300, NGC 604, NGC 5457 and He 2-10 ...... See Entry 104951

Near-infrared source counts in the galactic plane. II. A list of near-infrared sources ...... See Entry 104954

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The variability of the spectrum of Arakelian 120 ...... See Entry 104957

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Shell structure in NGC 5128 ...... See Entry 104965

A survey of galaxy redshifts. IV. The data ...... See Entry 104966

The rotation of spiral galaxies ...... See Entry 104968

Common Lyman-alpha absorption lines in the triple QSO PG 1115+08 ...... See Entry 104976

Discovery of a redshift $z=1.2$ quasar with a flat radio spectrum in the field of the gamma-ray source CG 195+04 ...... See Entry 104978

95.80M Space ultraviolet

Type I noise storms and the structure of the extreme ultraviolet corona ...... See Entry 104835

Direct measurements of the gradual extreme ultraviolet emission from large solar flares ...... See Entry 104838

Synthesis maps of ultraviolet observations of neutral interstellar gas ...... See Entry 104945

95.80N X-ray

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Direct measurements of the gradual extreme ultraviolet emission from large solar flares ....See Entry 104838

Magnetohydrodynamic simulation of the coronal transient associated with the solar limb flare of 1980, June 29, 18:21 UT ....See Entry 104841

A λ 10830 vs. X-ray correlation among late-type stars ....See Entry 104842

GK Persei ....See Entry 104890

X-ray emission and spin-up evolution of the 6.1-ms pulsar ....See Entry 104902

Hercules X-1 and MXB 1730−335 ....See Entry 104925

An identification for 'Geminga' (2CG 195+04) 1E 0630+178: a unique object in the error box of the high-energy gamma-ray source ....See Entry 104979

Transient X-ray source near 4U 1543−45 ....See Entry 104980

MXB 1730−335 ....See Entry 104981

95.80Q gamma-ray and elementary particle

Determination of the proton spectral index from data on solar microwave bursts ....See Entry 104688

95.80S Other (inc. gravitational radiation, magnetograms, etc)

Reconnection in the Jovian magnetosphere ....See Entry 104779

95.85 CATALOGUES, ATLASES ETC

104745 Medium size radio continuum loops and their association with H I shells. Y.Sofue (Tokyo Astron. Obs., Univ. of Tokyo, Nagano, Japan), N.Nakai.
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.1, p.57-70 (July 1983).
Radio continuum survey data at 408 and 820 MHz are examined in order to find very old supernova remnants, which might be hidden in the complicated background radio emission of the Galaxy. A method of substracting large-scale background structures of scale-sizes less than 4 degrees are abstracted. Among many loop-like features five loops of diameters 3-10 degrees are found to be associated with H I shells. They may be extremely old ($\sim 10^6$ yrs) SNRs at distances less than $\sim$ 1 kpc from the Sun. (19 refs.)

104746 Catalog of magnetic field measurements. P.Didelon (Obs. de Strasbourg, Strasbourg, France).
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.1, p.119-37 (July 1983).
Ther catalog contains references to all measurements of stellar magnetic fields published in the literature between 1958 and 1981. The catalog provides for each object identifications, position, magnitude, period, extrema of the magnetic field measured, number of measurements, method used, spectral type, bibliographic references and notes. (230 refs.)

104747 Groups of galaxies. III. The CfA survey. M.J.Geller, J.P.Huchra (Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA).
Astrophys. J. Suppl. Ser. (USA), vol.52, no.2, p.61-87 (June 1983).
Presents a statistically homogeneous group catalog (CfA) based on the CfA redshift survey (Huchra et al. 1983). Groups in the catalog are all density enhancements in redshift space of a factor greater than 20. Group members are identified according to the procedure described in a previous study (Huchra and Geller, 1982) of a shallower whole-sky sample. All groups contain at least three members. (27 refs.)

104748 A catalog of spectral classification and photometry of barium stars. P.K.Lu (Western Connecticut State Univ. Obs., Danbury, CT, USA), D.W.Dawson, A.R.Upgren, E.W.Weis.
Astrophys. J. Suppl. Ser. (USA), vol.52, no.2, p.169-81 (June 1983).
A catalog of spectroscopic and photometric data for 221 barium stars is presented. All spectra were obtained with an image-tube system at a dispersion of 43 Å mm^{-1} at Hγ. The intensity of the λ4554 line of Ba II is estimated on a scale of 1 to 5 in a manner similar to that used by Warner (1965). Photometric data in the DDO and *UBVRI* systems have been obtained for most of these stars. (29 refs.)

104749 Third Greenwich catalogue of stars, Sun, planets and Moon for 1950.0. R.H.Tucker, M.E.Buontempo, P.Gibbs, R.H.D.Swifte (Royal Greenwich Obs., Hailsham, England).
R. Greenwich Obs. Bull. (GB), no.187, p.5-48 (1983).
Contains the results of observations made at Greenwich with the Airy Transit Circle from 1942 May 26 to 1954 March 30. The results for the Sun, planets and Moon (in Parts IV and V of the catalogue) represent re-reductions of the results previously published in the annual volumes of Greenwich Observations. (22 refs.)

The First Dictionary of the Nomenclature of Celestial Objects (solar system excluded) ....See Entry 98663

95.90 OTHER TOPICS IN ASTRONOMY AND ASTROPHYSICS

Proceedings of Symposium 3 of the COSPAR Twenty-Fourth Plenary Meeting ....See Entry 98618

Proceedings of Workshop I of the COSPAR Twenty-Fourth Plenary Meeting ....See Entry 104583

The universe from $<10^{-36}$ second to $>10^{30}$ years. I ....See Entry 104993

96.00 SOLAR SYSTEM

96.10 GENERAL, SOLAR NEBULA, AND COSMOGONY

104750 Fragmentation of a nonisothermal protostellar cloud. A.P.Boss (Dept. of Terrestrial Magnetism, Carnegie Instn. of Washington, Washington, DC, USA).
Icarus (USA), vol.55, no.1, p.181-4 (July 1983).
The collapse of a very low thermal energy, rotating cloud results in fragmentation to a binary protostellar system even in the nonisothermal regime. The solar system therefore probably did not form from a fragmentation hierarchy involving ejection of the presolar nebula from a multiple system. (12 refs.)

104751 Implications of rare gas isotropic ratios for the age of the Solar System. R.W.Medeiros (Dept. of Chem., West Chester State Coll., West Chester, PA, USA).
Speculations Sci. & Technol. (Switzerland), vol.6, no.2, p.195-8 (June 1983).
The atmospheric ^{40}Ar/^{36}Ar ratios for the planets Mars-Earth-Venus are discussed. A marked increase in these values has been noted with increasing planetary distance from the Sun, implying differing degrees of ^{36}Ar outgassing. This is attributed to an early active sun, which produced lithospheric melting to depths dependent upon orbital distance. The results indicate that the Solar System may be older than the currently accepted age of 4.5 to 5.0 billion years. Suggestions are made for future investigations. (16 refs.)

Proceedings of the Topical Meeting of the COSPAR Interdisciplinary Scientific Commission B and Symposium 6 of the COSPAR Twenty-Fourth Plenary Meeting ....See Entry 98616

On the 90th Anniversary of the Birth of O.Yu. Shmidt ....See Entry 98629

Collisions in self-gravitating clouds of planetesimals ....See Entry 104715

Origin of the Moon—capture by gas drag of the Earth's primordial atmosphere ....See Entry 104754

96.20 MOON

104752 Grabens, basin tectonics, and the maximum total expansion of the Moon. M.P.Golombek, G.E.McGill (Dept. of Geology & Geography, Univ. of Massachussetts, Amherst, MA, USA).
J. Geophys. Res. (USA), vol.88, no.B4, p.3563-78 (10 April 1983). [received: Aug. 1983]
These structures have been explained as due to global expansion and contraction, basin subsidence, or both. Even if the extension implied by all lunar grabens were due to global expansion, the total radius increase permissible after terminal bombardment would be much less than that predicted by the most conservative models of lunar thermal evolution. The obvious areal association of most grabens and wrinkle ridges with impact basins suggests that a genetic relationship exists also. Both it is necessary to develop either kinematic or dynamic models to determine if basin subsidence alone can account for these structures. These models are developed and described. (31 refs.)

104753 A correlation between large-scale asymmetry of the Moon and the foci of moonquakes. G.X.Song (Dept. of Astron., Univ. of Manchester, Manchester, England).
Moon & Planets (Netherlands), vol.28, no.3, p.247-50 (June 1983).
Some evidence is produced to show that the Moonis asymmetric on the large scale as regards its figure, structure, composition, the distribution of tidal force, natural remnant magnetism and magnetic anomaly. This asymmetry produces the state of stress in the Moon, causing most foci of moonquakes to be located in the nearside of the Moon. (13 refs.)

104754 Origin of the Moon—capture by gas drag of the Earth's primordial atmosphere. K.Nakazawa (Geophys. Inst., Univ. of Tokyo, Tokyo, Japan), T.Komuro, C.Hayashi.
Moon & Planets (Netherlands), vol.28, no.3, p.311-27 (June 1983).
The authors propose a new scenario of the lunar origin. In this model the Earth grew up in a gaseous solar nebula and, consequently, the sphere of its gravitational influence (i.e. the Hill sphere) was filled by a gas forming a dense primordial atmosphere. In the later stages this atmosphere was dissipated gradually, owing to strong solar activity. Dynamical processes where a low-energy (i.e. slightly unbound) planetesimal is trapped within the terrestrial Hill sphere are studied. The orbital motion of such a planetesimal under solar gravity and atmospheric gas drag is calculated. The results show that a planetesimal with the lunar mass or less can be trapped if it enters the Hill sphere before the atmospheric density decreases to about 1/50 of the initial value. (25 refs.)

On the indirect influence of the planets on nutation. I. Effects of planetary perturbations in lunar orbit ....See Entry 104164

Direct conversion of LOS acceleration data to vertical gravity anomalies: a new approach ....See Entry 104744

Phase functions of atmosphereless bodies of the solar system ....See Entry 104757

96.30 PLANETS AND SATELLITES

(exc. the Moon; for celestial mechanics, see 95.10; for Earth as an astronomical body, see 91. Geophysics)

104755 Perturbed particle disks. N.Borderies, P.Goldreich (Div. of Geological & Planetary Sci., California Inst. of Technol., Pasadena, CA, USA), S.Tremaine.
Icarus (USA), vol.55, no.1, p.124-32 (July 1983).
The Boltzmann moment equations are solved to determine the velocity ellipsoid in a particle disk near an isolated satellite resonance. The particles are modeled as identical, indestructible, imperfectly elastic, smooth spheres. Gravitational interactions between particles are neglected. The solutions of the equations are used to set a bound on the deformation rate and to illustrate the significant characteristics of the angular momentum transport. Potential applications of the results to dynamical processes in planetary rings are outlined. (4 refs.)

104756 Planetary geodesy. W.L.Sjogren (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.528-37 (April 1983).
Deals with geodetic parameters of the planets and their satellites (including the Moon but not the Earth): shape, rotation, orientation, and gravity. A summary reference table of radii, masses, and gravity fields is provided. (182 refs.)

104757 Phase functions of atmosphereless bodies of the solar system. V.V.Shevchenko (P.K. Shternberg State Astron. Inst., Moscow, USSR).
Sol. Syst. Res. (USA), vol.16, no.4, p.164-70 (Oct.-Dec. 1982). Translation of: *Astron. Vestn. (USSR)*, vol.16, no.4, p.209-15 (Oct.-Dec. 1982).
Compares the phase functions of the Moon, Mercury, Jupiter's Galilean satellites, Vesta, and Ceres. The effect of the surface on the integral phase brightness is investigated. The shadow function, which depends on the degree of cratering of the surface, has an effect on the phase curve and the opposition effect. The opposition effect decreases with increasing surface albedo. (19 refs.)

Proceedings of the Workshop on 'Cosmic Magnetic Fields' in Honour of Giorgio Abetti .... See Entry 98636

Origin and evolution of planetary atmospheres .... See Entry 98662

A dynamic model for the demonstration of planetary motions or 'celestial mechanics on the desk' .... See Entry 98698

On the indirect influence of the planets on nutation. I. Effects of planetary perturbations in lunar orbit .... See Entry 104164

Collisions in self-gravitating clouds of planetesimals .... See Entry 104715

Magnetic fields in the cosmos .... See Entry 104732

Direct conversion of LOS acceleration data to vertical gravity anomalies: a new approach .... See Entry 104744

Implications of rare gas isotropic ratios for the age of the Solar System .... See Entry 104751

96.30E Venus

104758 5577-Å airglow and electron fluxes in the nighttime atmosphere of Venus. V.A.Krasnopol'skii.
Cosmic Res. (USA), vol.20, no.5, p.530-4 (Sept.-Oct. 1982). Translation of: *Kosm. Issled. (USSR)*, vol.20, no.5, p.742-7 (Sept.-Oct. 1982). [received: June 1983]
Observations of the 5577-Å airglow by Veneras 9 and 10 agree with direct measurements of electron fluxes on the night side of the planet in the presence of a magnetic field of less than 18° inclination. An estimate of electron ionization by Pioneer Venus is extremely sensitive to the nature of the assumed electron spectrum at $E>50$ eV. Venera measurements of the electron flux were higher by an order of magnitude in the absence of a magnetic field, and agree with radio occultation data only for magnetic fields with an inclination smaller than 5°. Ionization by interplanetary light in the 584 Å helium line and meteoric ionization may be significant in maintaining the lower maximum of the ionosphere. (22 refs.)

104759 Evidence for helical kink instability in the Venus magnetic flux ropes. R.C.Elphic (Lab. for Planetary Atmospheres, NASA/Goddard Space Flight Center, Greenbelt, MD, USA), C.T.Russell.
Geophys. Res. Lett. (USA), vol.10, no.6, p.459-62 (June 1983).
Empirical models of the magnetic field structure of flux ropes found in the Venus ionosphere indicate that ropes are unstable to long wavelength (>100 km) helical kink perturbations. The onset of such an instability can explain the apparent volume distribution of flux ropes with altitude, and their orientation as a function of altitude. In the subsolar region, the fraction of volume that is occupied by flux ropes increases from roughly 20% at high altitudes to more than 50% at low altitudes, which is a greater increase than would be expected if ropes convect downward as simple straight horizontal cylinders. The helical kink instability increases the fractional volume occupied by ropes by turning the originally straight, horizontal flux tubes into corkscrew-shaped structures as they convect to lower altitudes. (8 refs.)

104760 Optical signature of Venus lightning as seen from space. M.A.Williams, L.W.Thomason (Inst. of Atmospheric Phys., Univ. of Arizona, Tucson, AZ, USA).
Icarus (USA), vol.55, no.1, p.185-6 (July 1983).
The calculations of Williams, Thomason, and Hunten (1982) for the light transmitted to space by a Venus lightning flash by dropping the use of similarity relations have been improved. This revised model increases their escape fractions and image sizes by about a factor of 2; however, their conclusions remain valid. (5 refs.)

104761 Venus: global surface radio emissivity. P.G.Ford, G.H.Pettengill (Dept. of Earth & Planetary Sci., MIT, Cambridge, MA, USA).
Science (USA), vol.220, no.4604, p.1379-81 (24 June 1983).
Observations of thermal radio emission from the surface of Venus, made by the Pioneer Venus radar mapper at a wavelength of 17 centimeters, show variations that are dominated by changes in surface emissivity. The regions of lowest emissivity (0.54 ± 0.05 for the highland areas of Aphrodite Terra and Theia Mons) correspond closely to regions of high radar reflectivity. These results support the inference of inclusions of material with high electrical conductivity in the surface rock of these areas. (14 refs.)

104762 Venera 13 and Venera 14: sedimentary rocks on Venus?. C.P.Florensky, A.T.Basilevsky, V.P.Kryuchkov, R.O.Kusmin, O.V.Nikolaeva, A.A.Pronin, I.M.Chernaya, Yu.S.Tyuflin, A.S.Selivanov, M.K.Naraeva, L.B.Ronca.
Science (USA), vol.221, no.4605, p.57-9 (1 July 1983).
Venera 13 and Venera 14 transmitted almost complete panoramic views of their landing sites. Analyses of the photogaphs show the presence of rock formations undergoing geomorphic degradation. The formations display ripple marks, thin layering, differential erosion, and curvilinear fracturings. Some of them are interpreted as lithified clastic sediments. The lithification could have taken place at depth or at the surface, resulting in a type of duricrust. The origin of the sediments is unknown but could be aeolian, volcanic, or related to impacts or to turbidity currents. (12 refs.)

A study of the disintegration of meteoric particles moving in the atmospheres of the Earth, Mars, and Venus .... See Entry 104812

96.30G Mars

104763 The role of seasonal reservoirs in the Mars water cycle. I. Seasonal exchange of water with the regolith. B.M.Jakosky (Div. of Geological & Planetary Sci., California Inst. of Technol., Pasadena, CA, USA).
Icarus (USA), vol.55, no.1, p.1-18 (July 1983).
Observations of the seasonal cycle of water vapor in the Mars atmosphere imply that there is a seasonal exchange of water with a reservoir of ice in the polar regions and of adsorbed water in the global near-surface regolith. The equilibrium between water vapor and adsorbed water is sufficiently temperature-dependent that seasonal surface temperature variations are capable of driving a large exchange of water between the atmosphere and subsurface. A one-dimensional model of this process is presented, and calculations are done of the amount of water exchanged seasonally at each latitude. (47 refs.)

104764 Orbital evolution and origin of the Martian satellites. A.M.K.Szeto (Res. School of Earth Sci., Australian Nat. Univ., Canberra, Australia).
Icarus (USA), vol.55, no.1, p.133-68 (July 1983).
The role of tidal dissipation within the Martian satellite system is examined through orbital evolution integrations and assessed in the context of its origin scenario through calculations of collision probabilities between Phobos and Deimos in the distant past. A wide range of assumptions concerning models of dissipation by anelastic tidal deformation within Mars and its satellites has been considered in investigating the possibility of a capture origin using generalized Q laws and the Darwin-Kaula formulation of the secular evolution equations. An accretion origin is preferred over capture, although an accretion model that is consistent with the likely carbonaceous chondritic composition of the Martian satellites has yet to be established. (92 refs.)

104765 The effect of orbital element variations on the mean seasonal daily insolation on Mars. E.Van Hemelrijck (Belgian Inst. for Space Aeronomy, Brussels, Belgium).
Moon & Planets (Netherlands), vol.28, no.2, p.125-36 (April 1983).
Studies changes in the mean seasonal insolation on the planet Mars caused by significant large-scale variations in the following orbital elements: the eccentricity (e), the obliquity (ϵ) and the longitude of perihelion (λ_p). Three orbital configurations are investigated. In the first, the eccentricity equals successively 0, 0.075, and 0.15, whereas for the obliquity and the longitude of perihelion the author takes the present values which amount, respectively to 25° and 250°. In the second situation, $\epsilon=15$, 25, and 35° for a circular orbit ($e=0$) with $\lambda_p=250°$. In the last model the author sets $e=0.075$ and $\epsilon=25°$ for $\lambda_p=-90$, 0, and 90°. (19 refs.)

Planet Mars. Proceedings of a Workshop (ESA SP-185) .... See Entry 98656

A study of the disintegration of meteoric particles moving in the atmospheres of the Earth, Mars, and Venus .... See Entry 104812

96.30H Asteroids

104766 Infrared (*JHK*) photometry of asteroids. II. G.J.Veeder, D.L.Matson, G.Hoover (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA), C.Kowal.
Astron. J. (USA), vol.88, no.7, p.1060-3 (July 1983).
For pt.I see ibid., vol.87, no.5, p.834-9 (1982). The authors report *JHK* (1.2, 1.6, and 2.2 μ) photometry for 38 asteroids of various spectral classifications. M asteroids tend to have infrared colors intermediate between the color domains of E and P asteroids. A few D asteroids have redder $J-H$ colors than most C asteroids. The unusually red $J-H$ color of 246 Asporina indicates it is a member of the A class. (15 refs.)

104767 The large C-type asteroids 146 Lucina and 410 Chloris, and the small S-type asteroids 152 Atala and 631 Philippina: rotation periods and lightcurves. H.J.Schober (Inst. fur Astron., Graz, Austria).
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.1, p.71-5 (July 1983).
Photoelectric observations are presented for four ateroids. The rotation periods of 146 Lucina and 410 Chloris are found to be 18.54^h and 32.50^h, respectively. The rotation period of 152 Atala is found to be $5.282^h \pm 0.004^h$; the amplitude of the light curve is 0.50 mag. The rotation period and amplitude of 631 Philippina are $5.92^h \pm 0.01^h$, and 0.20 mag. Colours and magnitudes were measured for 146 Lucina, 410 Chloris and 631 Philippina; the colours of 631 Philippina showed no variation during the rotation period. (4 refs.)

104768 Lightcurves and rotation periods for the asteroids 70 Panopaea and 235 Carolina. .Schroll (Inst. fur Astron., Univ. Graz, Sattendorf, Austria), H.J.Schober.
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.1, p.77-9 (July 1983).
The asteroids 70 Panopaea and 235 Carolina were observed photoelectrically in UBV during four nights in September 1980. The rotation period and lightcurve amplitude of 70 Panopaea were found to be $15.87^7 \pm 0.04^h$ ($0.661^d \pm 0.002^d$), and 0.12 mag; for 235 Carolina the rotation period and amplitude are $17.56^h \pm 0.03^h$ ($0.732^d \pm 0.001^d$) and at least 0.35 mag. Both asteroids have double wave light curves. UBV colours were measured for both asteroids; no variation was found during the rotation period. (4 refs.)

104769 Physical studies of asteroids. XI. Photoelectric observations of the asteroids 2, 161, 216 and 276. M.Carlsson, C.-I.Lagerkvist (Astron. Obs., Uppsala, Sweden).
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.1, p.157-9 (July 1983).
For pt.X see Moon and Planets, vol.27, no.4, p.463-6 (1982). Lightcurves and *UBV*-colours are presented for the asteroids 2 Pallas, 161 Athor, 216 Kleopatra and 276 Adelheid. For asteroid 216 a lightcurve amplitude of 1.1^m was observed. (9 refs.)

104770 The R asteroids reconsidered. G.J.Veeder, D.L.Matson, E.F.Tedesco (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
Icarus (USA), vol.55, no.1, p.177-80 (July 1983).
JHK infrared photometry shows that R asteroids have two distinct infrared color domains. Most R asteroids have JHK and visual colors and albedos that fall amongst those observed for S asteroids, but a small subset is clearly different. These are designated as a new A class of asteroids. (24 refs.)

104771 Occultation of 14 Piscium by (51) Nemausa on 1983 Sept. 11. G.E.Taylor, A.R.Klemola.
I.A.U. Circ. (USA), no.3850, 1 pp. (12 Aug. 1983).
Presents an ephemeris for the central line of this occultation. (1 ref.)

104772 1983 LB. B.G.Marsden.
I.A.U. Circ. (USA), no.3853, 1 pp. (17 Aug. 1983).
Presents an ephemeris for the period 1983 August 4 to November 2, at five-day intervals. (1 ref.)

104773 1983 LC. B.G.Marsden.
I.A.U. Circ. (USA), no.3849, 1 pp. (5 Aug. 1983).
An ephemeris is presented for the period 1983 August 4 to September 23, at five-day intervals. (1 ref.)

104774 Photoelectric photometry of 2 Pallas. C.J.Cunningham.
J. R. Astron. Soc. Can. (Canada), vol.77, no.3, p.121-5 (June 1983).
Photoelectric observations of the asteroid 2 Pallas are presented. Data were obtained on three nights in 1982 April. A phase coefficient of 0.037^m per degree, an absolute magnitude of 4.11^m, an albedo of 0.10, a diameter of 630 km, and a period of 8.16^h are computed. (4 refs.)

104775 Minor Planet Circulars.
Minor Planet Circ. (USA), no.7791-7874, 84 pp. (27 April 1983).
Present precise positions for asteroids and ten comets observed at eight observatories or observing stations. Identification changes are given for 30 asteroids and 11 objects are identified with numbered minor planets. 71 corrected observations are also presented. Orbital elements are given for 56 one-opposition asteroids, newly-numbered asteroids 2865-2881, three named and

three previously numbered objects as well as 24 asteroids still with just discovery designations including one Palomar-Leiden object. Ephemerides are given for four comets and 84 minor planets for the inclusive period 1983 April 16-1984 August 28 at 10-day intervals and for Periodic Comets Encke and Crommelin for the inclusive period 1983 August 14-1984 October 7 at 5- and 10-day intervals as appropriate.

104776 Minor Planet Circulars 7875-7980.
Minor Planet Circ. (USA), no.7875-7980, 106 pp. (26 May 1983).
Present precise positions for asteroids and 16 comets observed at 26 observatories or observing stations. Identification changes are given for four asteroids and 18 corrected and three deleted observations are also presented. Orbital elements are given for 198 one-opposition asteroids, and newly numbered asteroids 2882-2888 as well as 23 asteroids still with just discovery designations including eight Palomar-Leiden objects. Ephemerides are given for 93 minor planets for the inclusive period 1983 May 26−1984 March 21 at 10-day intervals. Finally new names are given to 57 asteroids.

104777 Minor Planet Circulars 7981-8024.
Minor Planet Circ. (USA), no.7981-8024, 44 pp. (25 June 1983).
Present precise positions for asteroids and 72 comets observed at 57 observatories or observing stations. Identification changes are given for 63 asteroids. 69 corrected observations and 11 deleted observations are also presented. Orbital elements are given for seven one-opposition asteroids, newly numbered asteroids 2889-2892, 11 named objects as well as four asteroids still with just discovery designations including one Palomar-Leiden object. Ephemerides are given for four minor planets for the inclusive period 1983 July 5-1984 March 21 at 10-day intervals. An index to the orbital elements of eight comets, 19 periodic comets, and 1669 asteroids is given on MPC 8000-8007.

104778 Results of astrophysical investigations of asteroids (survey). I. D.F.Lupishko, I.N.Bel'skaya (A.M. Gor'ki State Univ., Kharkov, Ukrainian SSR).
Sol. Syst. Res. (USA), vol.16, no.4, p.153-64 (Oct.-Dec. 1982). Translation of: *Astron. Vestn. (USSR)*, vol.16, no.4, p.195-208 (Oct.-Dec. 1982).
Contains the results of photometric investigations of the physical properties of asteroids. (66 refs.)

96.30K Jupiter

104779 Reconnection in the Jovian magnetosphere. A.Nishida (Inst. of Space & Astronautical Sci., Tokyo, Japan).
Geophys. Res. Lett. (USA), vol.10, no.6, p.451-4 (June 1983).
In the nightside Jovian magnetosphere, Voyager 1 and 2 detected signatures of reconnection. The anti-sunward streaming events, recognized and designated as magnetospheric winds by Krimigis et al., were clearly associated with the northward inclination of the magnetic field. The reconnection is likely to be due to the need to adjust the length of the extended nightside field lines to the dimension of the dayside magnetosphere, but it is not a steady-state feature and shows considerable variability. In addition to these events, there were numerous occasions where northward and southward field polarities were mixed at the neutral sheet. These latter events were observed by Voyager 2 beyond about 80 R_J where the observed field across the neutral sheet exceeded the dipole field strength, and they probably represent the product of the tearing mode. (14 refs.)

104780 Voyager photometry of Europa. B.Buratti, J.Veverka (Lab. for Planetary Studies, Cornell Univ., Ithaca, NY, USA).
Icarus (USA), vol.55, no.1, p.93-110 (July 1983).
Ninety Voyager images ranging in phase angle from 3 to 143° and covering the spectral range from 0.34 to 0.58 μm were analyzed to derive the photometric properties of Europa. (31 refs.)

104781 The interiors of the giant planets−1983. R.Smoluchowski (Dept. of Astron. & Phys., Univ. of Texas, Austin, TX, USA).
Moon & Planets (Netherlands), vol.28, no.2, p.137-54 (April 1983).
The last few years have brought progress in our understanding of the interiors of the giant planets especially of the two larger ones which have been visited by the Pioneer and Voyager spacecraft. An analysis of the formation of the giant planets helps to clarify certain important common features. The presently available model of Jupiter is still based on certain somewhat bothersome approximations but it appears to satisfy the main observational constraints. Saturn's interior is much better understood than it was previously although the quantitative aspects of the role of the miscibility gap in the hydrogen-helium system have not yet been entirely resolved. Much attention has been directed at the interiors of Uranus and Neptune. Both the two- and the three-layer models are moderately successful. Serious difficulties arise from the considerable uncertainties concerning the rotational periods of both planets. (43 refs.)

Proceedings of Symposium 3 of the COSPAR Twenty-Fourth Plenary Meeting ....See Entry 98618

Volcanoes on Io ....See Entry 98696

A second order Jupiter-Saturn planetary theory. II ....See Entry 104788

96.30M Saturn

104782 Scheme for the formation of the rings of Saturn and the nature of the Cassini Division. V.D.Davydov.
Cosmic Res. (USA), vol.20, no.5, p.535-46 (Sept.-Oct. 1982). Translation of: *Kosm. Issled. (USSR)*, vol.20, no.5, p.748-59 (Sept.-Oct. 1982). [received: June 1983]
A unified solution of two problems is proposed on the basis of an analysis of the observed properties of the rings of Saturn: the problem of the width of the Cassini Division and the question of the cause of a former satellite of Saturn descending into the region of tidal disruption. A scheme for the formation of the system of rings is constructed, and specific characteristics of the former satellite from which it originated are derived. The published results on the observations of the rings of Saturn from Voyager 1 and Voyager 2 are used in the work. (29 refs.)

104783 Detached plasma in Saturn's front side magnetosphere. C.K.Goertz (Max-Planck-Inst. fur Aeronomie, Katlenburg-Lindau, Germany).
Geophys. Res. Lett. (USA), vol.10, no.6, p.455-8 (June 1983).
Discusses plasma observations in the outer front side Saturnian magnetosphere which indicate the existence of dense flux tubes outside the plasma sheet. It is suggested that flux tubes are detached from the plasma sheet by a centrifugally driven flute instability. The same instability leads to a dispersal of Titan-injected plasma. It is shown that the detached flux tubes will probably break open as they convect into the nightside magnetotail and lose their content in form of a planetary wind. (16 refs.)

104784 Vertical distribution of scattering hazes in Titan's upper atmosphere. K.Rages, J.B.Pollack (NASA Ames Res. Center, Moffett Field, CA, USA).
Icarus (USA), vol.55, no.1, p.50-62 (July 1983).
Radial intensity scans of a Voyager 2 high phase angle image of Titan have been inverted to yield vertical extinction profiles at 1° intervals around the limb. A detached haze layer with peak particle number densities ~ 0.2 cm^{-3} exists at all latitudes south of $\sim 45°$N, and at an altitude of 300-350 km. The optical depth 0.01 level lies at a radius of 2932 ± 5 km at the equator and at a radius of 2915 ± 10 km over the poles (altitudes of 357 ± 5 and 340 ± 10 km, respectively). In addition to the haze layer at 300-350 km, there is a small enhancement in the extinction at ~ 450 km which exists at all latitudes between 75°S and $\sim 60°$N. (14 refs.)

104785 Collision-induced absorption in the far infrared spectrum of Titan. J.L.Hunt (Dept. of Phys., Univ. of Guelph, Guelph, Ontario, Canada), J.D.Poll, D.Goorvitch, R.H.Tipping.
Icarus (USA), vol.55, no.1, p.63-72 (July 1983).
After a review of the procedure for the theoretical calculation of the N_2 translation-rotational spectrum, new results for the temperature range of 70 to 120K are reported. These are used as input data for a simple atmospheric model in order to compute the far infrared radiance, brightness temperature, and spectral limb function. This source of opacity alone is not capable of explaining the Voyager results. When the collision-induced methane is included, the results are in closer agreement in the range between 200 and 300 cm^{-1}, suggesting that a more complete treatment of collision-induced absorption including particularly CH_4-N_2, N_2-H_2, and H_2-H_2 results, may provide sufficient opacity to reduce or obviate the need for opacities due to clouds or aerosols in order to explain the observed spectra. (21 refs.)

104786 Galactic cosmic rays and N_2 dissociation on Titan. L.A.Capone (Dept. of Meteorology, San Jose State Univ., San Jose, CA, USA), J.Dubach, S.S.Prasad, R.C.Whitten.
Icarus (USA), vol.55, no.1, p.73-82 (July 1983).
The electromagnetic and particle cascade resulting from the absorption of galactic cosmic rays in the atmosphere of Titan is shown to be an important mechanism for driving the photochemistry at pressures of 1 to 50 mbar in the atmosphere. In particular, the cosmic ray cascade dissociates N_2, a process necessary for the synthesis of nitrogen organics such as HCN. The important interactions of the cosmic ray cascade with the atmosphere are discussed. The N_2 excitation and dissociation rates and the ionization rates of the principal atmospheric constituents are computed for a Titan model atmosphere that is consistent with Voyager 1 observations. (41 refs.)

104787 Plasma clouds in Saturn's rings. G.E.Morfill (Max-Planck-Inst. fur Extraterrestrische Phys., Garching, Germany), C.K.Goertz.
Icarus (USA), vol.55, no.1, p.111-23 (July 1983).
The expansion and ionization of vapor produced by impacts of meteorites on Saturn's rings is described. There is an 'impact plasma' produced in the initial collision, and a 'secondary plasma' produced by subsequent ionization of the neutral gas ejecta. The dynamics of these plasma clouds, their size, density, and life time are calculated. It is suggested that large clouds, produced by meter-sized meteorites may lead to the formation of spokes. (36 refs.)

104788 A second order Jupiter-Saturn planetary theory. II. O.M.Kamel (Astron. Dept., Faculty of Sci., Cairo Univ., Cairo, Giza, Egypt), A.Aziz Bakry.
Moon & Planets (Netherlands), vol.28, no.2, p.113-23 (April 1983).
For pt.I see ibid., vol.27, no.4, p.417-30 (1982). The authors complete the establishment of a second order secular Jupiter-Saturn theory (Kamel and Bakry, 1982). This is achieved by taking into consideration the influence of the indirect part of the planetary disturbing function, and expressing the second order secular Hamiltonian in terms of Poincare's canonical variables. (10 refs.)

104789 The shape of the small satellites of Saturn: gravitational equilibrium vs. solid-state strength. P.Farinella, A.Milani, A.M.Nobili (Dipartimento di Matematica, Univ. Pisa, Pisa, Italy), P.Paolicchi, V.Zappala.
Moon & Planets (Netherlands), vol.28, no.3, p.251-8 (June 1983).
Among the small satellites of Saturn there is a transition from irregularly-shaped, strength-dominated objects to larger, gravity-dominated bodies with shapes roughly fitting the theoretical equilibrium figures. The transition occurs for a radius of 100 ± 50 km, corresponding to a typical material strength of the order of 10^7 dynes cm^{-2}. Mimas, Enceladus, Hyperion, Phoebe and the small coorbital and F-ring shepherding moons are discussed; and it is shown that an analysis of the shape data can provide interesting results on the physical properties, origin and collisional history of these objects. (17 refs.)

104790 Titan: discovery of carbon monoxide in its atmosphere. B.L.Lutz (Planetary Res. Center, Lowell Obs., Flagstaff, AZ, USA), C.De Bergh, T.Owen.
Science (USA), vol.220, no.4604, p.1374-5 (24 June 1983).
The 3-0 rotation-vibration band of carbon monoxide in the near-infrared spectrum of Titan has been identified, and a reflecting layer model mixing ratio of carbon monoxide to molecular nitrogen of 6×10^{-5} has been determined. This result supports the probable detection of carbon dioxide by Samuelson and his co-workers and strengthens possible analogies between the atmosphere of Titan and conditions on the primitive Earth. (12 refs.)

104791 Is Titan wet or dry?. R.Eshleman (Stanford Univ., Stanford, CA, USA), G.F.Lindal, G.L.Tyler.
Science (USA), vol.221, no.4605, p.53-5 (1 July 1983).
Titan's dense and cold nitrogen atmosphere contains a small amount of methane under conditions at least approaching those at which one or both constituents would condense. From specific features of radio occultation and other Voyager results, however, it is concluded that nitrogen does not condense on Titan and that Titan has neither global methane oceans nor a global cloud of liquid methane droplets. However, other considerations favor a methane ice haze high in the troposphere and liquid and solid methane might exist on the surface and as low clouds at polar latitudes. (19 refs.)

104792 Oceans on Titan?. F.M.Flasar (NASA Goddard Space Flight Center, Greenbelt, MD, USA).
Science (USA), vol.221, no.4605, p.55-7 (1 July 1983).
If global oceans of methane exist on Titan, the atmosphere above them must be within 2 percent of saturation. The two Voyager radio occultation soundings, made at low latitudes, probably occurred over land, since they imply a relative humidity ≤ 70 percent near the surface. Oceans might exist at other low-latitude locations if the zonal wind velocities in the lowest 3 kilometers are ≤ 4 centimeters per second. (24 refs.)

Proceedings of Symposium 3 of the COSPAR Twenty-Fourth Plenary Meeting ....See Entry 98618

The interiors of the giant planets−1983 ....See Entry 104781

96.30T Other planets

104793 Weak dynamical effects in the Uranian ring system. A.P.Freedman (Dept. of Earth & Planetary Sci., MIT, Cambridge, MA, USA), S.Tremaine, J.L.Elliot.
Astron. J. (USA), vol.88, no.7, p.1053-9 (July 1983).
A number of weak gravitational forces were examined for their kinematic effects on the Uranian ring system, in an attempt to account for errors of ~ 2 km between the ring positions and the best fitting orbit model. The principal conclusions are as follows: (1) Perturbations by the five known satellites, with the best current estimates of the satellite masses, are too small to have observable effects. (2) Limits can be set on the masses of possible inter-ring 'shepherd' satellites from their influence on apse precession rates and their radial perturbations of the rings. For example, the maximum mass of a shepherd satellite between rings 4 and 5 would be $\sim 10^{19}$ g. (3) Using the best available ring orbit parameters, there is no convincing evidence that the rings are associated with resonances with known satellites. The only close association is of rings 5, α, and γ with three-body resonances due to Miranda and Ariel. It is possible, however, that the shepherd satellites occupy these resonances. (4) The known satellites could cause the observed residuals by changing the position of Uranus relative to the system barycenter during an occultation. The maximum change so far, during the 1981 April 26 event, was ~ 2 km. This effect is currently being studied with the MIT Uranus ring model. (32 refs.)

104794 Absolute spectrophotometry of Neptune: 3390 to 7800 Å. J.T.Bergstralh (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA), J.S.Neff.
Icarus (USA), vol.55, no.1, p.40-9 (July 1983).
Absolute spectrophotometry of Neptune from 3390 to 7800 Å, with spectral resolution of 10 Å in the interval 3390-6055 and 20 Å in the interval 6055-7800 Å, is reported. The results are compared with filter photometry and with synthetic spectra computed on the basis of a parameterization proposed for aerosol scattering and absorption. A CH_4/H_2 ratio is derived for the convectively mixed part of Neptune's atmosphere, and constrains optical properties of hypothetical aerosol layers. (23 refs.)

104795 The Uranian satellites: surface compositions and opposition brightness surges. R.Hamilton Brown (Planetary Geosci. Div., Hawaii Inst. of Geophys., Honolulu, HI, USA), D.P.Cruikshank.
Icarus (USA), vol.55, no.1, p.83-92 (July 1983).
High-precision spectrophotometry at 5% resolution has been obtained for the Uranian satellites Ariel, Umbriel, Titania, and Oberon. These spectra cover the wavelength region 1.43-2.57 μm and represent a substantial improvement in precision or wavelength coverage over previous studies. The 1.5- and 2.0-μm water absorption band depths and the continuum reflectance indicate significant differences among the surface compositional properties of the four satellites. Preliminary measurements of the near-infrared opposition brightness surges of Ariel, Titania, and Oberon show them to be among the largest in the solar system. (24 refs.)

104796 The elimination of the critical terms of a first order Uranus-Neptune theory by Hori's method. II.. O.M.Kamel (Dept. of Astron., Cairo Univ., Giza, Egypt).
Moon & Planets (Netherlands), vol.28, no.3, p.221-45 (June 1983).
For pt.I see ibid., vol.27, no.4, p.407-15 (1982). The values of S_1 $(\hat{F}_1)_p$ and $(\bar{F}_1)_p$ are determined in terms of the canonical variables of Poincare. A complete solution of the auxiliary system of equations generated by the Hamiltonian $(\bar{F}_1)_p$ is presented. (19 refs.)

104797 New light on cold worlds.
Sky & Telesc. (USA), vol.66, no.1, p.23-5 (July 1983).
The author describes optical and near-infrared observations of Pluto and Triton, which have provided evidence for the existence of methane on both bodies. It is possible that Pluto has both a methane atmosphere and a surface layer of methane frost; large variations in atmospheric pressure are to be expected during the Plutonian year as methane freezes or sublines. In contrast no atmosphere has been detected on Triton, and methane ice appears to be confined mostly to one hemisphere; however, there does appear to be a shallow ocean of liquid nitrogen near Triton's south pole. (no refs.)

Proceedings of Symposium 3 of the COSPAR Twenty-Fourth Plenary Meeting ....See Entry 98618

The interiors of the giant planets—1983 ....See Entry 104781

96.50 OTHER OBJECTS IN THE PLANETARY SYSTEM

96.50D Interplanetary matter, magnetic and electric fields

(inc. gegenschein and zodiacal light; see also 94.60 Interplanetary space)

104798 The Poynting-Robertson effect and lifetimes of micrometeoroids. I.Kapisinsky (Astron. Inst., Slovak Acad. of Sci., Bratislava, Czechoslovakia).
Bull. Astron. Inst. Czech. (Czechoslovakia), vol.34, no.3, p.167-73 (June 1983).
The Poynting-Robertson effect is discussed, taking into account the mass loss of meteoroids caused by impact erosion. This effect, together with the consequent diffraction of light on the particle, can substantially change the radiation-pressure efficiency in the micron and submicron size ranges of particles. A correction function, involving the two phenomena, is derived and applied to the classical Poynting-Robertson equations. It is shown that the impact erosion has very strong effects on the dynamics and lifetimes of microparticles. In the motion of dust particles it is possible to distinguish five phases with different regimes of their motion. (24 refs.)

104799 Can solar wind induce the luminescence emission in zodiacal grains?. J.Svatos (Dept. of Astron. & Astrophys., Charles Univ., Praha, Czechoslovakia).
Bull. Astron. Inst. Czech. (Czechoslovakia), vol.34, no.3, p.191-2 (June 1983).
Colourization effects in zodiacal grains due to solar high-speed streams are discussed. It is argued that the occurrence of luminescence emission in interplanetary grains is very improbable. (13 refs.)

104800 Mass loss rate of the zodiacal dust cloud. T.Mukai (Kanazawa Inst. of Technol., Ishikawa, Japan).
Moon & Planets (Netherlands), vol.28, no.3, p.305-9 (June 1983).
The mass loss rate of the zodiacal dust cloud near the Sun has been estimated on the basis of the orbital behaviour of circumsolar dust grains suffering sublimation. It is found that the solar dust ring located at 4 solar radii from the Sun, which consists of grains whose inward spiraling due to the Poynting-Robertson effect is stopped by the influence of sublimation, loses its mass at a rate of 3.5 to 0.35 tons per second. (15 refs.)

96.50G Comets

104801 Comet Swift-Tuttle and the Perseids. J.Rao.
Astronomy (USA), vol.11, no.8, p.16-22 (Aug. 1983).
Describes the independent discoveries of Comet 1862b, later designated Periodic Comet Swift-Tuttle (1862 III), and its visual appearance. The comet's connection with the Perseid meteor shower is reviewed and the likelihood of recovering the comet at its next apparition is considered. (no refs.)

104802 Classification of cometary orbits based on the concept of orbital mean temperature. J.Klinger (Lab. de Glaciologie et de Geophys. de l'Environnement, CNRS, St. Martin d'Heres, France).
Icarus (USA), vol.55, no.1, p.169-76 (July 1983).
The orbital mean temperature for periodic cometary orbits has been calculated as a function of eccentricity e for $0 \leq e \leq 0.97$, the semimajor axis a for $1 \leq a \leq 100$ AU, and for an albedo $A=0$. If water ice is the major constituent of comets, d'Arrest, Encke, Oterma, Schwassmann-Wachmann 2, and Tempel 2 contain crystalline ice. In the past, they must have experienced a short period of high activity due to the phase transition from amorphous to cubic ice. The actual low activity of those comets is not necessarily due to depletion of volatiles. The present statements are also valid for albedos $A \leq 0.3$. The results are generalized to other periodic orbits. (16 refs.)

104803 Periodic Comet Wolf (1983m). J.Gibson.
I.A.U. Circ. (USA), no.3850, 1 pp. (12 Aug. 1983).
It is reported that Periodic Comet Wolf has been recovered as a 20th-magnitude object in Ophiuchus. Two precise positions are reported for 1983 August 1 and 3. (2 refs.)

104804 Periodic Comet Crommelin (1983n). S.Wyckoff, P.A.Wehinger, L.Kohoutek, B.G.Marsden.
I.A.U. Circ. (USA), no.3851, 1 pp. (17 Aug. 1983).
It is reported that this comet has been recovered as a 20th-magnitude object in Vulpecula. Three semi-accurate positions and one precise position are reported, covering the period 1983 August 9 to 13. In addition an ephemeris is given for the period 1983 July 25 to December 12, at ten-day intervals. (2 refs.)

104805 Comet Cernis (1983l). S.Furuyama, Yu.V.Batrakov, B.G.Marsden, J.Bortle.
I.A.U. Circ. (USA), no.3852, 1 pp. (17 Aug. 1983).
Precise positions are reported for the period 1983 August 5 to 10. Parabolic orbital elements are given. Finally total visual magnitude estimates and coma diameters are reported for the period 1983 August 3 to 16. (1 ref.)

104806 Periodic Comet IRAS (1983j). J.Bortle.
I.A.U. Circ. (USA), no.3854, 1 pp. (22 Aug. 1983).
Total visual magnitude estimates are reported for 1983 August 15 and 16. (no refs.)

104807 Comet Cernis (1983l). T.Seki, A.C.Gilmore, B.G.Marsden.
I.A.U. Circ. (USA), no.3848, 1 pp. (5 Aug. 1983).
Three precise positions are reported, for 1983 July 25 and 26. Improved parabolic orbital elements are given, together with an ephemeris for the period 1983 August 4 to September 23, at ten-day intervals. (no refs.)

104808 Periodic Comet Russell 3 (1983i). B.G.Marsden.
I.A.U. Circ. (USA), no.3849, 1 pp. (5 Aug. 1983).
An ephemeris is presented for the period 1983 August 4 to November 22, at ten-day intervals. (1 ref.)

104809 Periodic Comet Tempel 2 (1982d). C.S.Morris, J.Bortle, D.Machholz.
I.A.U. Circ. (USA), no.3849, 1 pp. (5 Aug. 1983).
Total visual magnitude estimates are reported for the period 1983 July 10 to 22. (no refs.)

104810 1983d: May's surprise comet. B.G.Marsden, D.W.E.Green (Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA).
Sky & Telesc. (USA), vol.66, no.1, p.26-9 (July 1983).
The authors describe the discovery of Comet IRAS-Araki-Alcock (1983d) and observations during its close approach during May 1983. This comet passed 0.03 a.u. from the Earth on May 11th and reached an apparent visual magnitude of 1.5. The comet was observed by optical telescopes and by the IUE satellite, and radar echoes were obtained on May 11th by the Arecibo radio telescope. (no refs.)

Proceedings of the Topical Meeting of the COSPAR Interdisciplinary Scientific Commission B and Symposium 6 of the COSPAR Twenty-Fourth Plenary Meeting ....See Entry 98616

Minor Planet Circulars ....See Entry 104775

Minor Planet Circulars 7875-7980 ....See Entry 104776

Minor Planet Circulars 7981-8024 ....See Entry 104777

Genetic relationship between the Taurid meteor swarm and Comet Encke-Baklund ....See Entry 104814

Large-scale explosion in the inhomogeneous atmosphere of the Earth with allowance for spectral radiation ....See Entry 104817

96.50K Meteors, showers and meteoroids

104811 Photographic data on the Traunstein fireball (EN 290181, Jan. 29, 1981) and suspected meteorite fall. Z.Ceplecha, J.Bocek, M.Novakova (Astron. Inst., Czechoslovak Acad. of Sci., Ondrejov, Czechoslovakia), G.Polnitzky.
Bull. Astron. Inst. Czech. (Czechoslovakia), vol.34, no.3, p.162-7 (June 1983).
Geometric, dynamic, photometric and orbital data on the Traunstein Fireball photographed at two Czech stations of the European Network are given. A multiple meteorite fall of 3 to 4 bodies of comparable mass close to 1 kg is predicted, the mass of the biggest fragment is determined at 1.0 ± 0.2 kg and its impact point and area are computed. Indirect data on fragmentation of the type-II-fireball body are presented and a carbonaceous chondrite fall proposed. The meteorite search activities are briefly described. (6 refs.)

104812 A study of the disintegration of meteoric particles moving in the atmospheres of the Earth, Mars, and Venus. E.Z.Apshtein, N.N.Pilyugin, N.V.Vartanyan.
Cosmic Res. (USA), vol.20, no.5, p.519-24 (Sept.-Oct. 1982). Translation of: *Kosm. Issled. (USSR)*, vol.20, no.5, p.730-5 (Sept.-Oct. 1982). [received: June 1983]
The problem of the motion of a meteoric particle is studied, taking into account its nonstationary heating and its change of shape form evaporation in the rarefied layers of the atmospheres of Earth, Venus, and Mars. Numerical calculations are made for a series of stony particles. The removal of mass

from the particles, their temperatures and intensity of radiation, and a meteoric trail's electron concentration at successive moments of time during the motion along the trajectory are determined. For the atmosphere of the Earth the authors compare the results with the known approximate solutions of the physical theory of meteors and the results of observations. Distinctive features are pointed out in the disintegration of meteoric particles in the different atmospheres. The authors propose methods for determining atmospheric parameters from observations of the motion of meteoric particles. (22 refs.)

104813 Physical parameters of meteoroids undergoing quasicontinuous crushing in the atmosphere. II. Interpretation of the parameters. V.V.Kalenichenko (Astron. Obs., Kiev Univ., Kiev, Ukrainian SSR).
Sol. Syst. Res. (USA), vol.16, no.4, p.171-7 (Oct.-Dec. 1982). Translation of: *Astron. Vestn. (USSR)*, vol.16, no.4, p.216-22 (Oct.-Dec. 1982).
For pt.I see Astron. Vestn., vol.16, no.2, p.116-23 or Sol. Syst. Res., vol.16, no.2, p.86-93 (1982). Discusses the values of the physical parameters of meteoroids obtained by analyzing the observed light curves of meteoroids. A model of quasicontinuous fragmentation of the surface layer of the meteoroid is used which includes the effects of variable heat transfer. About half of the meteoroid experiences only a single evaporation. About half of the meteoroids investigated were destroyed in the atmosphere while still in the solid phase. The rest were destroyed by ablation from a liquid phase. Nothing distinctive is found about the bodies which give rise to bright photographic meteors. (35 refs.)

104814 Genetic relationship between the Taurid meteor swarm and Comet Encke-Baklund. L.A.Katasev, N.V.Kulikova (Moscow Engng.-Phys. Inst., Moscow, USSR).
Sol. Syst. Res. (USA), vol.16, no.4, p.177-84 (Oct.-Dec. 1982). Translation of: *Astron. Vestn. (USSR)*, vol.16, no.4, p.223-30 (Oct.-Dec. 1982).
Discusses a mechanism for forming the Taurid meteor swarm by ejection of material from the nucleus of Periodic Comet Encke. The swarm may have been formed as a result of 'normal' comet activity. It does not seem to be necessary to adopt the hypothesis that the swarm originated when the comet nucleus collided with asteroids. (8 refs.)

104815 Perseid shower in 1980. V.V.Martynenko, A.I.Grishchenyuk, A.A.Kozlov, A.S.Levina, Yu.V.Lyzhin (All-Union Astron. & Geodetic Society, USSR).
Sol. Syst. Res. (USA), vol.16, no.4, p.191-8 (Oct.-Dec. 1982). Translation of: *Astron. Vestn. (USSR)*, vol.16, no.4, p.238-46 (Oct.-Dec. 1982).
The results of observations of the high activity of the Perseid meteor shower in 1980 are given. The hourly rates and indices of relative activity are calculated, the brightness distribution of the Perseids is obtained, and the structure of the radiants of the stream and their displacement are investigated. (13 refs.)

Characteristic curve of meteoric spectrograms obtained by an optical diffraction transmission grating .... See Entry 100881

Comet Swift-Tuttle and the Perseids .... See Entry 104801

96.50M Meteorites, micrometeorites

104816 Cosmogenic records in Antarctic meteorites. J.N.Goswami (Phys. Res. Lab., Ahmedabad, India), K.Nishiizumi.
Earth & Planet. Sci. Lett. (Netherlands), vol.64, no.1, p.1-8 (July 1983).
Aliquot samples of twenty-nine Antarctic L and H chondrites were analyzed for their nuclear track records and ^{53}Mn activities. Track density in the analyzed samples range from 10^4 to $\sim 6\times 10^6$ cm^{-2}. An important finding is the observation of track-rich grains in a set of four L3 chondrites ALPHA 77215, 77216, 77217 and 77252 which are suspected to belong to the same fall. ^{53}Mn activity is at near saturation level in ~65% of the analyzed samples. Combined analysis of ^{53}Mn and nuclear track data makes it possible to estimate the preatmospheric sizes of some of these meteorites. (40 refs.)

104817 Large-scale explosion in the inhomogeneous atmosphere of the Earth with allowance for spectral radiation. L.V.Shurshalov.
Fluid Dyn. (USA), vol.17, no.6, p.916-22 (Nov.-Dec. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.6, p.124-30 (Nov.-Dec. 1982).
The author has continued his work on systematic calculations of a very specific explosion that simulates the explosion of the Tungusska meteorite with a simple description of the radiation emitted by the hot gas (diffusion approximation and gray-body model). For the same simulated explosion, a study is made of the importance of the spectral dependence of the absorption coefficient on the radiation frequency. This dependence is taken into account in the multigroup approximation. The results are compared with those obtained earlier using the gray-gas model. (19 refs.)

104818 I-Xe and ^{40}Ar-^{39}Ar analyses of silicate from the Eagle Station pallasite and the anomalous iron meteorite Enon. S.Niemeyer (Phys. Dept., Univ. of California, Berkeley, CA, USA).
Geochim. & Cosmochim. Acta (GB), vol.47, no.6, p.1007-12 (June 1983).
Silicate from two unusual iron-rich meteorites was analyzed by the I-Xe and ^{40}Ar-^{39}Ar techniques. Enon, an anomalous iron meteorite with chondritic silicate, shows no loss of radiogenic ^{40}Ar at low temperature, and gives a plateau age of 4.59 ± 0.03 Ga. Although the Xe data fail to define an I-Xe correlation the inferred Pu/U ratio is more than 2σ above the chondritic value. These findings suggest that presence of chondritic silicate in an iron-rich meteorite is diagnostic of an old radiometric age with little subsequent thermal disturbance. Eagle Station gives a complex ^{40}Ar-^{39}Ar age pattern which suggests a recent ($\lesssim$0.85 Ga) severe thermal disturbance. (17 refs.)

104819 Nitrogen and xenon in acid residues of iron meteorites. S.V.S.Murty, P.S.Goel (Dept. of Chem., Indian Inst. of Technol., Kanpur, India), D.V.Minh, Yu.A.Shukolyukov.
Geochim. & Cosmochim. Acta (GB), vol.47, no.6, p.1061-8 (June 1983).
Total nitrogen, measured by neutron activation analysis, is highly enriched in residues from iron meteorites obtained by dissolution of the metal in dilute H_2SO_4, relative to the bulk value. On the average, the residues, representing 3% mass, contain 22% of total N. Total Xe has been measured in several residues and its isotopic composition is similar to atmospheric Xe for mass numbers 131 to 136 but not for ^{124}Xe and ^{126}Xe which are strongly depleted in the nonmagnetic residues. It is suggested that iron meteorites have trapped in their micro-inclusions some pre-solar nebular matter which is isotopically heterogeneous. (36 refs.)

104820 The Tunguska explosion of 1908: discovery of meteoritic debris near the explosion site and at the South Pole. R.Ganapathy (Res. Lab., J.T. Baker Chem. Co., Phillipsburg, NJ, USA).
Science (USA), vol.220, no.4602, p.1158-60 (10 June 1983).
Submillimeter-sized metallic spheres extracted from soil in the Tunguska region of central Siberia contain noble metals in cosmic proportions. The trace element composition and geographical distribution of these spheres suggest that they are from the 30 June 1908 Tunguska explosion. Debris from this explosion was also discovered in a South Pole ice core; this discovery indicates that the Tunguska object exploded in the atmosphere with subsequent stratospheric injection and transport of the debris. The celestial body that exploded over Tunguska weighed more than 7 million tons, was more than 0.16 kilometer in diameter, and may well have been a stony meteorite. (17 refs.)

104821 Interstellar matter in meteorites. R.S.Lewis, E.Anders (Univ. of Chicago, Chicago, IL, USA).
Sci. Am. (USA), vol.249, no.2, p.54-66 (Aug. 1983).
Carbonaceous chondrites, the most primitive meteorites, are shown to incorporate material originating from outside the Solar System, including matter expelled by supernova and other stars. (no refs.)

104822 Secondary minerals and structurs of iron fragments of the Kaali meteorite. I.A.Yudin, V.N.Loginov, V.G.Gmyra, V.I.Koval', N.F.Obotnin (S.M. Kirov Ural Polytech. Inst., Acad. of Sci., USSR).
Sol. Syst. Res. (USA), vol.16, no.4, p.185-90 (Oct.-Dec. 1982). Translation of: *Astron. Vestn. (USSR)*, vol.16, no.4, p.231-7 (Oct.-Dec. 1982).
A study of 226 iron fragments of the Kaali meteorite, which were collected near craters 2-8 and 5 (which have diameters of 40-20 and 13 m, respectively), has been carried out. Using mineralogical analyses, plastic deformation structures have been found to exist in kamacite and schriebersite as well as olivine grains in kamacite. Taenite globules 1-5 μm in size, formed as a result of melting during crater formation, were observed in the samples. A large number of taenite lamellae and separate schriebersite and olivine inclusions was found. This allows the small sizes of the metallic fragments and the anomalous content of crusts and plates in the finely dispersed material to be explained. (18 refs.)

Proceedings of the Topical Meeting of the COSPAR Interdisciplinary Scientific Commission B and Symposium 6 of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 98616

A search for superheavy nuclei tracks in extraterrestrial olivine crystals .... See Entry 104694

Discovery of s-process Nd in Allende residue .... See Entry 104724

Photographic data on the Traunstein fireball (EN 290181, Jan. 29, 1981) and suspected meteorite fall .... See Entry 104811

96.60 SOLAR PHYSICS

104823 Small scale solar magnetic fields and their relation to various solar activity indices. B.P.Tritakis (Res. Center for Astron. & Appl. Math., Acad. of Athens, Athens, Greece).
Astrophys. & Space Sci. (Netherlands), vol.93, no.1, p.141-7 (June 1983).
Correlates various solar activity indices with a long time series of annual sums of the maximum value of solar magnetic field intensity for groups of sunspots. Faculae have a significant contribution to the small scale solar magnetic fields. The area index of the solar activity is related to the maximum values of the solar magnetic field. Photospheric indices of the solar activity could be useful in long-term studies of the solar magnetic field. (13 refs.)

104824 The problem of field geometry in sunspots. V.Bumba, J.Suda (Astron. Inst., Czechoslovak Acad. of Sci., Ondrejov, Czechoslovakia).
Bull. Astron. Inst. Czech. (Czechoslovakia), vol.34, no.3, p.155-61 (June 1983).
Compares the results of older spectroscopic magnetic field and velocity field observations in regular sunspots with the results obtained from white-light and monochromatic photographs of sunspots in the form of three schemes of magnetic field lines of force, velocity vectors and fine structure fibril distribution. The authors obtain the difference between the umbral and penumbral field topology and physical conditions, as well as the uncertainty of the position of bright penumbral fibrils in relation to the magnetic field and radial motion distribution. The possible conclusions of the comparison are briefly discussed. (25 refs.)

104825 RATAN 600 observations on the radio characteristics of the quiet Sun in the range 2-4 cm. V.N.Borovik.
Bull. Spec. Astrophys. Obs.-North Caucasus (USA), vol.13, p.13-23 (1981). Translation of: *Astrofiz. Issled.-Izv. Spets. Astrofiz. Obs. (USSR)*, vol.13, p.17-29 (1981).
Methods and results are presented from studies of the quiet Sun at five wavelengths in the range 2-4 cm performed with the RATAN 600. It is found that the brightness is uniformly distributed over the disk out to 0.95 $R_\odot$. The limb brightening at 4.0 cm is about 10%, but this decreases at shorter wavelengths. The brightness-temperature spectrum at the center of the disk is determined. The brightness temperature falls to half at distances of $1.024R_\odot$ (2.0 cm), $1.029R_\odot$ (2.3 cm), $1.032R_\odot$ (2.7 cm), $1.035R_\odot$ (3.2 cm), $1.052R_\odot$ (4.0 cm) and constitutes correspondingly 400, 550, 700, 1100, and 1500K at a distance of $1.1R_\odot$ from the center. These characteristics indicate a substantially inhomogeneous structure in the transitional layer and the inner corona. (29 refs.)

104826 Magnetic-flux transport by a convecting layer—topological, geometrical and compressible phenomena. W.Arter (Dept. of Appl. Maths. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
J. Fluid Mech. (GB), vol.132, p.25-48 (July 1983).
Numerical calculations by Drobyshevski and Yuferev (1974) of the redistribution of magnetic flux by a Benard layer with cells of square planform have been extended to higher values of electrical conductivity and to other velocity patterns, using a computer code developed for another purpose. Reconnection does not proceed as they supposed, but leads to overall field enhancement, and although the energy is greater at the bottom, there is as much unsigned flux in the upper half as in the lower half of the layer. However, compressible velocity patterns can concentrate flux at their bases. (34 refs.)

104827 Interaction of solar neutrinos with the cosmic background. L.M.Slad' (M.V. Lomonosov State Univ., Moscow, USSR).
JETP Lett. (USA), vol.37, no.2, p.142-5 (20 Jan. 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.2, p.115-18 (20 Jan. 1983).
Annihilation of solar neutrinos by cosmic-background electron anitneutrinos into pairs of axial photons and Compton scattering of cosmic-background axial photons by solar neutrinos can appreciably attenuate the flux of solar neutrinos at the Earth's surface. Starting from the experimental results for ^{37}Cl, predictions are given for the forthcoming experiments for ^{71}Ga and ^{115}In. (11 refs.)

104828 Magnetic flux tubes on the Sun. H.C.Spruit, B.Roberts (Dept. of Appl. Math., Univ. of St. Andrews, St. Andrews, Fife, Scotland).
Nature (GB), vol.304, no.5925, p.401-6 (4 Aug. 1983).
Magnetic fields are the cause of almost all forms of solar activity. Near the solar surface, and possibly in the entire convection zone, these fields occur in

the form of isolated flux tubes. In recent years, new views have been developed (and older ones revived) in which this property plays a central role. These ideas are reviewed dealing with the nature of the solar cycle, sunspot structure, the origin of spicules and the source of mechanical heating in the solar atmosphere. The ideas are illustrated with the aid of a simple mathematical model for the behaviour of thin magnetic flux tubes. The properties of inhomogeneities in the corona (coronal loops) are also discussed. (103 refs.)

104829 Quiet Sun brightness temperature in the millimeter-wavelength range. S.A.Pelyushenko (Radiophys. Sci.-Res. Inst., USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.9, p.698-702 (Sept. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.9, p.977-82 (Sept. 1982).
Solar brightness temperature measurements available in the literature are recalibrated by comparison with lunar radio radiation, and the radio spectrum of the quiet Sun over the wavelength range 1-20 mm is obtained, with data scattering no greater than ±(3-4)%. (13 refs.)

104830 An estimation of the fluctuations in the extreme limb of the Sun. B.W.Lites (Sacramento Peak Nat. Obs., Sunspot, NM, USA).
Sol. Phys. (Netherlands), vol.85, no.2, p.193-214 (June 1983).
Detailed computations of synthetic solar limb curves are carried out for the purpose of estimating the effects of inhomogeneities in the solar atmosphere upon the observed limb position. Methods of determining the limb position given a solar limb curve are compared. (25 refs.)

104831 Poleward migration of the magnetic neutral line and the reversal of the polar fields on the Sun. I. Period 1945-1981. V.I.Makarov, M.P.Fatianov (Kislovodsk Station of Pulkovo Obs., Kislovodsk, USSR), K.R.Sivaraman.
Sol. Phys. (Netherlands), vol.85, no.2, p.215-26 (June 1983).
Poleward migration of the magnetic neutral line on the Sun has been calculated for the periods 1945-1950 and 1955-1981 using synoptic charts based on Hα observations. Epochs of sign reversal of the solar magnetic field at latitudes 50° to 90° have been determined. During the cycles 19 and 20 a threefold sign reversal took place in the northern hemisphere. (14 refs.)

104832 Poleward migration of the magnetic neutral line and the reversal of the polar fields on the Sun. II. Period 1904-1940. V.I.Makarov (Kislovodsk Station of Pulkovo Obs., Kislovodsk, USSR), K.R.Sivaraman.
Sol. Phys. (Netherlands), vol.85, no.2, p.227-33 (June 1983).
For pt.I see ibid., vol.85, no.2, p.215-26 (1983). Poleward migration of the magnetic neutral line on the Sun has been computed for the period 1904-1940 using synoptic charts based on Hα observations and the epochs of sign reversal of the solar magnetic field at latitudes 50° to 90° have been determined for this period. During the cycles 16 and 14, a threefold sign reversal took place in the northern and southern hemispheres, respectively. (1 ref.)

104833 Broad-band, high-resolution photograph of the solar corona February 16, 1980. K.K.Scaria (Indian Inst. of Astrophys., Bangalore, India).
Sol. Phys. (Netherlands), vol.85, no.2, p.235-6 (June 1983).
Unsharp masking may be used for better reproduction of over-exposed solar corona photographs. (2 refs.)

104834 Network to cell contrast at microwaves. F.C.Drago (Istituto di Astron., Univ. di Firenze, Firenze, Italy), M.R.Kundu, E.J.Schmahl.
Sol. Phys. (Netherlands), vol.85, no.2, p.237-42 (June 1983).
Using different models deduced from EUV lines for the cell and for various network components, the corresponding radio brightness temperature in the millimetric and centimetric range of wavelengths is computed. The contrast $C=[T_b(\text{network})]/[T_b(\text{cell})]$ and the difference $\Delta T=T_b(\text{network})\text{-}T_b(\text{cell})$ are compared with the few available observations of the quiet Sun inhomogeneities performed with sufficient angular resolution. The comparison shows a satisfactory agreement with most of the observations. (10 refs.)

104835 Type I noise storms and the structure of the extreme ultraviolet corona. G.E.Brueckner (E.O. Hulburt Center for Space Res., Naval Res. Lab., Washington, DC, USA).
Sol. Phys. (Netherlands), vol.85, no.2, p.243-65 (June 1983).
The spatial fine structure of the solar corona as observed in the EUV line Fe XV is compared with the occurrence of major type I metric noise storms. In all cases, strong changes in the loop structure of the corona are observed. On the disk, these coronal changes are correlated to the emergence of new magnetic flux in the vicinity of existing large active regions. The reverse is demonstrated: during noise storm free periods no coronal changes can be observed. In all cases, reconnection of coronal magnetic fields over large distances is the cause of noise storms rather than changes of magnetic fields within an active region. (7 refs.)

104836 X-ray and microwave observations of active regions. D.F.Webb, J.M.Davis (American Sci. & Engng. Inc., Cambridge, MA, USA), M.R.Kundu, T.Velusamy.
Sol. Phys. (Netherlands), vol.85, no.2, p.267-83 (June 1983).
The authors compare coordinated, high spatial resolution (2-3 arc sec) observations at 6 cm and in soft X-rays with photospheric magnetograms and optical filtergrams of two active regions. The correspondence of the brightest centimetric components in these regions with coronal loops, sunspots and pores, chromospheric structures and the photospheric magnetic field was determined. The principal results are described. (24 refs.)

104837 Spectral analysis of the optical continuum in the 24 April 1981 flare. D.F.Neidig (Air Force Geophys. Lab., Sacramento Peak Obs., Sunspot, NM, USA).
Sol. Phys. (Netherlands), vol.85, no.2, p.285-302 (June 1983).
Spectrograph and multiple-band polarimeter observations of the 24 April 1981 white-light flare indicate the presence of an optical continuum with intensity increasing strongly below 4000 Å. The flare emission (lines and continuum combined) is unpolarized and, at 3600 Å, exceeds the brightness of the background solar surface by 360%. The wavelength dependence of the continuum indicates emission by both negative hydrogen (H^-) and Balmer continuum with the H^- probably originating in the upper photosphere at a height in the range 200-300 km. The observed continuum intensity, if originating at a height of 300 km, implies an energy loss rate of 10^3 erg s^{-1} cm^{-3}. (45 refs.)

104838 Direct measurements of the gradual extreme ultraviolet emission from large solar flares. D.M.Horan, R.W.Kreplin, K.P.Dere (E.O. Hulburt Center for Space Res., Naval Res. Lab., Washington, DC, USA).
Sol. Phys. (Netherlands), vol.85, no.2, p.303-12 (June 1983).
Broadband sensors aboard the Naval Research Laboratory's SOLRAD 11 satellites measured solar emission in the 0.5 to 3 Å, 1 to 8 Å, 8 to 20 Å, 100 to 500 Å, 500 to 800 Å, and 700 to 1030 Å bands. Data from sixteen large flares show that the EUV emission is dominated by gradual emission which parallels the soft X-ray emission in duration and magnitude. The data are consistent with the separation of EUV and X-ray flare emission into two distinct components. A persistent component is made up of gradual EUV and gradual soft X-ray emissions. A brief component consists of hard X-rays, impulsive soft X-rays, and impulsive EUV emission. (20 refs.)

104839 Purely coronal flare-like variations. Z.Svestka, J.Schrijver (Space Res. Lab., Astron. Inst., Utrecht, Netherlands), B.Somov, B.R.Dennis, B.E.Woodgate, E.Furst, W.Hirth, L.Klein, A.Raoult.
Sol. Phys. (Netherlands), vol.85, no.2, p.313-37 (June 1983).
A detailed study of the quasi-periodical post-flare variations on November 6, 1980 in X-rays, UV lines, microwaves, and metric waves confirms that these variations were predominantly thermal phenomena and occurred solely in the corona. The authors suggest that the variations were produced in a coronal plasmoid with closed field lines completely detached from the lower atmospheric layers. Reasons are given why such a detached plasmoid can be expected to be formed in the very late phase (some 4-5 hr after the onset) of a major two-ribbon flare. (15 refs.)

104840 Dependence of radio emission in large Hα flares 1967-1970 upon the orientation of the local solar magnetic field. E.C.Roelof, H.W.Dodson, E.R.Hedeman (Appl. Phys. Lab., Johns Hopkins Univ., Laurel, MD, USA).
Sol. Phys. (Netherlands), vol.85, no.2, p.339-49 (June 1983).
During 1967-1970,the greatness of ~90 large flares (Hα importance ≳2) was influenced by the orientation of the large-scale (~100000 km) magnetic field structure over the flare site; the meter-wave-length prompt flux maxima are, on average, an order of magnitude greater for the flares with southward oriented magnetic fields. It is concluded that, during this period, the orientation of the overlying magnetic field affects the amount of electromagnetic flare energy radiated promptly in the corona relative to that radiated in the chromosphere. (12 refs.)

104841 Magnetohydrodynamic simulation of the coronal transient associated with the solar limb flare of 1980, June 29, 18:21 UT. S.T.Wu, S.Wang (Univ. of Alabama, Huntsville, AL, USA), M.Dryer, A.I.Poland, D.G.Sime, C.J.Wolfson, L.E.Orwig, A.Maxwell.
Sol. Phys. (Netherlands), vol.85, no.2, p.351-73 (June 1983).
Soft X-ray data from the XRP experiment on SMM are used to generate the temperature and density in the flaring region of the 1980, June 29 solar flare. The temporal data, together with an assumed velocity, are used to simulate mass injection as the input pulse for the MHD model of Wu et al. (1982, 1983). The spatial and temporal coronal response is compared with the ground-based, Mark III *K*-coronameter observations of the subsequent coronal transient. The simulation produces a spatially-wide, large amplitude, temporarily-steepened MHD wave for either of the two 'canonical' magnetic topologies (closed and open), but no shock wave. (33 refs.)

Proceedings of the Workshop on 'Cosmic Magnetic Fields' in Honour of Giorgio Abetti ....See Entry 98636

Compressible, conductive, steady MHD flow in a gravitational field ....See Entry 101404

Determination of the proton spectral index from data on solar microwave bursts ....See Entry 104688

Characteristics of solar-flare proton fluxes in the auroral oval at various magnetospheric disturbance levels ....See Entry 104689

Nuclei with an extra quark, stellar burning, and the solar neutrino problem ....See Entry 104730

Magnetic fields in the cosmos ....See Entry 104732

Determination of the parameters of the interstellar wind from observations of the L_α-background at large distances from the Sun ....See Entry 104953

97.00 STARS

97.10 STELLAR CHARACTERISTICS

104842 A λ 10830 vs. X-ray correlation among late-type stars. M.A.Smith (Sacramento Peak Obs., Sunspot, NM, USA).
Astron. J. (USA), vol.88, no.7, p.1031-3 (July 1983).
Plots of fractional X-ray luminosity versus He I λ 10830 absorption show different behaviors among $F-K$ dwarfs and $G-K$ giants. There is no correlation between these chromospheric parameters for dwarfs, but a rather good one exists for giants. The author infers that coronal EUV photons are dominant in the formation of λ 10830 absorption lines in giant atmospheres and are roughly comparable with electronic collisions in forming λ 10830 in dwarfs. (20 refs.)

104843 Effects of rotation on internal structure of the stars. Z.Kopal (Dept. of Astron., Univ. of Manchester, Manchester, England).
Astrophys. & Space Sci. (Netherlands), vol.93, no.1, p.149-75 (June 1983).
Establishes the explicit form of the equations which govern the internal structure of stars rotating with constant angular velocity formulated in terms of Clairaut coordinates in which the radial coordinate is replaced by the total potential, which for equilibrium configurations remains constant over distorted level surfaces. (47 refs.)

104844 Stellar structures with constant local adiabatic index under extreme relativistic conditions. M.C.Durgapal, A.K.Pande (Dept. of Phys., Kumaun Univ., Nainital, India).
Astrophys. & Space Sci. (Netherlands), vol.93, no.2, p.247-54 (June 1983).
Stellar structures with a constant local adiabatic index Γ discussed under the extreme relativistic condition (dP/dρ=1, at the center of the configuration). The equation of state, $P\alpha\rho_r^{\Gamma}$, where ρ_r is the rest-mass density leads to the relations, (i) $\rho=AP^{1/\Gamma}\text{-}P/(\Gamma\text{-}1)$ between energy density and pressure, and (ii) $e=NP$ between internal energy density and pressure, where the constant N may be called local polytropic index. The local adiabatic index, Γ, is found to be related to the adiabatic index, γ, through a simple relation, $\Gamma=\gamma(1+P/\rho)$. (12 refs.)

104845 Intrinsic polarization and extinction features of early-type stars with emission lines due to X-ray irradiation. J.Svatos (Dept. of Astron. & Astrophys., Charles Univ., Prague, Czechoslovakia).
Astrophys. & Space Sci. (Netherlands), vol.93, no.2, p.267-9 (June 1983).
The explanation of intrinsic polarization and extinction of early-type stars with emission due to X-ray irradiation of silicate grains is given. (11 refs.)

104846 Dissipation of thick accretion disks. A.G.W.Cameron (Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA).
Astrophys. & Space Sci. (Netherlands), vol.93, no.2, p.295-303 (June 1983).
A thick accretion disk which is isentropic cannot have simple laminar flow because fluid elements follow orbits which intersect the orbits of other fluid elements, leading to turbulence in astrophysical disks which have very large Reynolds numbers. The turbulence in such disks is estimated using molecular analogies for the behavior of the fluid elements. Characteristic local disk parameters are calculated for a variety of conditions at different distances from a central star of one solar mass. Circumstances involving low midplane

optical depths or external heating which can lead to large reductions in the turbulence are discussed. (5 refs.)

104847 Very massive stars: evolution with mass loss. I. The hydrogen and helium burning phase. J.Klapp (Dept. of Astrophys., Oxford Univ., Oxford, England).
Astrophys. & Space Sci. (Netherlands), vol.93, no.2, p.313-45 (June 1983).
The evolution of mass-losing very massive stars in the 500-10000 $M_\odot$ range has been investigated for two different initial compositions. The evolutionary tracks are governed by two opposing factors which are the increase in the mean molecular weight in the convective core and the effect of mass loss. Conservative evolution of stars with mass $M \ll 10000\ M_\odot$ is similar to that of massive stars (20-100 $M_\odot$), always moving to lower effective temperatures. For low values of the standard mass loss parameter N ($50 \lesssim N \lesssim 200$) the two opposing factors are almost in balance and the star is forced to move in a series of loops. For higher mass loss rates the loops disappear. In the 10000 $M_\odot$ case no loops are observed and the tracks always move to higher effective temperatures. (47 refs.)

104848 An approximate solution to the equation $\epsilon XY(dY/dX)=X-Y(Y+1)$. R.E.Mickens (Dept. of Phys., Atlanta Univ., Atlanta, GA, USA).
Acta Phys. Pol. B (Poland), vol.B14, no.7, p.561-4 (July 1983).
Extends the calculations of a previous paper (1978) to include the boundary layer behavior of the solution to the equation $\epsilon XYY'=X-Y(Y+1)$. An iteration technique is used to calculate higher-order corrections to the solution. (7 refs.)

104849 Flux density monitoring of radio stars observable by Hipparcos at S-band and X-band. R.Estalella, J.M.Paredes (Dept. de Fisica de la Tierra y del Cosmos, Univ. de Barcelona, Barcelona, Spain), A.Rius.
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.309-12 (Aug. 1983).
Single-dish simultaneous S-band (13 cm) and X-band (3.6 cm) flux density measurements of radio stars are reported. The aim of the observational program is to monitor the variability and flux density of radio stars with an optical counterpart observable by the future astrometric satellite Hipparcos. From a list of 69 selected radio stars for astrometric purposes, 49 of them have been observed during 1982 with the 64 m antenna of the Madrid DSCC. The number of radio stars that have been detected is 15. (25 refs.)

104850 Star formation within OB subgroups: implosion by multiple sources. R.I.Klein (Lawrence Livermore Nat. Lab., Univ. of California, Berkeley, CA, USA), M.T.Sandford,II, R.W.Whitaker.
Astrophys. J. Lett. Ed. (USA), vol.271, no.2, pt.2, p.L69-73 (15 Aug. 1983).
Presents the results of new detailed two-dimensional radiation-hydrodynamical calculations of the effects of radiation-driven shock waves from two O stars on inhomogeneities embedded in molecular clouds. Inhomogeneities that are compressed in this manner by stars in the range O7-B0 survive ionization evaporation and may form new stars. Low-mass objects would not survive, and there would be a natural cutoff of low-mass and high-mass stars. The authors present a scenario for hierarchical radiation-driven implosion as a mechanism for star formation that may explain aspects of new star formation in ultracompact H II regions. (7 refs.)

104851 Stellar spectrophotometric atlas, $3130<\lambda<10800$ Å. J.E.Gunn (Princeton Univ. Obs., Princeton, NJ, USA), L.L.Stryker.
Astrophys. J. Suppl. Ser. (USA), vol.52, no.2, p.121-53 (June 1983).
A spectrophotometric catalog of 175 stars covering a complete range of spectral types and luminosity classes is presented. The Oke multichannel scanner was used to obtain the energy distributions over the wavelength region $3130<\lambda<10800$ Å. Broad-band and Stromgren colors are computed from the scanner data, and these are compared with published photoelectric observations. The catalog is available on magnetic tape. (27 refs.)

104852 Nuclear β-decays of highly ionized heavy atoms in stellar interiors. K.Takahashi, K.Yokoi (Inst. fur Kernphys., Tech. Hochschule Darmstadt, Darmstadt, Germany).
Nucl. Phys. A (Netherlands), vol.A404, no.3, p.578-98 (15 Aug. 1983).
β-transition processes of heavy nuclei in stellar interiors are re-investigated. First, the relative abundances of ions in thermal equilibrium for given temperature, density and chemical composition are determined by solving the Saha ionization equation with the simultaneous inclusion of the continuum depression evaluated from a finite-temperature Thomas-Fermi model. Next, β-transitions in the equilibrated matter are studied. The numerical results for some selected examples demonstrate the need for such an involved treatment of β-decays (and particularly of bound-state β^- decays and orbital-electron captures) of certain nuclei of astrophysical importance. (54 refs.)

104853 A model of accretion of small bodies onto a binary system. P.Artymowicz.
Postepy Astron. (Poland), vol.31, no.1, p.19-34 (Jan.-March 1983). In Polish.
A numerical model of the accretion of matter falling from an outer, flattened accretion cloud onto a binary system with given masses and geometrical parameters is presented. The accretion processes is sensitive to the mass ratio of the two components of the system and the orbital angular momentum of the infalling matter. The main result is the observation of the mass-equalizing effect of accretion: the less massive component can accrete more matter than the more massive one. (9 refs.)

Proceedings of the Workshop on 'Cosmic Magnetic Fields' in Honour of Giorgio Abetti	See Entry 98636
Frascati Workshop 1982: The First Stellar Generations	See Entry 98637
Characteristic curve of meteoric spectrograms obtained by an optical diffraction transmission grating	See Entry 100881
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^{25}Mg(α,n)^{28}Si and ^{26}Mg(α,n)^{29}Si as neutron sources in explosive neon burning	See Entry 104728
Nuclei with an extra quark, stellar burning, and the solar neutrino problem	See Entry 104730
Nonlinear interaction of magnetogravity waves with Alfven and sound waves	See Entry 104731
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A study of the magnetic star HD 215441. I	See Entry 104887
A search for lines of heavy elements in the 3170-3700 Å region for the Ap stars 21 Per, 53 Cam, and β CrB	See Entry 104888
A search for rapid variability in magnetic stars from the core of the H_γ hydrogen line	See Entry 104889
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Nova Muscae 1983	See Entry 104891
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Novalike object in Libra	See Entry 104893
GK Persei	See Entry 104894
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Quark-abnormal neutron stars	See Entry 104904
A photometric and spectroscopic study of the short-period eclipsing binary BV Eridani	See Entry 104907
Variable infrared radiation from X-ray sources 4U 0115+634 and A 0535+262	See Entry 104908
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Five years of photometry of σ Geminorum	See Entry 104910
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Extensive photometric study of RT Lacertae	See Entry 104913
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Average radii, masses and mean densities of stars—components of eclipsing systems	See Entry 104930
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NGC 6256, a galactic globular cluster .... See Entry 104935

Proper motions of Herbig-Haro objects. III. HH-7 through -11, HH-12, and HH-32 .... See Entry 104938

Cometary globules in the Gum-Vela complex .... See Entry 104939

Structure of molecular clouds. VII. Energy balance in clouds with star formation (Type IIb) .... See Entry 104941

The bright stellar content of the giant galactic H II region NGC 3603 .... See Entry 104942

The Local Group irregular galaxies LGS 3 and Pegasus .... See Entry 104958

X-ray emission associated with gamma-ray bursts .... See Entry 104977

Transient X-ray source near 4U 1543−45 .... See Entry 104980

MXB 1730−335 .... See Entry 104981

The dependence of the surface and interior characteristics of theoretical stellar models, evolved with variable G, on the age of the isochrone .... See Entry 104991

97.20 NORMAL STARS (BY CLASS): GENERAL OR INDIVIDUAL

104854 Additional *UBVRI* and *JHKL* photometry of T Tauri stars in the Taurus region. A.E.Rydgren (Dept. of Phys., Rensselaer Polytech. Inst., Troy, NY, USA), F.J.Vrba.
Astron. J. (USA), vol.88, no.7, p.1017-26 (July 1983).
The authors present nearly simultaneous *UBVRI* and *JHKL* photometry for 21 T Tauri stars in the Taurus region and three stars in northern Orion. Some nonsimultaneous *UBVRI* and *JHKL* photometry of T Tauri stars in the Taurus and NGC 2264 regions is also given. These new data reinforce the conclusion from Rydgren, Schmelz, and Vrba (1982) that the T Tauri loci in the $(J-H,\ H-K)$ and $(H-K,\ K-L)$ diagrams are relatively narrow, implying a limited range in maximum temperature for the associated circumstellar dust. From an analysis of the available data for five actively variable T Tauri stars the authors find that (1) the slopes $d(B-V)/dV$ and $d(V-I)/dV$ differ significantly between stars, (2) the $J-H$, $H-K$, and $K-L$ colors tend to become larger when the star is fainter at V, and (3) the amplitude of variations at L is much smaller than the amplitude at V. The resulting constraints on models for T Tauri variability are considered. (35 refs.)

104855 New spectral types for white dwarfs previously thought to be of class DC. G.Wegner (Dept. of Phys. & Astron., Dartmouth Coll., Hanover, NH, USA).
Astron. J. (USA), vol.88, no.7, p.1034-7 (July 1983).
The visual spectra of 18 white dwarfs previously given spectral type DC have been reexamined using the image intensified dissector scanner on the Kitt Peak 2.1-m telescope. With this new high signal-to-noise data, only eight stars remain classified DC, while two are cool narrow lined DA, three appear as cool DB, two show evidence of the Swan bands of the C_2 molecule, and one may have an unidentified feature near λ 5000. The remaining object is of a new variety, hitherto unreported, that has its spectrum dominated by C I lines. (30 refs.)

104856 Astrometry of the low-luminosity stars VB8 and VB10. R.S.Harrington, V.V.Kallarakal (US Naval Obs., Washington, DC, USA), C.C.Dahn.
Astron. J. (USA), vol.88, no.7, p.1038-9 (July 1983).
The very low luminosity stars VB8 and VB10 have absolute parallaxes of $0.154'' \pm 0.006''$ and $0.174'' \pm 0.005''$, respectively, and they each apparently have an unseen companion, either or both of which could have masses of a few milli-Suns. (6 refs.)

104857 The loss of magnetic flux from pre-main sequence stars. D.Moss (Math. Dept., Manchester Univ., Manchester, England).
Astrophys. & Space Sci. (Netherlands), vol.93, no.1, p.213-16 (June 1983).
In response to a paper by Piddington (1982), a mechanism of magnetic flux loss from largely convective stellar models is explicitly demonstrated. (9 refs.)

104858 Nineteen new spectroscopic binaries and the rate of binary stars among F-M supergiants. G.Burki, M.Mayor (Obs. de Geneve, Sauverny, Switzerland).
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.256-66 (Aug. 1983).
Radial velocity measurements obtained with the spectrophotometer CORAVEL on 181 northern F-M supergiants are analyzed. Nineteen new spectroscopic binaries are discovered. Orbital elements are derived for 6 of them. A partial radial velocity curve is given for the 13 others, as also for 3 already suspected or known SB. In addition, 16 other supergiants are suspected to be SB. The rate of SB among northern F-M supergiants is discussed. The study of the binary F-M supergiants with known orbital elements shows that all the systems with a period smaller than a critical value, P_{circ}, have a nearly circular orbit. The value of P_{circ} depends on the luminosity class. This circularization of the orbits results probably from the transfer of angular momentum during the phase of binary mass exchange. (44 refs.)

104859 RGU photometry and Population II stars. F.Thevenin (LAM, Obs. de Meudon, Meudon, France), A.Spaenhauer, R.Foy.
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.331-3 (Aug. 1983).
Preliminary results on the calibration of the RGU photometric system in terms of atmospheric physical parameters are presented. Six stars with $\delta(U-G)$ excess are studied in three different fields: SA54, SA57, and M35. They are found metal deficient, in the range $-0.6 \leq [M/H]_{\odot}{}^{*} \leq -2.5$. These results are consistent with the calibration of the RGU photometry based on synthetic spectra. (22 refs.)

104860 Nickel overabundances in extremely metal-deficient red giants. R.E.Luck, H.E.Bond (Dept. of Phys. & Astron., Louisiana State Univ., Baton Rouge, LA, USA).
Astrophys. J. Lett. Ed. (USA), vol.271, no.2, pt.2, p.L75-8 (15 Aug. 1983).
The authors have carried out local thermodynamic equilibrium model-atmosphere abundance analyses of 37 metal-poor ($-3.0<[\mathrm{Fe/H}]<-0.6$) field red-giant stars on the basis of high-dispersion echelle spectrograms. Nickel has been found to be overabundant in all stars with $[\mathrm{Fe/H}]<-1.8$; for the most metal-deficient star in the sample, $[\mathrm{Ni/Fe}]=+0.8$. The elements in extreme Population II stars were probably synthesized in very massive Type II supernovae. Therefore, these results imply that such supernovae eject material with a much higher Ni/Fe ratio than do the less massive and more typical supernovae that made the elements in the solar system and young stars. (20 refs.)

104861 The discovery of a hot stellar wind. R.L.White (Space Telescope Sci. Inst., Baltimore, MD, USA), R.H.Becker.
Astrophys. J. Lett. Ed. (USA), vol.272, no.1, pt.2, p.L19-23 (1 Sept. 1983).
High-resolution 6 cm observations of two early-type stars have been made with the very large array. Cyg OB2 No.12 appears to have a normal wind with a temperature of about 5000K; Cyg OB2 No.9 has unusual and unexpected radio properties which imply that its radio-emitting circumstellar gas is hotter than 300000K. (17 refs.)

Discovery of s-process Nd in Allende residue .... See Entry 104724

Nonlinear interaction of magnetogravity waves with Alfven and sound waves .... See Entry 104731

A catalog of spectral classification and photometry of barium stars .... See Entry 104748

Occultation of 14 Piscium by (51) Nemausa on 1983 Sept. 11 .... See Entry 104771

A λ 10830 vs. X-ray correlation among late-type stars .... See Entry 104842

Stellar spectrophotometric atlas, 3130<λ<10800 Å .... See Entry 104851

The metal abundances of RR lyrae stars in the globular clusters NGC 3201, NGC 4590, and NGC 6171 .... See Entry 104862

VLA observations of MWC 349 at 15 and 23 GHz .... See Entry 104864

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The photometric period of 39 AY Ceti .... See Entry 104909

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Cygnus X-1: optical variation on the 294 day X-ray period ... See Entry 104916

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A physical study of the Ursa Major cluster (with special attention to peculiar A stars) .... See Entry 104934

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Radio observations of compact H II regions .... See Entry 104937

Proper motions of Herbig-Haro objects. III. HH-7 through -11, HH-12, and HH-32 .... See Entry 104938

The Local Group irregular galaxies LGS 3 and Pegasus .... See Entry 104958

97.30 VARIABLE AND PECULIAR STARS

(inc. novae)

104862 The metal abundances of RR lyrae stars in the globular clusters NGC 3201, NGC 4590, and NGC 6171. H.A.Smith (Dept. of Phys. & Astron., Michigan State Univ., East Lansing, MI, USA), A.Manduca.
Astron. J. (USA), vol.88, no.7, p.982-4 (July 1983).
The ΔS metal abundance index has been measured for RR Lyrae stars in the globular clusters NGC 3201, NGC 4590, and NGC 6171. The abundance of NGC 3201 was found to be $[\mathrm{Fe/H}]=-1.33 \pm 0.15$ on Butler's scale, with no evidence of star-to-star variation among nine stars studied. The results for NGC 4590 and NGC 6171 (two stars each) were $[\mathrm{Fe/H}]=-1.96$ and -0.84, respectively. The result for NGC 6171 is in good agreement with previous ΔS determinations. (21 refs.)

104863 Intermediate band and (*R,I*) observations of long-period Cepheids. O.J.Eggen (Cerro Tololo Inter-American Obs., La Serena, Chile).
Astron. J. (USA), vol.88, no.7, p.998-1013 (July 1983).
Intermediate band and (R,I) observations of most of the known southern long-period Cepheids, brighter than about visual magnitude 10 at maximum, and a few northern variables, are presented. (8 refs.)

104864 VLA observations of MWC 349 at 15 and 23 GHz. J.W.Dreher (Dept. of Phys., MIT, Cambridge, MA, USA), W.J.Welch.
Astron. J. (USA), vol.88, no.7, p.1014-16 (July 1983).
The dense stellar wind surrounding the peculiar star MWC 349 was mapped with a resolution of $\sim 0.4'' \times 0.1''$. The r^{-2} density profile suggested by Olnon (1975) fits the maps very well. The fluxes when combined with previously published data indicate a good fit to the spectrum by a power law with $\alpha=+0.65$. If the distance to MWC 349 is 2.1 kpc, then the mass loss rate is $3 \times 10^{-5}\ M_{\odot}\ \mathrm{yr}^{-1}$. (17 refs.)

104865 Light variations of Be stars. I. R.Hirata.
Astron. Her. (Japan), vol.76, no.4, p.100-3 (1983). In Japanese.
Describes B-type emission line stars, photometric variability as revealed by UBV studies, colour-magnitude diagram techniques of analysing Be subgroups, and polarisation phenomena. (no refs.) *M.J.C.*

104866 Stellar activity and the period gap in cataclysmic variables. H.C.Spruit, H.Ritter (Max-Planck-Inst. fur Phys. und Astrophys., Inst. fur Astrophys., Garching, Munchen, Germany).
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.267-72 (Aug. 1983).
The possibility is investigated that the period gap in cataclysmic variables is related to the sudden decrease in magnetic activity observed in main sequence stars at $B\text{-}V \approx 1.65$. To this end the authors calculate the evolution of a cataclysmic binary under the assumption that the angular momentum loss is due primarily to a magnetic wind from the secondary. It is found that a decrease in the angular momentum loss rate, at the point where the secondary becomes fully convective, can switch off the mass transfer temporarily. A period gap of the right width and location is obtained if certain conditions are met. (31 refs.)

104867 Can shell phases of Be stars be predicted on the basis of rapid spectroscopic micro-variability?. D.Baade (European Southern Obs., Garching Munchen, Germany).
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.283-6 (Aug. 1983).
High resolution high signal-to-noise observations show significant spectroscopic variations of ηCen on a timescale of hours. The observing frequency is not sufficient to decide if the variations are periodic. In June 1982, ηCen was observed outside a shell phase, but at the bottom of Hβ a very faint, rapidly variable emission feature was detected. This is reminiscent of Doazan's (1975) observations of o And during its intershell phase of 1973, shortly before new shell lines became visible. The observations of ηCen are interpreted as further evidence that rapid variability is the variability of the central star. It is speculated that the rapid variability of the faint central emission line is directly related to the ejection of matter into a circumstellar envelope. (32 refs.)

104868 BD Pavonis: a unique cataclysmic variable. H.Barwig, R.Schoembs (Univ.-Sternwarte Munchen, Munchen, Germany).
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.287-93 (Aug. 1983).
High speed multicolour photometry and spectroscopy of BDPav are presented. The object had been classified as a nova. A rediscussion of the eruption however suggests that BDPav more likely is a dwarf nova with rare outbursts. The light curves in quiescence show a sharp eclipse feature, flickering activity, periodic WUMa like variations in *B*, *V*, *R*, and a typical U Gem hump light curve in *U*. The orbital period is 4.3^{h}, for which BDPav is unusually red (G0-G5). Light and colour variations of 0.5 and 0.1 mag, respectively occur during the cycle. The spectra mainly show Balmer emission lines with complex profiles and occasionally He-emission. Radial velocity variations up to 600 mks^{-1} are found. (11 refs.)

104869 Speckle interferometry of IRC+10216 in the fundamental vibration-rotation lines of CO. H.M.Dyck (Inst. for Astron., Univ. of Hawaii, Honolulu, HI, USA), S.Beckwith, B.Zuckerman.
Astrophys. J. Lett. Ed. (USA), vol.271, no.2, pt.2, p.L79-83 (15 Aug. 1983).
Measurements have been made of the spatial distribution of five fundamental vibration-rotation lines of ^{12}CO and ^{13}CO in the carbon star IRC+10216 by combining high angular ($1''$) and spectral (45 km s^{-1}) resolution. All five lines were spatially resolved and found to be larger in size than the stellar continuum radiation at the same wavelengths. (14 refs.)

104870 Bright, rapid, highly polarized radio spikes from the M dwarf AD Leonis. K.R.Lang (Dept. of Phys., Tufts Univ., Medford, MA, USA), J.Bookbinder, L.Golub, M.M.Davis.
Astrophys. J. Lett. Ed. (USA), vol.272, no.1, pt.2, p.L15-18 (1 Sept. 1983).
Observes a radio burst from the main-sequence (dM4.5e) star AD Leo at 1400 MHz from 0536 to 0556 UT on 1983 February 1 at the Arecibo Observatory. A rapid sequence of highly polarized spikes was observed during the gradual rise of a longer lasting event. The maximum flux density of the spikes was $S_{\max}=130$ mJy, and they had rise times $\tau \lesssim 200$ ms. The spikes were all 100% left-hand circularly polarized with an instrumental uncertainty of 5%. The rise times provide an upper limit to the linear size $L \lesssim 6 \times 10^{9}$ cm for the emitter. Provided that the source is symmetric, it has an area that is less than 0.03 of the star's surface area. In this case, the lower limit to the brightness temperature of the spikes is $T_{\mathrm{B}} \gtrsim 10^{13}$K. The high brightness temperatures and high degrees of circular polarization are explained. (17 refs.)

104871 Pulsational constraints on the mass and luminosity of R Coronae Borealis stars. H.Saio, J.C.Wheeler (Dept. of Astron., Univ. of Texas, Austin, TX, USA).
Astrophys. J. Lett. Ed. (USA), vol.272, no.1, pt.2, p.L25-8 (1 Sept. 1983).
Allowed ranges of mass and luminosity are given for two pulsating R Coronae Borealis stars, R CrB and RY Sgr. The bounds are set by new theoretical analysis of linear nonadiabatic radial pulsations, by published results for the evolution of helium stars, and by atmospheric parameters derived from spectroscopic analysis. The allowed values are $0.9 \lesssim M/M_{\odot} \lesssim 3$ and $4.2 \lesssim \log(L/L_{\odot}) \lesssim 4.7$ for R CrB and $0.8 \lesssim M/M_{\odot} \lesssim 3$ and $4.1 \lesssim \log(L/L_{\odot}) \lesssim 4.8$ for RY Sgr. (19 refs.)

104872 Photoelectric *UBV* photometry of southern and equatorial dwarf novae. N.Vogt (Univ.-Sternwarte Munchen, Munchen, Germany).
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.1, p.21-7 (July 1983).
323 *UBV* measurements of 32 dwarf novae and 2 nova-like variables ($\delta \leq +26°$) are listed. The observations were obtained between 1970 and 1979 at the European Southern Observatory, La Silla, Chile. Two supposed dwarf novae (SW Crt and V735 Sgr) probably are not cataclysmic variables. (97 refs.)

104873 Period determination of the Delta Scuti star HR 5005. J.H.Pena, R.Peniche, S.F.Gonzalez (Inst. de Astron., Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.1, p.81-4 (July 1983).
Differential photoelectric photometry of the delta Scuti star HR 5005 is presented. By means of a periodogram analysis and least square fitting to periodic functions the frequencies of pulsation 8.606 c/d and 9.208 c/d were found. These frequencies have a ratio that is not consistent with the radial mode of pulsation. (12 refs.)

104874 Determination of radii of Cepheids. II. Radial velocities and dimensions of AD Gem. M.Imbert (Obs. de Marseille, Marseille, France).
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.1, p.85-9 (July 1983).
In French.
The classical Cepheid AD Geminorum has been observed with the 'Coravel' radial velocity spectrometer. The radius was determined from 38 accurate velocities and from the UBV measurements of Mitchell et al., (1964), Takase (1969) and Szabados (1977). The radius is found to be $35.6 \pm 0.6\ R_{\odot}$, which is compatible with the most recent period-radius relations. (9 refs.)

104875 Infrared magnitudes (JHKLM) for 105 chemically peculiar A and B-stars. D.Groote (Hamburger Sternwarte, Hamburg, Germany), J.P.Kaufmann.
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.1, p.91-6 (July 1983).
For 105 Bp- and Ap-stars 410 photoelectrical measurements in 5 spectral bands (JHKLM) from 1.25 μm to 4.8 μm are presented. These measurements were collected in three observation periods. The observations, reductions and errors are discussed in detail. In addition the IR-excess is given for the brightest *M*-measurements. (6 refs.)

104876 Correlations and periodicities of equivalent widths in SS 433. A.Vittone (Capodimonte Astron. Obs., Napoli, Italy), L.Rusconi, G.Sedmak, A.Mammano, F.Ciatti.
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.1, p.109-17 (July 1983).
Spectrograms of SS 433 (=V1343 Aquilae) obtained during the years 1978-81 have been reduced from density to exposure through the ELSPEC package. In the calibrated spectra relevant parameters have been deduced for the emission lines in both the rest and moving systems. A list of equivalent widths is presented for these features, indicating a large range of erratic variability during the same night. Hα and other lines are shown to change through the precessional period of 163 days. On the other hand no definite trend is observed through the 13.08^{d} orbital period, nor through the 6.28^{d} modulation period. (21 refs.)

104877 Light variations of the Am star 32 Vir. C.Bartolini, F.Grilli, G.Parmeggiani, A.Piccioni, P.Silveri (Dipartimento di Astron., Bologna, Italy).
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.1, p.139-55 (July 1983).
Photoelectric observations of the spectroscopic binary and Am star 32 Vir which extended over a time interval of four years show that this star is pulsating with a strongly variable amplitude. Frequency analysis shows that the period $P=0.07188^{d}$ has the highest amplitude and is constant. A second, still fairly uncertain period seems to indicate a radial mode of oscillation. Between the two proposed models: primary or secondary pulsating, the first one seems to be preferable. (26 refs.)

104878 Flare stars in the region around γ Cygni. K.P.Tsvetkova (Dept. of Astron., Bulgarian Acad. of Sci., Sofia, Bulgaria), V.V.Hambarian, G.H.Brutian.
Inf. Bull. Variable Stars (Hungary), no.2365, p.1 (7 July 1983).
Two new flare stars have been discovered near γ Cygni. The authors report approximate positions and photographic magnitudes for these stars, together with the dates and the amplitudes of the observed flares. (no refs.)

104879 Light and radial velocity variations of HR 6127. J.Ziznovsky (Astron. Inst., Slovak Acad. of Sci., Prague, Czechoslovakia).
Inf. Bull. Variable Stars (Hungary), no.2366, p.1-2 (8 July 1983).
Reports photometric observations of the chemically peculiar star HR 6127 (A2p) between December 1981 and July 1982. Light variations were observed with an amplitude of 0.017 mag. and a period of 2.144202 days. Radial velocities were measured for the Ca II K line, and velocity variations were observed with P=2.144039 days and ΔV=5.6 km/s. The minimum of the radial velocity curve occurs at phase 0.1 following the minimum of the light curve. (1 ref.)

104880 Light variability of Nova Delphini 1967 in 1981 and 1982. H.-M.Steinbach, L.Kohoutek (Hamburger Sternwarte, Hamburg, Germany).
Inf. Bull. Variable Stars (Hungary), no.2367, p.1-3 (11 July 1983).
The authors report photometric observations of Nova Delphini 1967 (HR Delphini) between August and October 1981 and during July 1982. Five times of light maximum are reported. The most probable period of the light variations is 0.21231 days. The semi-amplitude of the light curve is decreasing; and the mean brightness of the star is apparently also decreasing. (5 refs.)

104881 Confirmation of the 6 minute period for 21 Com. R.Garrido (Inst. de Astrofisica de Andalucia, Granada, Spain), A.Sanchez-Lavega.
Inf. Bull. Variable Stars (Hungary), no.2368, p.1-2 (12 July 1983).
The authors report photometric observations of the Ap star 21 Comae Berenicis during April 1983. Light variations are observed with periods of about 6 minutes and 24 minutes (frequencies of 244 and 60 c/d respectively). (3 refs.)

104882 Variable star discovered near δ Sagittarii. K.A.Gloria (Maria Mitchell Obs., Nantucket, MA, USA).
Inf. Bull. Variable Stars (Hungary), no.2369, p.1 (13 July 1983).
Reports the discovery of a previously uncatalogued long period variable star at $\alpha=18^{h}14^{m}23^{s}$, $\delta=-29°54.2'$ (equinox 1900.0), southwest of δ Sagittarii. The period of light variation is 230.5 ± 0.5 days, and the epoch of maximum is JD 2433474. The photographic magnitude at maximum light is 13.8; at minimum the star is fainter than magnitude 16.0. (no refs.)

104883 BD+43°1894, a new delta Scuti star. F.Agerer, M.Fernandes, P.Frank (BAV, Berlin, Germany).
Inf. Bull. Variable Stars (Hungary), no.2370, p.1-2 (13 July 1983).
It is reported that BD+43°1894, which has been used as a comparison star for UU Lyncis, is itself a rapid small-amplitude variable star. Photoelectric and photographic observations between January and May 1983 are reported. The star varies between photovisual magnitudes 10.86 and 11.08 with a period of 0.097949 days; the light curve is almost sinusoidal and the period seems to be somewhat variable. (no refs.)

104884 Photoelectric photometry of Ap stars in IC 2602, NGC 6281 and in the Scorpio-Centaurus group: preliminary results. P.North (Inst. d'Astron., Univ. de Lausanne, Lausanne, Switzerland), C.Waelkens.
Inf. Bull. Variable Stars (Hungary), no.2372, p.1-6 (22 July 1983).
New photometric periods have been obtained for stars and for one He-weak star which are members of clusters and associations. (7 refs.)

104885 S 10807 Boo—a new RR Lyrae star. S.Rossiger (Sternwarte Sonneberg Zentralinst. fur Astrophys., Akad. der Wissenschaften, Berlin, Germany).
Inf. Bull. Variable Stars (Hungary), no.2373, p.1 (22 July 1983).
Reports photoelectric observations of the variable star S 10807 Bootis ($\alpha=14^{h}51.8^{m}$, $\delta=+15°50'$, equinox 1950.0) during 1981 and 1983. The star is found to be an RRc-type variable with P=0.281879 days and ΔV=0.6 mag. (1 ref.)

104886 Search for variability of the Sr-Cr-Eu star HD 8783. H.M.Maitzen (Inst. fur Astron., Univ. Wien, Wien, Austria), H.Schneider.
Inf. Bull. Variable Stars (Hungary), no.2374, p.1-2 (25 July 1983).
The authors report uvby photometry of the Ap star HD 8783 between November 1981 and December 1982. No light variations were found. It is pointed out that this lack of variation is rather strange, since the Δa index of this star is definitely variable, with a period of about 1 day or 20 days. It is also reported that one of the comparison stars, HD 8781 (F0 II-III), is a short period variable. (3 refs.)

104887 A study of the magnetic star HD 215441. I. Yu.V.Glagolevskii, K.I.Kozlova, R.N.Kumaigorodskaya, V.S.Lebedev, I.I.Romanyuk, N.M.Chunakova.
Bull. Spec. Astrophys. Obs.-North Caucasus (USA), vol.13, p.1-4 (1981). Translation of: *Astrofiz. Issled.-Izv. Spets. Astrofiz. Obs. (USSR)*, vol.13, p.3-7 (1981).
Four spectra are examined for the magnetic star HD 215441 as recorded with a Zeeman circular-polarization analyzer with the 6-meter telescope (dispersion 9 Å/mm) in phase 0.87. The inclination of the axis of rotation to the line of sight and the angle between the axis of rotation and the axis of the dipole are calculated. Unno's method is used in calculating the theoretical profiles. It is found that the magnetic field is closely represented by a central dipole. The measured H_γ profiles are used with the Mihales (1972) theoretical profiles to determine the effective temperature and log g. The growth curve constructed from Ti II, Fe II and Cr II lines gives T_e. The average value of T_e derived from these estimates and published data is $T_e=14600K$. (13 refs.)

104888 A search for lines of heavy elements in the 3170-3700 Å region for the Ap stars 21 Per, 53 Cam, and β CrB. Yu.V.Glagolevskii, K.I.Kozlova.
Bull. Spec. Astrophys. Obs.-North Caucasus (USA), vol.13, p.5-8 (1981). Translation of: *Astrofiz. Issled.-Izv. Spets. Astrofiz. Obs. (USSR)*, vol.13, p.8-11 (1981).
Ultraviolet spectra are examined with a dispersion of 6.7 Å/mm in the region λ 3160-3700 Å for the magnetic stars 21 Per, 53 Cam, β CrB in order to locate the lines of heavy elements with $Z>74$. Spectra were recorded with the principal stellar spectrograph on the 6-meter telescope. The faintest observable line has an equivalent width of 7-9 mÅ. The numerous lines from various elements include from one to several lines of certain elements as a rule with relatively low reliability. All the other lines coincide with those of elements usually present and cannot be distinguished reliably. (13 refs.)

104889 A search for rapid variability in magnetic stars from the core of the H_γ hydrogen line. Yu.V.Glagolevskii, I.I.Romanyuk, V.G.Shtol, V.D.Bychkov.
Bull. Spec. Astrophys. Obs.-North Caucasus (USA), vol.13, p.9-12 (1981). Translation of: *Astrofiz. Issled.-Izv. Spets. Astrofiz. Obs. (USSR)*, vol.13, p.12-16 (1981).
The Zeiss 600 telescope has been used with a UAGS spectrograph equipped with a photoelectric attachment to examine two peculiar stars (α And and 53 Cam) in a search for short-term intensity variations in the central part of the H_γ line. The width of the photometered region was 10 Å. The measurements were made relative to comparison stars and in one case (α And) relative to part of the continuum from the star itself. It is found that α And shows no intensity variation exceeding 0.6% while that for 53 Cam does not exceed 2.5%. (3 refs.)

104890 GK Persei. M.G.Watson, A.Smith.
I.A.U. Circ. (USA), no.3850, 1 pp. (12 Aug. 1983).
The authors report the discovery of a 351-second X-ray periodicity in GK Persei (Nova Persei 1901). This modulation was discovered as a result of observations by EXOSAT on 1983 August 9. In addition it is reported that the mean 2 to 10 keV flux at this time was about 7 μJy, indicating an X-ray brightening correlated with the current optical outburst. (2 refs.)

104891 Nova Muscae 1983. E.Budding.
I.A.U. Circ. (USA), no.3853, 1 pp. (17 Aug. 1983).
Reports UBV photometry for the period 1983 January 22 to February 5. Minor brightness fluctuations were noted within minutes on February 5. (no refs.)

104892 Variable star in Ara. W.Liller.
I.A.U. Circ. (USA), no.3853, 1 pp. (17 Aug. 1983).
Spectroscopic observations of the newly-discovered variable star in late July 1983 show strong TiO bands characteristic of a very cool long-period variable. (3 refs.)

104893 Novalike object in Libra. J.Maza.
I.A.U. Circ. (USA), no.3854, 1 pp. (22 Aug. 1983).
Reports the discovery on 1983 August 10 of a 9th-magnitude novalike object at $\alpha=15^h16^m58.03^s$, $\delta=-24°49'35.7''$ (equinox 1950.0). The object was fainter than $m_{pg}=18$ on 1983 July 13 and on many earlier plates. (no refs.)

104894 GK Persei. J.Mattei.
I.A.U. Circ. (USA), no.3848, 1 pp. (5 Aug. 1983).
Visual magnitude estimates are reported for the period 1983 July 21 to 25. (1 ref.)

Catalog of magnetic field measurements .... See Entry 104746

A catalog of spectral classification and photometry of barium stars .... See Entry 104748

Occultation of 14 Piscium by (51) Nemausa on 1983 Sept. 11 .... See Entry 104771

Additional *UBVRI* and *JHKL* photometry of T Tauri stars in the Taurus region .... See Entry 104854

The loss of magnetic flux from pre-main sequence stars .... See Entry 104857

The photometric period of 39 AY Ceti .... See Entry 104909

Five years of photometry of σ Geminorum .... See Entry 104910

Intrinsic polarization in β Lyrae and nova T-Pyxidis due to irradiation of silicate glassy grains .... See Entry 104911

Cygnus X-1: optical variation on the 294 day X-ray period ... See Entry 104916

YZ Cassiopeiae and the Utrecht photometric system .... See Entry 104921

Properties of young clusters near reflection nebulae .... See Entry 104932

A physical study of the Ursa Major cluster (with special attention to peculiar A stars) .... See Entry 104934

The bright stellar content of the giant galactic H II region NGC 3603 .... See Entry 104942

Search for Wolf-Rayet features in the spectra of giant H II regions. I. Observations in NGC 300, NGC 604, NGC 5457 and He 2-10 .... See Entry 104951

97.60 LATE STAGES OF STELLAR EVOLUTION
(inc. black holes)

104895 Accretion disk stories. I. Observational aspects. J.Fukue.
Astron. Her. (Japan), vol.76, no.4, p.92-5 (1983). In Japanese.
Considers thin accretion disks surrounding black hole/neutron star/white dwarf/main-sequence star combinations as well as thick accretion disks with jets. The nucleus of our Galaxy, cataclysmic binaries, and contact binary systems are also described. (no refs.) *M.J.C.*

On the collapse of neutron stars and stellar cores to pion-condensed stars .... See Entry 104903

97.60B Supernovae

104896 Supernova in NGC 5746. R.P.Kirshner.
I.A.U. Circ. (USA), no.3854, 1 pp. (22 Aug. 1983).
It is reported that spectroscopic observations on 1983 August 5 show that this object is a type I supernova which was then roughly one month past maximum. (1 ref.)

104897 Electron capture rates during collapse of the supernova core. A.Zaringhalam (Niels Bohr Inst., Copenhagen, Denmark).
Nucl. Phys. A (Netherlands), vol.A404, no.3, p.599-610 (15 Aug. 1983).
Electron capture rates in the core of a collapsing star are calculated. It is shown that allowed Gamow-Teller transitions are quickly suppressed and that the neutronization rates are dominated by first forbidden transitions. These rates are evaluated using a simple model of the nucleus. In the calculation of the total neutronization rates, the contribution of free protons is also included. Comparison shows that early investigators overestimated the rates by a factor of ~20. (11 refs.)

Nickel overabundances in extremely metal-deficient red giants .... See Entry 104860

Limits on the accuracy of determining q_0 from supernovae ... See Entry 104984

97.60G Pulsars

104898 Discovery of a 6.1-ms binary pulsar PSR 1953+29. V.Boriakoff (Nat. Astron. & Ionosphere Center, Cornell Univ., Ithaca, NY, USA), R.Buccheri, F.Fauci.
Nature (GB), vol.304, no.5925, p.417-19 (4 Aug. 1983).
A systematic search for fast radio pulsars in some of the error boxes of the γ-ray satellite COS B unidentified point sources on the 305-m Arecibo Observatory radiotelescope was started 3 years ago. One of the search areas covered was the Gg-source 2CG065+00. The discovery is reported of a 6.13317-ms pulsar in a binary system with a 120-day orbital period inside the error box of this source. The initial search observation (23 July 1980) with a sampling rate of 4.167 ms produced an aliased (76.93 Hz) detection at 430 MHz. Confirmatory observations made in March 1983, showed a variable pulse frequency indicating a Doppler shift due to a periodic orbit around another object. A compilation of measured system parameters and the underlying assumptions are given. (12 refs.)

104899 On the origin of the 6.1-ms pulsar. P.C.Joss, S.A.Rappaport (Dept. of Phys., MIT, Cambridge, MA, USA).
Nature (GB), vol.304, no.5925, p.419-21 (4 Aug. 1983).
PSR 1953+29 is in a binary system with an unseen companion: its orbital period, P_{orb}, is ~120 days, its projected semi-major axis, $a_p\sin i$, is $\sim9\times10^{11}$ cm, and its orbital eccentricity, e, is small. A model for the origin and evolution of this binary system is presented that quantitatively accounts for all of its salient features. The evolutionary scenario begins with a luminous binary X-ray source composed of a neutron star and a lower giant-branch companion and terminates when the system has evolved into its present configuration and the companion has become a low-mass degenerate dwarf. This model can explain both the large separation of the binary and the approximate circularity of the orbit despite the large separation relative to the present sizes of the component stars. (18 refs.)

104900 Evolutionary history of the 6.1-ms pulsar. B.Paczynski (Princeton Univ. Obs., Princeton, NJ, USA).
Nature (GB), vol.304, no.5925, p.421-2 (4 Aug. 1983).
The rapid rotation of the pulsar, small mass function, circular orbit, and long binary period suggest that following the formation of a neutron star there had to be a phase of mass transfer from the low-mass secondary onto the neutron star primary. That mass transfer circularized the orbit and spun up the primary, and it required the secondary to be a red giant at that time. The present binary period of 120 days implies that the secondary has a mass of $0.3M_\odot$. The observed mass function of $0.0027M_\odot$ implies that the primary must be less massive than $3.1M_\odot$, not an interesting mass limit for a neutron star. The secondary is probably a white dwarf at present. (9 refs.)

104901 Is the 6-ms binary pulsar the remnant of a bright galactic X-ray source?. G.J.Savonije (Astron. Inst., Univ. of Amsterdam, Amsterdam, Netherlands).
Nature (GB), vol.304, no.5925, p.422-3 (4 Aug. 1983).
It is argued that the recently discovered 6-ms radio pulsar with orbital period $P_b=120\neq4$ days, a sin $i=(0.92\neq0.08)\times10^{12}$ cm and $e\approx0$) is the spun up remnant of a formerly heavily accreting ($\dot{M}\approx10^{-8}M_\odot yr^{-1}$) X-ray source, belonging to a new type of low-mass X-ray binaries. This new type of X-ray binary consists of a critical lobe filling (lower) branch giant star of $\approx1M_\odot$ that spills mass to its neutron star companion. Such systems will end their lives as wide binary systems ($P_b\gtrsim100$ days), consisting of a $\approx0.3M_\odot$ helium white dwarf (the remnant core of the giant) in orbit about a rapidly spinning neutron star. (13 refs.)

104902 X-ray emission and spin-up evolution of the 6.1-ms pulsar. D.J.Helfand, M.A.Ruderman, J.Shaham (Dept. of Phys., Columbia Univ., New York, NY, USA).
Nature (GB), vol.304, no.5925, p.423-5 (4 Aug. 1983).
An upper bound to the X-ray luminosity of PSR 1953+29 of $L_x<4\times10^{32}$ erg s^{-1} is reported. The consequences of this and other observational data for theoretical models of this pulsar's formation and spindown are considered. The two fast pulsars have features in common which suggest a similar genesis (very low magnetic field and surface temperature, low galactic latitude) and it is proposed that both are members of a new class of radio pulsars. (17 refs.)

Fate of very low-mass secondaries in accreting binaries and the 1.5-ms pulsar .... See Entry 104929

97.60J Neutron stars

104903 On the collapse of neutron stars and stellar cores to pion-condensed stars. B.Kampfer (Zentralinst. fur Kernforschung Rossendorf, Dresden, Germany).
Astrophys. & Space Sci. (Netherlands), vol.93, no.1, p.185-97 (June 1983).
The transition from a neutron star to a pion-condensed star is investigated in Newtonian hydrodynamics. It is shown that in a certain range of ultradense equations of state, there occurs a mass ejection with energies comparable with usual supernova outputs. But the ejected mass is only in the order of 0.02 $M_\odot$. Additionally the collapse of a stellar core to a neutron star with pion-condensed core is considered. Further, the possible consequence of pion condensation during the secular evolution of the bounced core of a collapsing star to the cool final neutron star is discussed. (36 refs.)

104904 Quark-abnormal neutron stars. Qu Qinyue, Wang Zhenru, Zhao Jiabing (Dept. of Astron., Nanjing Univ., Nanjing, China).
Sci. Sin. (China), vol.26, no.6, p.650-6 (June 1983).
Using the equation of state given by Freedman and McLerran (1978) for quark state and that given by the authors for abnormal neutron state with abnormal protons, they have explored the models of stars with the interior in quark state and the outer layer in abnormal neutron state. They have arrived at the conclusion that there possibly exist stable quark-abnormal neutron stars. (12 refs.)

On the origin of the 6.1-ms pulsar .... See Entry 104899

Evolutionary history of the 6.1-ms pulsar .... See Entry 104900

Is the 6-ms binary pulsar the remnant of a bright galactic X-ray source? .... See Entry 104901

X-ray emission and spin-up evolution of the 6.1-ms pulsar .... See Entry 104902

Hercules X-1 and MXB 1730−335 .... See Entry 104925

Fate of very low-mass secondaries in accreting binaries and the 1.5-ms pulsar .... See Entry 104929

X-ray emission associated with gamma-ray bursts .... See Entry 104977

97.60L Black holes

104905 A charged black hole in a uniform magnetic field. K.D.Krori, S.Chaudhury, S.Dowerah (Math. Phys. Forum, Cotton Coll., Gauhati, India).
Can. J. Phys. (Canada), vol.61, no.8, p.1192-7 (Aug. 1983).
The authors present an investigation of the event horizon of a charged black hole embedded in a uniform magnetic field by studying the Gaussian curvature. It is shown that the Gauss-Bonnet theorem holds for this magnetized black hole and also for a magnetized Kerr black hole. (15 refs.)

104906 Searching for black holes. D.Crampton, J.B.Hutchings, A.P.Cowley (Dominion Astrophys. Obs., Victoria, BC, Canada).
J. R. Astron. Soc. Can. (Canada), vol.77, no.3, p.103-7 (June 1983).
Continuing observations of X-ray sources have led to the discovery of many neutron stars but few black-hole candidates. A brief account is given of the observations leading to the discovery of the massive unseen object in the LMC X-3 system. (7 refs.)

Gravitational radiation from a particle with zero orbital angular momentum plunging into a Kerr black hole .... See Entry 98888

Spontaneous symmetry breaking near a black hole .... See Entry 98912

The multiple structure of solitons in the O(2) supergravity theory .... See Entry 98925

Are black holes necessary? .... See Entry 104969

On the hypothesis of ejection of supermassive black holes from centers of galaxies and its application to quasar-galaxy associations .....See Entry 104975

The motion of test particles in black-hole backgrounds with non-zero cosmological constant .... See Entry 104990

97.80 BINARY AND MULTIPLE STARS

(inc. extrasolar planetary systems)

104907 A photometric and spectroscopic study of the short-period eclipsing binary BV Eridani. D.Baade (European Southern Obs., Garching, Germany), H.W.Duerbeck, M.T.Karimie, A.Yamasaki.
Astrophys. & Space Sci. (Netherlands), vol.93, no.1, p.69-77 (June 1983).
UBV observations of the short-period eclipsing binary BV Eri are reported and analyzed. The radial velocity curve is given. The system shows a light curve distortion, making an analysis difficult. The secondary fills its critical Roche lobe. The system seems to be in an interesting evolutionary stage. (9 refs.)

104908 Variable infrared radiation from X-ray sources 4U 0115+634 and A 0535+262. Yu.N.Gnedin, G.V.Khozov, V.M.Larionov (A.E. Ioffe Physico-Tech. Inst., Acad. of Sci., Leningrad, USSR).
Astrophys. & Space Sci. (Netherlands), vol.93, no.1, p.207-11 (June 1983).
Observations of the X-ray binaries 4U 0115+634 and A 0535+262 performed in 1981-2 revealed a significant IR variability of these sources. 4U 0115+634 was observed twice in the periods close to high and low levels of X-ray activity. A 0535+262 ($K \approx 6^m$) showed temporal variations ranging from tens of minutes to some days. The regular variations of IR brightness are suspected in the period close to 104 s, which corresponds to the period of axial rotation of a neutron star in A 0535+262. The results obtained present arguments in favour of the hypothesis that IR radiation is generated near the accreting neutron star and is possible of a maser nature. (11 refs.)

104909 The photometric period of 39 AY Ceti. J.A.Eaton, D.S.Hall, G.W.Henry (Dyer Obs., Vanderbilt Univ., Nashville, TN, USA), J.L.Hopkins, K.Krisciunas, H.J.Landis, H.Louth, E.H.Olsen, T.R.Renner, H.J.Stelzer.
Astrophys. & Space Sci. (Netherlands), vol.93, no.2, p.271-6 (June 1983).
Photoelectric photometry obtained in 1971 and 1972 is compared with that obtained in 1980-81 and 1981-82 to derive a photometric period of 77.65^d. JD 2444636.0 is an epoch of minimum light. The full amplitude has been as large as 0.18^m in *V*. Curiously, the mean light level has dropped by almost 0.2^m over the last ten years. This binary is additionally interesting because of the recently discovered white dwarf secondary component and because unpublished radial velocity measures of Fekel (1982) show a large (0.1) eccentricity and an orbital period (57.1^d) very different from the authors' photometric period. (19 refs.)

104910 Five years of photometry of σ Geminorum. R.E.Fried (Braeside Obs., Flagstaff, AZ, USA), J.A.Eaton, D.S.Hall, G.W.Henry, C.A.Vaucher, J.L.Hopkins, J.D.Sabia, K.Krisciunas, C.R.Chambliss, H.J.Landis, H.J.Louth, T.G.McFaul, D.R.Skillman, T.R.Renner.
Astrophys. & Space Sci. (Netherlands), vol.93, no.2, p.305-11 (June 1983).
Five years of photoelectric photometry of this bright K1 III RS CVn binary has been obtained at thirteen different observatories. Except for one year, the light curve has shown two minima, separated by roughly a half cycle. At the epoch of discovery (1977.2) one minimum was shallower but as of 1980.2 the two became comparable in depth. During the 1979-80 season the light curve changed shape rapidly, the shallower minimum becoming as deep as the other within about 80 days or perhaps less. Times of both minima can be fit with a photometric period of 19.423^d, which is 0.9% shorter than the 19.603^d orbital period. The overall brightness range during the five years has been $4.13^m < V < 4.29^m$. (17 refs.)

104911 Intrinsic polarization in β Lyrae and nova T-Pyxidis due to irradiation of silicate glassy grains. J.Svatos (Dept. of Astron. & Astrophys., Charles Univ., Prague, Czechoslovakia).
Astrophys. & Space Sci. (Netherlands), vol.93, no.2, p.347-9 (June 1983).
It is shown that the main mechanism governing the intrinsic polarization in the binary β Lyrae and in nova T-Pyxidis is very probably X and/or UV irradiation of silicate glass-like grains. (13 refs.)

104912 A new computer approach to the modeling of close binary stars. D.Greenspan (Dept. of Maths., Univ. of Texas, Arlington, TX, USA).
Astrophys. & Space Sci. (Netherlands), vol.93, no.2, p.351-76 (June 1983).
A new, *n*-body approach is developed for the modeling of close binary systems, the most commonly occurring star systems known. Both local and long range forces are included. Computer examples of streaming, mass loss, and self-reorganization processes are described and discussed. (19 refs.)

104913 Extensive photometric study of RT Lacertae. Z.Tunca, C.Ibanoglu, O.Tumer, A.Y.Ertan, S.Evren (Ege Univ. Obs., Bornova, Izmir, Turkey).
Astrophys. & Space Sci. (Netherlands), vol.93, no.2, p.431-45 (June 1983).
Presents observations of the peculiar eclipsing binary RT Lac, which were obtained in 1980 and 1981. Examining the light curves obtained in successive years the authors estimate the period of the migrating light curve distortion to be about four years. The orbital period of the system is also found to be decreasing with an amount 34s century^{-1}. The brightnesses both at primary and secondary are changing with the time, which is clearly seen from the last light curves. The variations which occurred at primary are three times greater than secondary eclipse. Therefore, the authors suggest that the star, in front at primary eclipse, is more responsible for the distorted light curves and it should be the earlier spectral type and also the smaller one. (11 refs.)

104914 Optical photometry of massive X-ray binaries: Cen X-3/V779 Cen. J.van Paradijs (Astron. Inst., Univ. of Amsterdam, Amsterdam, Netherlands), J.Lub, J.W.Pel, M.Pakull, S.van Amerongen.
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.294-9 (Aug. 1983).
Presents the results of photometric observations of V779 Cen, the optical counterpart of the massive X-ray binary Cen X-3. Combining these results with previously published data the authors derive an average light curve. This curve shows the customary double-wave shape, with equal maxima and unequal minima, characteristic of ellipsoidal variations of a tidally distorted, gravitationally darkened, primary star. The light curve is shifted, by $\sim$0.015 cycles, with respect to the X-ray ephemeris. Only by stretching the system parameters to their extreme limits can the amplitudes of the light curve be understood as a result of ellipsoidal variations only, and an additional source of light is probably present in this system. It is attractive to identify this light source, with an accretion disk. (45 refs.)

104915 Statistics of binary stars. I. Multivariate analysis of spectroscopic binaries. M.Fofi, C.Maceroni (Osservatorio Astron. di Monte Mario, Roma, Italy), M.Maravalle, P.Paolicchi.
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.313-21 (Aug. 1983).
By multivariate statistical analysis the authors point out correlations among physical parameters of spectroscopic binary systems. The best clustering has been outlined allowing a direct interpretation in terms of HR diagram in the maximum variance plane. Cluster analysis confirms the probable period-eccentricity relation. The existence of a well defined cluster with strongly unbalanced masses supports the hypothesis of an original bimodality in the mass ratio distribution. (38 refs.)

104916 Cygnus X-1: optical variation on the 294 day X-ray period. J.C.Kemp, M.S.Barbour, G.D.Henson, D.J.Kraus, I.G.Nolt, J.V.Radostitz (Dept. of Phys., Univ. of Oregon, Eugene, OR, USA), W.C.Priedhorsky, J.Terrell, E.N.Walker.
Astrophys. J. Lett. Ed. (USA), vol.271, no.2, pt.2, p.L65-8 (15 Aug. 1983).
The 294 day X-ray period has optical counterparts. A 10 yr *B* band photometric record shows synchronous changes of 0.01 mag amplitude, with minima coinciding with the X-ray minima. Stronger and weaker variations, respectively, are seen in *U* and *V*. The 5.6 day orbital light curves, additionally, show pronounced changes on the 294 day cycle. There is also a 294 day polarization variation. (9 refs.)

104917 Binaries as a heat source in stellar dynamics: release of binding energy. P.Hut (Inst. for Advanced Study, Princeton, NJ, USA).
Astrophys. J. Lett. Ed. (USA), vol.272, no.1, pt.2, p.L29-33 (1 Sept. 1983).
Binaries play an important role in the energy budge of dense stellar systems, absorbing energy from and injecting energy into a star cluster. Several million binary-single star scattering experiments are carried out numerically to determine quantitatively these heat exchange processes. The results presented confirm and make more specific previous analytic approximations: soft binaries become softer while hard binaries become harder. The transition between these two regimes plays the role of a watershed. For the equal mass case, the velocity of the incoming star at this watershed is found. The average amount of energy exchange is plotted as a function of ν for initial binary eccentricity $e = 0.7$ (the rms value in a thermal distribution). The results can serve as input for models of evolving star systems, in much the same way as nuclear cross sections in models of stellar evolution. (22 refs.)

104918 Mystery star [epsilon Aurigae]. D.Darling.
Astronomy (USA), vol.11, no.8, p.66-71 (Aug. 1983).
Reviews numerous models for this long-period eclipsing binary. July 1982 saw the start of its seventh minimum since the discovery of its variability. Prospects for the study of the dark eclipsing companion are considered. (no refs.)

104919 Light curves and elements of AH Virginis. P.G.Niarchos (Dept. of Astron., Univ. of Athens, Athens, Greece).
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.1, p.13-19 (July 1983).
The W UMa-type system AH Virginis has been observed in two wavelengths (*V* and *B*) during the years 1977-78. The light curves of the system are analysed using frequency domain techniques and new geometric and photometric elements are given. (21 refs.)

104920 Spectroscopic orbit of the star HR 96. D.P.Hube (Dept. of Phys., Univ. of Alberta, Edmonton, Alberta, Canada).
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.1, p.29-31 (July 1983).
Orbital elements are derived for the first time for the spectroscopic binary HR 96. A relatively long period (48.2905^d), large eccentricity (0.384) and large mass function ($0.107 M_\odot$) are found. No supporting evidence has been found for previously suggested spectroscopic and photometric peculiarities are variability. (7 refs.)

104921 YZ Cassiopeiae and the Utrecht photometric system. A.C.de Landtsheer (Astron. Inst., Utrecht, Netherlands).
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.1, p.161-75 (July 1983).
Four light curves of YZ Cas measured in the Utrecht photometric system are presented. Interpretation with the programs of Wood, and Wilson and Devinney proves that the physical elements are not dependent on the wavelength of observation. Limb darkening coefficients of the hot component are only

marginally determinable, while the coefficient of the cool component is not recoverable. Accounting for the metallic character of the primary the spectral types (A2 IVm+F5 V) of the components of YZ Cas would now be B9.5 IVm and F1 V. The orbital period of the system is found to be constant and is described by the updated ephemeris: Hel. $JD=2444632.2685+4.4672234$ *E*. (30 refs.)

104922 Micrometric measurements of southern double stars. R.W.Argyle (Royal Greenwich Obs., Hailsham, England).
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.1, p.177-80 (July 1983).
Micrometric measurements of 111 double stars made with the 26.5 inch refractor at Johannesburg are presented. (1 ref.)

104923 Photoelectric observations of ϵ Aurigae during the ingress.
Inf. Bull. Variable Stars (Hungary), no.2371, p.1-3 (19 July 1983).
Reports UBV magnitudes and light curves of ϵ Aurigae for the period 1982 September 24 to 1983 March 14. Estimated magnitudes at mid-eclipse are also reported. The epoch of second contact is found to be about JD 2445306. (2 refs.)

104924 New photoelectric times of minima of VW Cephei. P.G.Niarchos (Dept. of Astron., Univ. of Athens, Athens, Greece).
Inf. Bull. Variable Stars (Hungary), no.2375, p.1-2 (27 July 1983).
Reports 12 times of light minimum (six primary minima and six secondary minima) for VW Cephei (BD+75°752), obtained by BV photometry between 5 and 11 September 1980. (4 refs.)

104925 Hercules X-1 and MXB 1730−335. Y.Tanaka.
I.A.U. Circ. (USA), no.3852, 1 pp. (17 Aug. 1983).
It is reported that the Tenma satellite observed high and low states of Hercules X-1 during the period 1983 May 20 to June 1. It is also reported that the Rapid X-ray Burster MXB 1730−335 may have become active. The Tenma satellite has observed the persistent X-ray flux and type 1 bursts from this source since 1983 August 5. (2 refs.)

104926 ϵ Aurigae. M.Parthasarathy, D.L.Lambert.
I.A.U. Circ. (USA), no.3848, 1 pp. (5 Aug. 1983).
Observations of ϵ Aurigae during totality show a significant decrease in the strength of the K I 770 nm resonance line and the Na I D-lines. During the same period the Hα line was broad and the emission in the wings of the line disappeared. These observations suggest that the neutral gas is mostly confined to the outer regions of the eclipsing object. (no refs.)

104927 Coude radial velocities of ζ Herculis. C.D.Scarfe, H.Funakawa, P.A.Delaney, D.J.Barlow (Climenhaga Obs., Dept. of Phys., Univ. of Victoria, Victoria, BC, Canada).
J. R. Astron. Soc. Can. (Canada), vol.77, no.3, p.126-41 (June 1983).
Radial velocities of ζ Herculis A have been obtained photographically since 1962. The data are fitted by a Keplerian curve with an r.m.s. residual of 0.23 km s^{-1}. However, the elements obtained from the radial velocities do not agree well with those from visual observations, and a solution combining the visual and spectroscopic data shows systematic trends in the residuals at some phases. Masses are obtained from this solution by adopting either the mass ratio or the parallax of Lippincott (1981); the latter appears to give the more plausible results. The question of a third component is reconsidered, and the one proposed by Baize (1976) is ruled out. (23 refs.)

104928 The double-lined spectroscopic binary HD 28475. D.P.Hube (Dept. of Phys., Univ. of Alberta, Edmonton, Canada).
J. R. Astron. Soc. Can. (Canada), vol.77, no.3, p.142-6 (June 1983).
Orbital elements are computed for the double-lined spectroscopic binary HD28475, including a period of 13.8761^{d}. The system is detached and consists of two unevolved stars of spectral type near B5. (10 refs.)

104929 Fate of very low-mass secondaries in accreting binaries and the 1.5-ms pulsar. M.A.Ruderman, J.Shaham (Dept. of Phys., Columbia Univ., New York, NY, USA).
Nature (GB), vol.304, no.5925, p.425-7 (4 Aug. 1983).
Families of old tight low-mass binaries in which mass transfer to a heavier collapsed primary from a lighter secondary is an essential evolutionary feature include the galactic bulge X-ray sources, in which the primary is a neutron star. Canonical theories for the evolution of such binaries assume that the mass transfer and secondary evolution are always stable. It is argued in this article that the stability postulate may fail if the secondary mass falls below $\sim 2\times10^{-2}\ M_{\odot}$. The secondary may then be almost entirely tidally disrupted, leaving behind, at most, a small remnant very much lighter than the Earth in an orbit with a period of several hours. In binary accretion scenarios for the origin of the millisecond pulsar PSR 1937+214, this could explain the absence of any detected binary companion. (8 refs.)

104930 Average radii, masses and mean densities of stars—components of eclipsing systems. T.Z.Dworak (Komisja Astronomii, Polskiego Towarzystwa Astronautycznego, Krakow, Poland).
Postepy Astron. (Poland), vol.31, no.1, p.53-9 (Jan.-March 1983). In Polish.
Contains average values of radii, masses and mean densities determined for stars of given spectral types and luminosity classes. These values have been calculated on the basis of data from a catalogue of parameters for eclipsing binaries (Brancewicz and Dworak 1980). Results are presented in tables and diagrams. Diagrams which present the radius-mass relation and mass-luminosity relation are given. For the first time the mass-luminosity relation has been determined for subgiants (luminosity class IV). (4 refs.)

104931 The planetary system of Barnard's star. P.van de Kamp.
Vistas Astron. (GB), vol.26, pt.2, p.141-57 (1982).
Analysis of astrometric positions of this nearby red dwarf star, obtained with the Sproul 61-cm photovisual refractor in 44 consecutive years over the interval 1938-81, confirms the orbital interpretation established earlier. The perturbation is attributed to two approximately circular orbits with periods 12 and 20 years and radii 0.0070″ and 0.0064″, caused by invisible companions with 0.7 and 0.5 Jupiter masses respectively. The orbits may be nearly coplanar and co-revolving, thus supporting the notion of a planetary system. (23 refs.)

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Astrometry of the low-luminosity stars VB8 and VB10 ... See Entry 104856
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Light variability of Nova Delphini 1967 in 1981 and 1982 ... See Entry 104880
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X-ray emission and spin-up evolution of the 6.1-ms pulsar ... See Entry 104902
Searching for black holes ... See Entry 104906
The bright stellar content of the giant galactic H II region NGC 3603 ... See Entry 104942
Transient X-ray source near 4U 1543−45 ... See Entry 104980
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98.00 STELLAR SYSTEMS; GALACTIC AND EXTRAGALACTIC OBJECTS AND SYSTEMS; THE UNIVERSE

98.10 STELLAR DYNAMICS

Dirichlet-Weierstrass-Poincare problem ... See Entry 104716
On the periodic orbits of the Contopoulos Hamiltonian ... See Entry 104718

98.20 STELLAR CLUSTERS AND ASSOCIATIONS

104932 Properties of young clusters near reflection nebulae. K.Sellgren (California Inst. of Technol., Pasadena, CA, USA).
Astron. J. (USA), vol.88, no.7, p.985-97 (July 1983).
Near-infrared observations in the reflection nebulae NGC 7023, 2023, and 2068 are used to study clusters of young stars found associated with these nebulae. At least 30%-60% of these stars are pre-main-sequence objects, as indicated by their infrared excesses, hydrogen line emission, or irregular variability. The spatial distributions and observed luminosity functions of these young open clusters are derived, and the inferred mass function and star formation efficiencies are discussed. (32 refs.)

104933 Positions, magnitudes, and colors for stars in the globular cluster M92. R.Buonanno, G.Buscema, C.E.Corsi, G.Iannicola, F.Smriglio (Osservatorio Astron. su Monte Mario, Roma, Italy), F.F.Pecci.
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.1, p.1-12 (July 1983).
B, *V* magnitudes and relative positions for all the stars brighter than $B=18$, and $V=17.5$ in an annulus ranging from $r=1.5$ arcmin to $r=4.5$ arcmin from the centre of the cluster NGC 6341=M92 have been derived using a reduction procedure applied to digitized photographic data. Moreover, *B*, *V* magnitudes (and positions) for a second sample of stars are given in order to allow a better definition of the main branches in the color magnitude diagram. The accuracy of the data is discussed in detail. (16 refs.)

104934 A physical study of the Ursa Major cluster (with special attention to peculiar A stars). L.O.Loden (Astron. Obs., Uppsala, Sweden).
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.1, p.33-42 (July 1983).
The investigation aims at a search for some spectral individualities that are characteristic of members of certain clusters or associations. Intermediate-dispersion spectra of 26 A-type stars in the Ursa Major region have been secured. A few of the stars are supposed or suspected to belong to the Ursa Major moving cluster. The material also includes a number of CP stars. Line intensities have been measured for 17 spectral lines representing 11 elements, and average values of these intensities have been scrutinised. The preliminary results indicate that a few particular lines ought to be subject to intensified examination with respect to sensitivity to astrogenetic origin. (32 refs.)

104935 NGC 6256, a galactic globular cluster. G.Alcaino (Inst. Isaac Newton, Min. de Educacion de Chile, Santiago, Chile).
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.1, p.47-55 (July 1983).
A provisional color-magnitude diagram (CMD) is constructed for 182 stars in the magnitude range $13.7<V<18.8$ and $14.5<B<20.0$. It is found that NGC 6256 is a globular cluster. Located in a dense stellar field at low galactic latitude, the cluster has a CMD consisting of a flattened giant branch as well as some red horizontal branch stars typical features of metal rich clusters. The adopted horizontal branch luminosity at $V_{HB}\sim18.2$ and the estimated reddening $E(B-V)=0.80$, place the object at 11.0 kpc from the Sun, 0.6 kpc from the galactic plane and 2.9 kpc from the galactic center. (22 refs.)

Star formation within OB subgroups: implosion by multiple sources ... See Entry 104850
The discovery of a hot stellar wind ... See Entry 104861
The metal abundances of RR lyrae stars in the globular clusters NGC 3201, NGC 4590, and NGC 6171 ... See Entry 104862
Photoelectric photometry of Ap stars in IC 2602, NGC 6281 and in the Scorpio-Centaurus group: preliminary results ... See Entry 104884
Binaries as a heat source in stellar dynamics: release of binding energy ... See Entry 104917

98.40 INTERSTELLAR MATTER; AND NEBULAE

104936 The galactic extinction of extragalactic objects. I. The csc *b* law and the extinction coefficient. G.de Vaucouleurs, R.Buta (Dept. of Astron., Univ. of Texas, Austin, TX, USA).
Astron. J. (USA), vol.88, no.7, p.939-61 (July 1983).
Galactic extinction models applicable to extragalactic objects and, in particular, the evidence for or against the assumption of zero-extinction windows in the galactic polar caps ($|b|>50°$) are re-examined by five independent methods: (i) counts of faint galaxies from two different data sources (Lick, Palomar); (ii) counts of distant galaxy clusters from two different catalogs (Abell, Zwicky); neither gives any support to the concept of polar windows; both obey closely the csc *b* law, right up to the poles in each galactic hemisphere; (iii) the mean surface brightness m'_{e} within the effective aperture A_{e} of 545 bright galaxies; (iv) the hydrogen-luminosity ratio measured by the H I index newly derived for 463 bright galaxies on the RC2 system; both are consistent with a csc *b* law up to the poles and with an extinction coefficient

in agreement with the value $A_1=0.20$ mag, adopted in RC2; and (v) the total color indices $(B-V)_T$ and $(U-B)_T$ of 830 and 488 bright galaxies give no indication of systematic departures from the RC2 galactic extinction model and the reddening is consistent with the adopted extinction coefficients. Because all tests measure essentially the same quantity, A_B, they can be combined with appropriate scale factors and relative weights. The normalized extinction derived from the combined galaxy and cluster counts (i, ii) verifies very precisely the statistical validity of the csc b law at all $|b|>20°$, including the polar caps. The differential extinction, $\Delta A_B=A_B(b)-A_B$ (90°), derived from the combined surface magnitudes and H I ratios (iii, iv) and colors (v) also follows closely the csc b law with a mean extinction coefficient $A_1=0.200\pm0.018$. These quantitative tests confirm the validity of the galactic extinction model adopted in RC2 and, in particular, the value of the polar extinction $A_1=0.20$. (68 refs.)

104937 Radio observations of compact H II regions. J.Krassner, J.L.Pipher, M.P.Savedoff (Dept. of Phys. & Astron., Univ. of Rochester, Rochester, NY, USA), B.T.Soifer.

Astron. J. (USA), vol.88, no.7, p.972-81 (July 1983).

Radio continuum observations at high (~10 arcsec) spatial resolution have been obtained for a number of compact H II regions using the NRAO Green Bank interferometer. Maps of the resolved sources are presented and the physical parameters of the H II regions derived. Each source detected is described in detail and the new radio information is compared with existing data. For some of the objects these are the first observations made with better than arcminute resolution. A significant fraction of the objects contain several hot spots, which are indicative of local density enhancements or the presence of several early-type stars. (39 refs.)

104938 Proper motions of Herbig-Haro objects. III. HH-7 through -11, HH-12, and HH-32. G.H.Herbig, B.F.Jones (Lick Obs., Univ. of California, Santa Cruz, CA, USA).

Astron. J. (USA), vol.88, no.7, p.1040-52 (July 1983).

For pt.II see ibid., vol.87, no.8, p.1223-32 (1982). Proper motions have been measured on Crossley and 120-in. plates for additional Herbig-Haro objects. The bright, nearly stellar HH-11 shows definite motion away from the heavily obscured H_2O maser and infrared source SSV-13, about 16″ distant. Three other nearby objects show no detectable motions. Repetitive ejection from the vicinity of SSV-13 at intervals of >500 years is suggested. Nuclei in the nearby extended object HH-12 show motion away from another obscured star, SSV-11, of type M1eα. The indicated travel time is 800-1400 years. All these objects have negative radial velocities with respect to the molecular cloud, and lie in regions of negative CO velocity. No objects have been found on the opposite sides of the exciting stars, where the velocity would presumably be positive. HH-32A, B are moving away from the bright T Tauri star AS-353A, and have both large positive velocities and double emission lines. The line splitting is interpreted in terms of pre- and post-shock gas on the front side of an (invisible) obstacle in the wind from AS-353A. (46 refs.)

104939 Cometary globules in the Gum-Vela complex. W.J.Zealey (Royal Obs., Edinburgh, Scotland), Z.Ninkov, E.Rice, M.Hartley, S.B.Tritton.

Astrophys. Lett. (GB), vol.23, no.3, p.119-31 (1983).

Twenty-nine cometary globules (CG) have been found in Gum-Vela, projected upon an annulus of angular radius 9.5°. The tails of the globules are directed away from a common central region. The velocity field based on 9 CGs can best be fitted by a slow expanding shell with a radius greater than 80 pc. The dominant velocity effects observed are due to galactic rotation. The phenomenon appears to be a later stage of that observed in the globules in the Rosette Nebula. It appears possible that the formation of the expanding shell is the result of the interaction of the stellar winds from ζ Puppis and γ^2 Velorum with the interstellar medium. The stretched globules formed due to either Rayleigh-Taylor instability in the shell or as the shell encountered dense interstellar cloudlets. (33 refs.)

104940 Equilibrium temperatures of interstellar iron grains. R.G.Tabak, A.K.Straitiff (Dept. of Phys. & Astron., Youngstown State Univ., Youngstown, OH, USA).

Astrophys. & Space Sci. (Netherlands), vol.93, no.1, p.199-206 (June 1983).

Temperature fluctuations are examined for iron grains and found to be minimal for sizes greater than 100 Å. Steady-state equilibrium temperatures are then calculated for a size distribution of iron particles ranging from 10^3 to 10^9 atoms per grain. The results are that iron grain temperatures are significantly greater than those of dielectric grains of comparable size in the same radiation field. (31 refs.)

104941 Structure of molecular clouds. VII. Energy balance in clouds with star formation (Type IIb). L.G.Stenholm (Inst. fur Theoretische Astrophys., Heidelberg, Germany).

Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.247-55 (Aug. 1983).

For pt. VI see ibid., vo.117, no.1, p.41-5 (1983). Studies the thermal equilibrium in molecular clouds with prominent star formation (Stenholm et al., 1981, Type IIb). The author derives an observationally based dust model as a supplement to the previously derived gas component model. The author discusses most of the heating and cooling processes, for dust and gas, suggested in the literature. Their efficiency is judged by their ability to explain the thermal structure of the observationally based dust-gas cloud model. (55 refs.)

104942 The bright stellar content of the giant galactic H II region NGC 3603. A.F.J.Moffat (Astron. Inst., Univ. Bonn, Bonn, Germany).

Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.273-8 (Aug. 1983).

NGC 3603 is the closest example of a massive giant H II region like those which serve as distance indicators in some extragalactic systems. In order to probe the stellar content of NGC 3603, optical spectra were obtained for nearly all member stars or unresolved clumps of stars brighter than $V=13.2$ ($M_v=-5.7$). Combined with BV photometry for the nine best single images, the spectral types yield mean differential extinction with no clear indication of real variability from star to star, and distance 7.0 ± 0.5 kpc. The total number of equivalent early O type stars of $M_v=-6.2\pm0.5$ is about twenty, easily accounting for the observed radio continuum emission. NGC 3603 contains proportionally fewer WR stars than NGC 2070 (O3-4) possibly due to the presence of relatively fewer very massive progenitor O stars. Alternately, this may be due to small number statistics. (21 refs.)

104943 Far ultraviolet observations of the expanding shell in Eridanus. F.Paresce, P.Jakobsen, S.Bowyer (Dept. of Astron., Univ. of California, Berkeley, CA, USA).

Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.300-8 (Aug. 1983).

A thin strip of the sky near the South Galactic Pole has been observed in the 1350-1750 Å wavelength band at high sensitivity and moderate spatial resolution by the EUV telescope on the Apollo-Soyuz mission. After correcting for hot stars in the instrument field of view, the measured count rates of this region were found to vary smoothly from a minimum of $\simeq55$ cs^{-1} near $l=30°$, $b=-60°$ to a maximum of $\simeq740$ cs^{-1} in the direction of $l=199°$, $b=-49°$ corresponding to specific intensities between $\simeq600$ and 8000 photons cm^{-2}s^{-1}sr^{-1} Å^{-1}, assuming a flat incident spectrum in this wavelength range. Three sources that, alone or together with reflection nebulae, might explain the high intensities in this region are H_2 fluorescence emission by cool clouds with a density $n_H=500$ cm^{-2}, H_1 two photon emission from ionized gas, and thermal emission from a fast radiative shock. The required emission parameters are compatible with the observed characteristics of the expanding shell in Eridanus which has been suggested to be connected with the stellar wind from the *I*OriOB association. (61 refs.)

104944 G296.05−0.50—a large-diameter supernova remnant. J.L.Caswell (Div. of Radiophys., CSIRO, Sydney, Australia), P.J.Barnes.

Astrophys. J. Lett. Ed. (USA), vol.271, no.2, pt.2, p.L55-8 (15 Aug. 1983).

A new map at 408 MHz made with the Molonglo Cross shows a supernova remnant (SNR) shell centered at $l=296.05°$, $b=-0.50°$ with a mean angular diameter of 33′. It is argued that a source of X-rays which had previously been interpreted as the emission from two SNRs is simply the emission from this single, large SNR, G296.05−0.50. Optical emission which lay outside the previously recognized portion of G296.05−0.50 is now seen to coincide with the newly mapped outlying regions of the radio shell. (15 refs.)

104945 Synthesis maps of ultraviolet observations of neutral interstellar gas. P.C.Frisch, D.G.York (Dept. of Astron., Univ. of Chicago, Chicago, IL, USA).

Astrophys. J. Lett. Ed. (USA), vol.271, no.2, pt.2, p.L59-63 (15 Aug. 1983).

The results of satellite observations of neutral interstellar material in front of 140 stars 10-3000 pc distant are shown projected onto representations of the galactic plane and of a plane passing through the galactic poles. The figures show that the contours of neutral hydrogen in the solar neighborhood asymmetrically surround the Sun, with the 5×18^{18} cm^{-2} contour at $\lesssim15$ pc in the Sco-Oph direction, but at $\gtrsim200$ pc in the third quadrant. This neutral gas distribution mirrors the distribution of the nearby B stars associated with the Gould belt. The maps clearly show the directions in which observations at $\lambda<912$ Å will be most successful. (31 refs.)

104946 Detection of $H^{15}NN^+$ and $HN^{15}N^+$ in interstellar clouds. R.A.Linke, M.Guelin, W.D.Langer (Crawford Hill Lab., Bell Labs., Holmdel, NJ, USA).

Astrophys. J. Lett. Ed. (USA), vol.271, no.2, pt.2, p.L85-8 (15 Aug. 1983).

$H^{15}NN^+$ and $HN^{15}N^+$ have been detected for the first time in an interstellar cloud, DR 21 (OH), through observations of their $J=1$-0 transitions near 90 GHz. These two isotopic species have nearly equal abundances. Comparison with the weakest component of $HN_2{}^+$ ($F=1$-0) yields an intensity ratio $^{14}N/^{15}N>170$, consistent with the terrestrial $^{14}N/^{15}N$ isotope ratio (270). The N_2H^+/HCO^+ abundance ratio has been found to be ~0.9. This value suggests that in DR 21 (OH) nitrogen could be mostly in the form of N_2 in the gas phase, while only 10% to 15% of carbon is in the form of gaseous CO. (20 refs.)

104947 The distribution of 6 centimeter H_2CO in Orion Molecular Cloud 1. K.J.Johnston (E.O. Hulburt Center for Space Res., Naval Res. Lab., Washington, DC, USA), P.Palmer, T.L.Wilson, J.H.Bieging.

Astrophys. J. Lett. Ed. (USA), vol.271, no.2, pt.2, p.L89-93 (15 Aug. 1983).

Measurements of 6 cm H_2CO emission associated with the Orion Molecular Cloud (OMC-1) show that the peak of the emission feature at 7.4 km s^{-1} is centered close to the infrared source IRc5, in the southern part of the KL nebula. The peak main-beam brightness is 9K, and the emission region has a deconvolved size of 25″×11″ (0.06×0.03 pc). Absorption by H_2CO is seen toward the southern peak found at 400 μm. The weaker absorption and emission features are consistent with sizes greater than 15″, showing clumpiness in the H_2CO emission and absorption. (21 refs.)

104948 Interstellar C_2 molecules in a Taurus dark cloud. L.M.Hobbs (Yerkes Obs., Univ. of Chicago, Williams Bay, WI, USA), J.H.Black, E.F.van Dishoeck.

Astrophys. J. Lett. Ed. (USA), vol.271, no.2, pt.2, p.L95-9 (15 Aug. 1983).

Five relatively strong interstellar absorption lines of the (2-0) Phillips band of C_2 near λ8760 are detected in the spectrum of HD 29647, a late B star which lies behind a substantial part of the Taurus molecular cloud complex about 20′ from TMC-1. In combination with newly determined oscillator strengths, the observations yield a column density $N(C_2)\approx9\times10^{13}$ cm^{-2}, which is comparable to those of widely distributed molecules like CH and H_2CO. Theoretical models of the observed C_2 rotational level populations indicate a kinetic temperature $T=14$K and a mean density $n\lesssim10^3$ cm^{-3}. HD 29647 is identified as a Hg-Mn peculiar star. (36 refs.)

104949 Observations of interstellar C_2 toward three heavily reddened stars. B.L.Lutz (Lowell Obs., Flagstaff, AZ, USA), R.M.Crutcher.

Astrophys. J. Lett. Ed. (USA), vol.271, no.2, pt.2, p.L101-5 (15 Aug. 1983).

Observations have been made of the 2-0 band of the Phillips system of interstellar C_2 toward the heavily obscured early-type stars VI Cygni No.12, HD 29647, and BD+66°1675. The first direct proof that the rotational excitation temperatures of interstellar C_2 are nonthermal was obtained. Toward VI Cygni No.12, the rotational distribution cannot be characterized by a single, unique excitation temperature; the distribution is consistent with radiative pumping models. A very strong linear correlation was found between $N(C_2)$ and E_{B-V}. (8 refs.)

104950 Polarization of interstellar molecular radiofrequency absorption lines. N.D.Kylafis (Inst. for Advanced Study, Princeton, NJ, USA), P.R.Shapiro.

Astrophys. J. Lett. Ed. (USA), vol.272, no.1, pt.2, p.L35-9 (1 Sept. 1983).

Predict that interstellar molecular radiofrequency absorption lines seen in the direction of radio continuum sources will, in general, be both linearly and circularly polarized, as a result of the linear dichroism and birefringence, respectively, of the interstellar medium. This linear dichroism and birefringence are caused by the non-local thermodynamic equilibrium population of magnetic sublevels. The amount of linear and circular polarization expected is discussed. (27 refs.)

104951 Search for Wolf-Rayet features in the spectra of giant H II regions. I. Observations in NGC 300, NGC 604, NGC 5457 and He 2-10. S.D'Odorico, M.Rosa, E.J.Wampler (European Southern Obs., Garching bei Munchen, Germany).

Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.1, p.97-108 (July 1983).

The results of a spectroscopic survey of continuum emission from giant H II regions in the galaxies NGC 300 and NGC 5457 (M101) are presented. In NGC 300, WR stars are detected in 2 out of 16 regions surveyed; in NGC 5457 in 2 out of 6. The evidence comes from the presence of broad emission bands in the blue (λλ4600-4700) and red (λλ5600-5900) spectral regions, identified with different lines of N V, N III, C IV and He II observed in galactic WR stars. New observations of the known WR emission bands in the giant H II region NGC 604 and in the galaxy He2-10 are also reported. (26 refs.)

104952 Absorption coefficients for CO molecules and molecular cooling of interstellar clouds. V.K.Khersonskii.
Bull. Spec. Astrophys. Obs.-North Caucasus (USA), vol.13, p.24-30 (1981). Translation of: *Astrofiz. Issled.-Izv. Spets. Astrofiz. Obs. (USSR)*, vol.13, p.30-9 (1981).
Detailed calculations are performed on the absorption coefficients for optically thin lines due to observed transitions in isotopic forms of the CO molecule. A wide range in kinetic temperature $T_k=10\text{-}100K$ is considered and also a wide concentration range $n=10\text{-}10^6$ cm^{-3}, the values being characteristic of interstellar gas clouds. The gas-cooling functions are calculated as arising from collisional excitation of rotational levels producing bulk energy losses and in the absence of gradients in the large-scale velocities. Analytical relationships are derived for the cooling functions in the limiting cases of small and large gas concentrations. (11 refs.)

104953 Determination of the parameters of the interstellar wind from observations of the L_α-background at large distances from the Sun. M.S.Burgin.
Cosmic Res. (USA), vol.20, no.5, p.515-19 (Sept.-Oct. 1982). Translation of: *Kosm. Issled. (USSR)*, vol.20, no.5, p.725-9 (Sept.-Oct. 1982). [received: June 1983]
Multiple scattering of solar photons by interstellar hydrogen and the presence of a galactic background leads to a dependence of the intensity of L_α-radiation on distance from the Sun and on the direction of the line of sight which, far from the Sun, differs from the dependence predicted by an optically thin model. By carrying out measurements of the intensity of the L_α-background at fairly large distances from the Sun, one can estimate the hydrogen density in the interstellar wind and the intensity of the galactic background without relying on an absolute calibration of the equipment and without having accurate information about the flux in the solar L_α-line. (15 refs.)

104954 Near-infrared source counts in the galactic plane. II. A list of near-infrared sources. K.Kawara, T.Kozasa, S.Sato (Dept. of Phys., Kyoto Univ., Kyoto, Japan), H.Okuda, Y.Kobayashi, J.Jugaku.
Mem. Fac. Sci. Kyoto Univ. Ser. Phys. Astrophys. Geophys. Chem. (Japan), vol.36, no.2, p.353-84 (March 1983). In Japanese.
Results on near-infrared source counts are presented as a list of positions and magnitudes of sources observed in 17 selected areas sampled along the galactic plane between $l=349°$ and $l=45°$. The total scanned area was 12 square degrees, and 1989 sources brighter than 6.5 mag in the *K*-band are listed. They are also graphically presented in $(\alpha,\delta)-(l,b)$ maps classifying the magnitudes and the colors of the sources. (10 refs.)

Proceedings of the Workshop on 'Cosmic Magnetic Fields' in Honour of Giorgio Abetti .... See Entry 98636

Cosmochemistry and the Origin of Life. Proceedings of the NATO Advanced Study Institute .... See Entry 98647

Self-similar flows behind cylindrical shock waves in magnetogasdynamics .... See Entry 104723

Discovery of s-process Nd in Allende residue .... See Entry 104724

Magnetic fields in the cosmos .... See Entry 104732

The O IV infrared and ultraviolet flux ratios as temperature and density diagnostics .... See Entry 104741

Medium size radio continuum loops and their association with H I shells .... See Entry 104745

Interstellar matter in meteorites .... See Entry 104821

Star formation within OB subgroups: implosion by multiple sources .... See Entry 104850

Properties of young clusters near reflection nebulae .... See Entry 104932

The H I extent and deficiency of spiral galaxies in the Virgo cluster .... See Entry 104955

The precision of velocity measurements from H I profiles .... See Entry 104959

A model for the emission spectrum of active galactic nuclei .... See Entry 104963

The new Milky Way .... See Entry 104967

Ammonia toward DR 21: a weak maser in ortho-NH_3? .... See Entry 104972

98.50 THE GALAXY, EXTRAGALACTIC OBJECTS AND SYSTEMS

104955 The H I extent and deficiency of spiral galaxies in the Virgo cluster. R.Giovanelli (Arecibo Obs., Arecibo, Puerto Rico), M.P.Haynes.
Astron. J. (USA), vol.88, no.7, p.881-908 (July 1983).
Neutral hydrogen observations mapping along the optical major axis have been made with the Arecibo 305-m telescope and flat feed system for 24 spiral galaxies in the Virgo cluster. Comparison of observed flux integrals with those obtained from a numerical convolution of the antenna beam pattern and an assumed H I surface density distribution yields a measure of an effective H I size, taken to be that radius interior to which lies 70% of the total H I mass. The neutral hydrogen properties of the Virgo cluster spirals have been compared with those of a similar sample of isolated galaxies. The authors find that, for a given optical diameter, a Virgo core galaxy has a smaller H I extent than its optical counterpart; they measure the ratio of the H I to optical Holmberg diameter $d_{\mathrm{H\ I}}/d_{\mathrm{HO}}$ to be 0.70 for the 19 galaxies within a five degree projected radius of the cluster center, whereas those outside show $d_{\mathrm{H\ I}}/d_{\mathrm{HO}}\simeq 1.10$. Using the relation derived between the optical linear diameter and the H I mass, the authors are able to define a H I deficiency parameter and find that the galaxies in the Virgo core are, on the average, H I deficient by a factor of 2.7 with respect to the isolated galaxies. (60 refs.)

104956 Colliding and merging galaxies. II. S0 galaxies with polar rings. F.Schweizer, B.C.Whitmore, V.C.Rubin (Dept. of Terrestrial Magnetism, Carnegie Instn. of Washington, Washington, DC, USA).
Astron. J. (USA), vol.88, no.7, p.909-25 (July 1983).
For pt.I see Astrophys. J., vol.252, no.2, pt.1, p.455-60 (1982). The authors first present a detailed optical study of A0136−0801, a $16^1/_2$-mag 'spindle' galaxy girdled by a ring of gas, dust, and young stars. The spindle is a normal S0 disk seen nearly edge-on, as shown by its photometric profile and fast rotation ($\nu_{\mathrm{rot}}/\sigma_\nu=2.2$); a prolate structure seems to be ruled out. The surrounding ring runs over the poles of this S0 disk and serves as a probe of the vertical potential. The ring motions suggest that a massive halo extends far beyond the S0 disk (out to $3R_{25}$) and that this halo is more nearly spherical than flat. The authors then list 22 related galaxies and derive that a few percent of all field S0s possess near-polar rings or disks. They suggest that these structures are due to a second event, most likely the transfer of mass from a companion galaxy during a close encounter and occasionally also the merger of a companion. Although accretion occurs presumably at random angles, polar rings are favored statistically because of their slow differential precession and consequent longevity. Alternate evolutionary schemes are also discussed. Finally, the authors suggest that M82 may be forming a polar ring from former M81 material, and predict that the 'tilted bulge' of UGC 7576 is an S0 disk seen nearly edge-on. (69 refs.)

104957 The variability of the spectrum of Arakelian 120. B.M.Peterson (Dept. of Astron., Ohio State Univ., Columbus, OH, USA), C.B.Foltz, H.R.Miller, R.M.Wagner, D.M.Crenshaw, K.A.Meyers, P.L.Byard.
Astron. J. (USA), vol.88, no.7, p.926-33 (July 1983).
New spectroscopic and photometric observations of the variable Seyfert 1 galaxy Arakelian 120 are presented. These data are supplemented with published data from other sources. It is shown that Akn 120 exhibits both short-term and long-term variability, as do other Seyfert galaxies. The flux in the broad $H\beta$ emission line closely follows the optical continuum flux, which provides strong support for photoionization models and implies that the broad-line emitting region is very small (less than ~0.04 pc in extent). (27 refs.)

104958 The Local Group irregular galaxies LGS 3 and Pegasus. C.A.Christian (Canada-France-Hawaii Telescope Corp., Kamuela, HI, USA), R.B.Tully.
Astron. J. (USA), vol.88, no.7, p.934-8 (July 1983).
The Galileo/IFA 500×500 CCD camera was used to resolve red giant stars in the gas-rich dwarf galaxy LGS 3 at magnitudes fainter than $V=21.8$. Depending on whether these stars are $>10^9$ yr old or $10^8\text{-}10^9$ yr old, the distance of the galaxy is 0.7-1.2 Mpc. Although H I gas has been detected in this system, there has been no significant star formation for at least the last 7×10^7 yr. The CM diagram of LGS 3 is compared with the CM diagrams of the Pegasus irregular galaxy discussed by Hoessel and Mould. A distance of 1.3 Mpc is suggested for Pegasus, rather than the larger distance preferred by Hoessel and Mould or the very much larger distance offered by Sandage and Tammann. (15 refs.)

104959 The precision of velocity measurements from H I profiles. B.M.Lewis (Arecibo Obs., Arecibo, Puerto Rico).
Astron. J. (USA), vol.88, no.7, p.962-71 (July 1983).
The intrinsic precision of both systematic velocity and of the velocity width estimates derived from H I profiles of galaxies is modelled by a Monte Carlo simulation of the effects of noise. This permits the achieved precision to be estimated directly from the S/N ratio. In particular, a $S/N\gtrsim7$ is required for reliable velocity estimates. The results suggest that observers usually underestimate their precision. New observations of 21 galaxies were made from Arecibo, to compare velocity estimates derived from high S/N ratio profiles with the results of other observers. Surprisingly, these show that the 20% width (ΔV_{20}) of many narrow profiles are significantly overestimated. With these cases identified, the remaining data have a precision of 10 km s^{-1} that does not scale with ΔV_{20}. Furthermore, when $S/N\gtrsim10$ and the galaxies are smaller than the 3.3′ Arecibo beam, the precision of 21-cm estimates of the systematic velocity is 3.6 km s^{-1}. (16 refs.)

104960 Hydrodynamic and turbulent motions in the galactic disk. R.J.Quiroga (Dept. de Fisica, Univ. Federal de Minas Gerais, Belo Horizonte, Brazil).
Astrophys. & Space Sci. (Netherlands), vol.93, no.1, p.37-54 (June 1983).
Studies the hierarchy of motions and its relation to the galactic structure using available observational data in the 21-cm line. Absorption 21-cm data show two types of components in the cool clouds; a narrow one associated with dense clouds with molecular cores, and a wide one associated with low density features which can be considered as the largest eddies of a Kolmogorov spectrum or as the minimum features of the spiral structure. The author analyzes the relation between these components and the Kolmogorov law of turbulence, the relation with hydrodynamic motions and the tensorial form for these motions according to the Helmholtz theorem. Conditions for gravitational collapse of the clouds and the eventual influence of the magnetic field are discussed. (37 refs.)

104961 What is a spiral galaxy?. F.Hoyle.
Astrophys. & Space Sci. (Netherlands), vol.93, no.1, p.55-68 (June 1983).
It is shown that hitherto mysterious properties of spiral galaxies can be understood if they have massive halos composed of unseen material, the elements of which are in motion radially in-and-out from the galactic center to an outer boundary with a radius of at least 100 kpc. A similar more compact model explains the curious properties of the system of NGC 7603, and if extended still further can provide a gravitational model for quasars. The most interesting possibility is that unseen halos consist of magnetic monopoles, each monopole having a mass of the order of the Planck mass, $(hc/2G)^{1/2}=1.54\times10^{-5}$ g, where h is Planck's constant divided by 2π. (5 refs.)

104962 Positron annihilation radiation from Seyfert nuclei and the cosmic diffuse γ-ray background. L.Bassani, A.J.Dean (Dept. of Phys., Univ. of Southampton, Southampton, England).
Astrophys. & Space Sci. (Netherlands), vol.93, no.1, p.135-40 (June 1983).
Observational features in the low energy γ-ray spectra of Seyfert galaxies are interpreted in terms of broad and blueshifted annihilation radiation. The possibility that this 'line' emission is the underlying source of the bump in the cosmic diffuse γ-ray background is investigated. The observational data available in the literature are then used to estimate the maximum temperature of the electron positron plasma and the average positron annihilation rate for Seyfert galaxies. The assumption that other active nuclei, namely radio galaxies and quasars, are powered by the same annihilation mechanism is used to set limits on their contribution to the cosmic diffuse γ-ray background. (23 refs.)

104963 A model for the emission spectrum of active galactic nuclei. T.J.-L.Courvoisier (ESA, Space Sci. Dept., EXOSAT Obs., ESOC, Darmstadt, Germany), M.Camenzind.
Astrophys. & Space Sci. (Netherlands), vol.93, no.2, p.277-80 (June 1983).
The overall spectrum of active galactic nuclei is discussed in terms of a wind and shock model. The central object of the active galactic nuclei is the source of a strong supercritical wind. The interaction of the wind with the surrounding medium generates the nonthermal radiation observed in active galactic nuclei. The spectrum predicted by the wind and shock model is compared with the observations of the quasar 3C 273. (15 refs.)

104964 Elliptical galaxies: can rotation be effective in determining their shapes?. R.Caimmi (Istituto di Astronomia, Univ. di Padova, Padova, Italy).
Astrophys. & Space Sci. (Netherlands), vol.93, no.2, p.403-18 (June 1983).
Investigates the modelling of real galaxies—at least as a zeroth order approximation—in such a way that rotation can be effective in determinating their intrinsic shape. The connection between the presence of isotropy in the pressure and observed gradients of metal content in most galaxies are briefly discussed, next solid-body rotating EC polytropes are proposed as acceptable models and the limits of this approach are considered. Appropriate estimates of both the theoretical ratio of some characteristic projected rotational veloc-

ity to some characteristic projected peculiar delocity, V/σ, and the apparent ellipticity $\hat{e}^*$, are calculated, then the behaviour of V/σ vs $\hat{e}^*$ is compared with observations. Some implications of the results are also reported and discussed. The author shows that solid-body rotating EC polytropes may lead to a naive model of galactic evolution, which enables both to reconcile observed gradients of metal content with the trend exibited by V/σ vs $\hat{e}^*$, and to simulate the morphological sequence of real galaxies. (25 refs.)

104965 Shell structure in NGC 5128. D.F.Malin (Anglo-Australian Obs., La Serena, Chile), P.J.Quinn, J.A.Graham.
Astrophys. J. Lett. Ed. (USA), vol.272, no.1, pt.2, p.L5-7 (1 Sept. 1983).
Specially processed photographs are presented which show a system of shells within the extended elliptical component of the giant radio galaxy NGC 5128. The photographic techniques are outlined. The system of shells is interpreted as being the aftermath of a merger with a smaller disk galaxy about 10^9 yr ago. The authors discuss the possibility that this same event produced the broad dust lane and the associated stars and gas which presently form a rapidly rotating subsystem of the galaxy. (25 refs.)

104966 A survey of galaxy redshifts. IV. The data. J.Huchra, M.Davis (Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA), D.Latham, J.Tonry.
Astrophys. J. Suppl. Ser. (USA), vol.52, no.2, p.89-119 (June 1983).
For pt.III see Ap. J., vol.254, no.2, pt.1, p.437-50 (1982). Presents the complete list of the best available radial velocities for the 2401 galaxies in the merged Zwicky-Nilson catalog brighter than 14.5 m_z and with b^{II} above +40° or below −30°. Almost 60% of the redshifts are from the CfA survey and are accurate to typically 35 km s^{-1}. (112 refs.)

104967 The new Milky Way. L.Blitz (Univ. of Maryland, College Park, MD, USA), M.Fich, S.Kulkarni.
Science (USA), vol.220, no.4603, p.1233-40 (17 June 1983).
Understanding of the large-scale structure of the Milky Way has undergone considerable revision during the past few years. The Galaxy is larger and much more massive than was previously supposed; the newly discovered mass consists of nonluminous matter which is likely to be the dominant form of matter in the Universe. New analyses of the atomic hydrogen gas show that the disk of the Galaxy is about twice as extended as was previously thought. Beyond the Sun, the gas is concentrated in large-scale, coherent spiral arms indicative of a regular four-armed spiral pattern. The outer edge of the disk has a remarkable scalloping. (59 refs.)

104968 The rotation of spiral galaxies. V.C.Rubin (Dept. of Terrestrial Magnetism, Carnegie Instn., Washington, DC, USA).
Science (USA), vol.220, no.4604, p.1339-44 (24 June 1983).
There is accumulating evidence that as much as 90 percent of the mass of the Universe is nonluminous and is clumped, halo-like, around individual galaxies. The gravitational force of this dark matter is presumed to be responsible for the high rotational velocities of stars and gas in the disks of spiral galaxies. At present, the form of the dark matter is unknown. Possible candidates span a range in mass of 10^{70}, from non-zero-mass neutrinos to massive black holes. (48 refs.)

104969 Are black holes necessary?. A.L.Peratt (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Sky & Telesc. (USA), vol.66, no.1, p.19-22 (July 1983).
The author discusses models of radio galaxies, with particular reference to observations of Cygnus A (3C 405). In the standard model the galaxy ejects beams of high-energy particles or relativistic plasma from a compact source in its nucleus. This compact object is usually identified as a black hole; however, an alternative model is possible in which energy is produced by the interaction of two plasma clouds which possess dipole magnetic fields. (3 refs.)

104970 The Lyapunov characteristic numbers and the number of isolating integrals in galactic models. P.Magnenat (Obs. de Geneve, Geneva, Switzerland).
Dynamical Systems and Chaos. Proceedings of the Sitges Conference on Statistical Mechanics, Sitges, Barcelona, Spain, 5-11 Sept. 1982 (Berlin, Germany: Springer-Verlag 1983), p.282-3
Observations show that the dynamical studies of galaxies must be undertaken in the frame of dynamical systems with 3 degrees of freedom. A first step consists of understanding the main properties of orbits in the simplest case of a 3-D conservative potential taking into account the most important nonlinear effects. Particularly the conditions of existence of 1 or 2 isolating integrals besides the Hamiltonian ('non-classical' integrals) are one of the main problems to be examined. (6 refs.)

Astrophysical Jets. Proceedings of an International Workshop .... See Entry 98661

Small-scale fluctuations in the relict radio radiation .... See Entry 104742

Raster equidensitometry applied to processing photographs from the 6 m telescope .... See Entry 104743

Groups of galaxies. III. The CfA survey .... See Entry 104747

Accretion disk stories. I. Observational aspects .... See Entry 104895

Supernova in NGC 5746 .... See Entry 104896

The galactic extinction of extragalactic objects. I. The csc *b* law and the extinction coefficient .... See Entry 104936

Search for Wolf-Rayet features in the spectra of giant H II regions. I. Observations in NGC 300, NGC 604, NGC 5457 and He 2-10 .... See Entry 104951

Near-infrared source counts in the galactic plane. II. A list of near-infrared sources .... See Entry 104954

A search for microwave background diminution towards the cluster 0016+16 .... See Entry 104971

The statistics of quasar-galaxy separations .... See Entry 104974

On the hypothesis of ejection of supermassive black holes from centers of galaxies and its application to quasar-galaxy associations ..... See Entry 104975

Common Lyman-alpha absorption lines in the triple QSO PG 1115+08 .... See Entry 104976

Discovery of a redshift z=1.2 quasar with a flat radio spectrum in the field of the gamma-ray source CG 195+04 .... See Entry 104978

Primordial quantum fluctuations and the origin of galaxies ... See Entry 104985

The universe from $<10^{-36}$ second to $>10^{30}$ years. I .... See Entry 104993

Irregularities formed by a cosmological axion field .... See Entry 105000

The anthropic principle .... See Entry 105002

The cosmological constant and the weak anthropic principle .... See Entry 105006

98.50K Groups, clusters, superclusters

104971 A search for microwave background diminution towards the cluster 0016+16. H.Andernach (Max-Planck-Inst. fur Radioastron., Bonn, Germany), D.Schallwich, G.B.Sholomitski, R.Wielebinski.
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.326-30 (Aug. 1983).
Observes the radio continuum emission in the direction of the distant cluster of galaxies C10016+16 at $\lambda\lambda$6.3 and 2.8 cm. Since at the shorter wavelength the temperature diminution of the microwave background towards this cluster does not exceed the decrement measured with the lower angular resolution, the authors conclude that the hot gas must be rather widely distributed. (14 refs.)

Groups of galaxies. III. The CfA survey .... See Entry 104747

The H I extent and deficiency of spiral galaxies in the Virgo cluster .... See Entry 104955

The Local Group irregular galaxies LGS 3 and Pegasus .... See Entry 104958

98.70 OTHER OBJECTS AND BACKGROUND RADIATIONS OF UNKNOWN ORIGIN AND DISTANCES

(for pulsars, see 97.60G)

Astrophysical Jets. Proceedings of an International Workshop .... See Entry 98661

98.70D Discrete radio sources

104972 Ammonia toward DR 21: a weak maser in ortho-NH_3?. S.Guilloteau (Groupe D'Astrophys., Univ. Sci. et Medicale de Grenoble, Saint Martin D'Heres, France), T.L.Wilson, R.N.Martin, W.Batrla, T.A.Pauls.
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.322-5 (Aug. 1983).
Measurements of the $(J,K)=(1,1)$, (2,2), (3,3), and (4,4) rotation-inversion doublet lines of NH_3, made with the 100-m telescope toward the thermal continuum source DR 21 are presented. The results show absorption in the (1,1) and (2,2), neither absorption nor emission in the (4,4) lines of para-NH_3, and emission from the (3,3) line of ortho-NH_3. The authors interpret these results in terms of deviations from LTE in the population of the (3,3) doublet. Additional measurements of the (3,3) line with the VLA yield an upper limit of 30K to the line emission. From this the authors conclude that the deviations in the population of the (3,3) levels are small. (9 refs.)

104973 Determination of the properties of magnetic turbulence in radio sources. S.R.Spangler (Dept. of Phys. & Astron., Univ. of Iowa, Iowa City, IA, USA).
Astrophys. J. Lett. Ed. (USA), vol.271, no.2, pt.2, p.L49-53 (15 Aug. 1983).
Considers the transport of polarized synchrotron radiation in a source possessing a highly irregular magnetic field, as proposed by Laing (1980, 1981). The transport equation has been solved in a special case, relating the observable correlation functions in the Stokes parameters Q and U to the correlation functions of magnetic field and plasma density in the source. A rough application of the results to observations of the radio galaxy 3C 166 indicates that the turbulent scale length may be a few percent of the lobe size. (7 refs.)

Emission mechanism of extragalactic X-ray and radio sources .... See Entry 104719

Medium size radio continuum loops and their association with H I shells .... See Entry 104745

Flux density monitoring of radio stars observable by Hipparcos at S-band and X-band .... See Entry 104849

VLA observations of MWC 349 at 15 and 23 GHz .... See Entry 104864

Speckle interferometry of IRC+10216 in the fundamental vibration-rotation lines of CO .... See Entry 104869

Bright, rapid, highly polarized radio spikes from the M dwarf AD Leonis .... See Entry 104870

Correlations and periodicities of equivalent widths in SS 433 .... See Entry 104876

Radio observations of compact H II regions .... See Entry 104937

G296.05−0.50−a large-diameter supernova remnant .... See Entry 104944

Detection of $H^{15}NN^+$ and $HN^{15}N^+$ in interstellar clouds ..... See Entry 104946

The distribution of 6 centimeter H_2CO in Orion Molecular Cloud 1 .... See Entry 104947

Polarization of interstellar molecular radiofrequency absorption lines .... See Entry 104950

Shell structure in NGC 5128 .... See Entry 104965

Are black holes necessary? .... See Entry 104969

Discovery of a redshift z=1.2 quasar with a flat radio spectrum in the field of the gamma-ray source CG 195+04 .... See Entry 104978

98.70J Quasars

104974 The statistics of quasar-galaxy separations. S.Phillips (Dept. of Appl. Maths. & Astron., Univ. Coll. Cardiff, Cardiff, Wales).
Astrophys. Lett. (GB), vol.23, no.3, p.155-9 (1983).
One of the arguments put forward in favour of physical associations between low redshift galaxies and high redshift quasars is shown to be void. (21 refs.)

104975 On the hypothesis of ejection of supermassive black holes from centers of galaxies and its application to quasar-galaxy associations. R.C.Kapoor (Indian Inst. of Astrophys., Bangalore, India).
Astrophys. & Space Sci. (Netherlands), vol.93, no.1, p.79-85 (June 1983).
It is argued that accreting supermassive black holes ejected from centers of galaxies are the likely models for the quasars observed in association with galaxies. Also pointed out are the implications of a suggestion by Horak (1982) to account for the excess redshifts of such quasars due to a combined effect of peculiar Doppler-motion and the gravitational field. (18 refs.)

104976 Common Lyman-alpha absorption lines in the triple QSO PG 1115+08. R.J.Weymann, C.B.Foltz (Steward Obs., Univ. of Arizona, Tucson, AZ, USA).
Astrophys. J. Lett. Ed. (USA), vol.272, no.1, pt.2, p.L1-4 (1 Sept. 1983).
Spectroscopic observations at a resolution of 1 Å have been obtained of the bright (A) and one of the faint (C) components of the triple QSO PG 1115+08 shortward to the Lyman-α emission line down to ~3200 Å. Two of the Lyman-α lines not associated with metal-containing absorption systems

are clearly present in the spectra of both objects. A lower limit of ~0.4 kpc for the lateral dimensions of one of these Lyα clouds follows if the lens system has a redshift of ~0.8. (12 refs.)

Discovery of a redshift z=1.2 quasar with a flat radio spectrum in the field of the gamma-ray source CG 195+04 .... See Entry 104978

98.70L IR sources

(see also 98.40 in nebulae)

Speckle interferometry of IRC+10216 in the fundamental vibration-rotation lines of CO .... See Entry 104869

98.70Q X-ray and gamma-ray sources

104977 X-ray emission associated with gamma-ray bursts. J.Nishimura, M.Fujii, T.Yamagami (Inst. of Space & Astronautical Sci., Tokyo, Japan).
Astrophys. & Space Sci. (Netherlands), vol.93, no.1, p.87-96 (June 1983).
The energy spectra of gamma-ray bursts differ from those of black-body radiation and are similar to the thermal bremsstrahlung spectra of optically thin plasma. This could be realized if the source is located in the outer atmosphere of a neutron star. In this case, almost one half of the emitted photons hit the surface of the star. The surface of the star is heated to a temperature of the order 10^7K, and a dominant flux of X-rays with a black-body spectrum would be expected. The X-rays produced by this mechanism are detectable in the energy range from a few keV to 10 keV. This model is discussed in relation to observations in the X-ray region at the time of gamma-ray bursts, and modifications of this model are also presented. (12 refs.)

104978 Discovery of a redshift z=1.2 quasar with a flat radio spectrum in the field of the gamma-ray source CG 195+04. A.F.J.Moffat (Astron. Inst., Univ. Bonn, Bonn, Germany), R.Schlickeiser, M.M.Shara, W.Sieber, R.Tuffs, H.Kuhr.
Astrophys. J. Lett. Ed. (USA), vol.271, no.2, pt.2, p.L45-8 (15 Aug. 1983).
Several radio sources are located within the 90% confidence limit of the strong, unresolved γ-ray source CG 195+04. For the best radio candidate 0630+180, the authors have optically identified a quasar at $z=1.2$, the third such object found to lie within a *COS B* error circle. If the QSO 0630+180 really is associated with CG 195+04, it is the most luminous source of high-energy photons known. If its luminosity is due to proton enhancement, this may be the first step toward identifying a potential source of the nucleonic component of cosmic rays. (20 refs.)

104979 An identification for 'Geminga' (2CG 195+04) 1E 0630+178: a unique object in the error box of the high-energy gamma-ray source. G.F.Bignami, P.A.Caraveo (Istituto di Fisica Cosmica, CNR, Milano, Italy), R.C.Lamb.
Astrophys. J. Lett. Ed. (USA), vol.272, no.1, pt.2, p.L9-13 (1 Sept. 1983).
In the search for counterparts for *COS B* high-energy gamma-ray sources, 2CG 195+04 was covered with two Einstein Observatory IPC exposures and one follow-up HRI pointing. In a 10^4 s observation, four serendipitous sources have been found, three near to the detection limit and one, 1E 0630+178, at a flux level of approximately 2×10^{-12} ergs cm^{-2} s^{-1}. The 3″ HRI position has permitted an optical identification with a faint blue object, while VLA data at 6 cm do not show radio flux at the HRI position. The object appears to be unique on the basis of its observational characteristics, mainly the $L_x/L_v\approx1000$, the lack of a radio counterpart, and the absence of temporal variability and of spatial extent in the X-ray data. Moreover, the very small interstellar absorption suggests a distance of the object of approximately 100 pc (or less). Because of the peculiarity of the X-ray object the authors propose it for the counterpart of 2CG 195+04 'Germinga.'. (29 refs.)

104980 Transient X-ray source near 4U 1543−45. Y.Tanaka.
I.A.U. Circ. (USA), no.3854, 1 pp. (22 Aug. 1983).
Reports the discovery on 1983 August 18 of a bright transient X-ray source at $\alpha=15^h48^m\pm4^m$, $\delta=-47.5°\pm1.0°$. The location is consistent with that of 4U 15434−45. The X-ray source, which is increasing in intensity, was half as bright as Scorpius X-1 in the 0.5 to 3.7 keV band on August 21. (1 ref.)

104981 MXB 1730−335. G.Pollard, N.White, P.Barr, L.Stella.
I.A.U. Circ. (USA), no.3854, 1 pp. (22 Aug. 1983).
It is reported that the Rapid X-ray Burster (MXB 1730−335) is active. EXOSAT observations on 1983 August 7 and 15 show a persistent flux of about 50 mJy. Type 1 bursts occurred at an average interval of 80 minutes, but no type 2 bursts were observed. (1 ref.)

Emission mechanism of extragalactic X-ray and radio sources .... See Entry 104719

Radiation spectrum of optically thin relativistic electron-positron plasma .... See Entry 104722

A λ 10830 vs. X-ray correlation among late-type stars .... See Entry 104842

Bright, rapid, highly polarized radio spikes from the M dwarf AD Leonis .... See Entry 104870

Five years of photometry of σ Geminorum .... See Entry 104910

Hercules X-1 and MXB 1730−335 .... See Entry 104925

G296.05−0.50—a large-diameter supernova remnant .... See Entry 104944

Positron annihilation radiation from Seyfert nuclei and the cosmic diffuse γ-ray background .... See Entry 104962

98.70V Background radiations

104982 The quadrupole component of the relic radiation in a quasi-hyperbolic cosmological model. H.V.Fagundes (Inst. de Fisica Teorica, Sao Paulo, Brazil).
Astrophys. Lett. (GB), vol.23, no.3, p.161-3 (1983).
A closed cosmological model is fitted to the quadrupole moment of the background radiation and to Hubble's constant. Then the author predicts an anisotropy in the latter, as well as the values of deceleration parameters, the density ratio, and (more speculatively) the total mass of the Universe. (6 refs.)

Small-scale fluctuations in the relict radio radiation .... See Entry 104742

Positron annihilation radiation from Seyfert nuclei and the cosmic diffuse γ-ray background .... See Entry 104962

A search for microwave background diminution towards the cluster 0016+16 .... See Entry 104971

Primordial quantum fluctuations and the origin of galaxies ... See Entry 104985

98.80 COSMOLOGY

(for observational cosmology, see 98.70V; for origin and evolution of galaxy, see 98.50)

104983 Neutron oscillation and the primordial magnetic field. C.Sivaram, V.Krishan (Indian Inst. of Astrophys., Bangalore, India).
Astrophys. Lett. (GB), vol.23, no.3, p.139-43 (1983).
The phenomenon of neutron-antineutron oscillations has been recently proposed as a novel consequence of grand unified theories. The sensitivity of the oscillations to the existence of a magnetic field and the presence of a large neutron population in the nucleosynthetic era of the big bang provides a lower limit on the strength of any ordered primordial magnetic field. This would supplement recent attempts to fix upper limits on the primordial field by considerations such as neutrino oscillations and helium production. (15 refs.)

104984 Limits on the accuracy of determining q_0 from supernovae. S.Phillipps (Dept. of Appl. Maths. & Astron., Univ. Coll. Cardiff, Cardiff, Wales).
Astrophys. Lett. (GB), vol.23, no.3, p.145-9 (1983).
The effects of peculiar velocities on the determination of q_0 from supernovae (and other methods) are discussed and the intrinsic errors evaluated. (16 refs.)

104985 Primordial quantum fluctuations and the origin of galaxies. H.R.Pagels (Rockefeller Univ., New York, NY, USA).
Astrophys. Lett. (GB), vol.23, no.3, p.151-4 (1983).
Using supersymmetry the author calculates the contribution of the one-loop autocorrelation function at temperature T_G, characteristic of the inflationary era, to the density contrast $\delta\rho/\rho$. The author obtains a Zeldovich spectrum and for perturbations of the size of the horizon finds $(\delta/\rho/\rho)_H\sim10^{-4}$ for $T_G\sim1.6\times10^{16}$ GeV. (8 refs.)

104986 On dissipational processes in the cosmological GUT era. M.Ostrowski (Astronomical Obs., Jagiellonian Univ., Krakow, Poland).
Astrophys. & Space Sci. (Netherlands), vol.93, no.1, p.127-34 (June 1983).
A discussion of equilibrium conditions in the cosmological GUT (≡Grand Unified Theories) era leads to the conclusion that viscous approximation is not adequate to describe kinetic dissipative processes acting at that epoch. The attempt of an alternative description is presented within the assumed simple model. The maximal possible gain of entropy is a slowly increasing function of the initial anisotropy parameter. The mechanism generating bulk viscosity in the gas of interacting massless particles is also presented. There is only a small dissipative effect connected with this phenomenon. (18 refs.)

104987 Primordial nucleosynthesis and scale-covariant cosmology. Yan-Feng Li (Dept. of Phys. & Astron., Univ. of Nebraska, Lincoln, NE, USA).
Astrophys. & Space Sci. (Netherlands), vol.93, no.2, p.255-9 (June 1983).
The scale-covariant theory of gravitation, which was proposed by Canuto et al. (1977), assumes that gravitational and atomic units are related by a scalar function of space-time. The cosmology based on this theory can explain very well the 3K radiation, as well as Hubble's redshift law. However, Falik (1979) derived a result from the scale-covariant cosmology which was in conflict with the observed helium abundance. Contrary to Falik, the author shows that if one chooses a gauge function $\beta\sim t^\alpha$ and α satisfies the condition $-{}^1/_3<\alpha<1$, the scale-covariant cosmology will be consistent with the observed cosmic-helium abundance. The value $\alpha={}^1/_2$ has recently been suggested by Canuto and Goldman (1982) on general grounds. (9 refs.)

104988 Spatially self-similar cosmological model of Bianchi type-$_1$I. D.Lorenz (Fakultat fur Phys., Univ. Konstanz, Konstanz, Germany).
Astrophys. & Space Sci. (Netherlands), vol.93, no.2, p.419-22 (June 1983).
The Einstein equations are integrated for a tilted spatially self-similar Bianchi type-$_1$I space-time with 'stiff' matter content. The solution represents an anisotropic model which tends to isotropic expansion in a special case. (26 refs.)

104989 On the general vacuum solution with a cosmological constant for Bianchi type-VI$_0$. D.Lorenz (Fakultat fur Phys., Univ. Konstanz, Konstanz, Germany).
Acta Phys. Pol. B (Poland), vol.B14, no.7, p.479-84 (July 1983).
Investigates the field equations for Bianchi type-VI$_0$ space-times with a non-vanishing cosmological constant. Exact solutions are given for the vacuum case of Bertotti-Robinson-type models. In addition a reduction of the field equations to a second order differential equation is given in the general case. The general vacuum case is discussed in various equivalent ways and a transcendental solution is derived. (12 refs.)

104990 The motion of test particles in black-hole backgrounds with non-zero cosmological constant. Z.Stuchlik (Dept. of Phys., Coll. of Mines, Ostrava-Poruba, Czechoslovakia).
Bull. Astron. Inst. Czech. (Czechoslovakia), vol.34, no.3, p.129-49 (June 1983).
Due to the present indications of the existence of a non-zero cosmological constant, some aspects of the influence of $\Lambda\neq0$ on the character of test-particle motion in black-hole backgrounds are discussed. Equations of motion of electrically charged particles and magnetic monopoles are written in the most general Kerr-Newman-de Sitter dyon background. For the Kerr-de Sitter spacetime, the latitudinal motion is examined in detail by using the 'Chinese boxes' technique. The radial motion in the Schwarzschild-de Sitter background is considered with attention devoted to the existence and stability of circular orbits and to the properties of purely radial trajectories. Finally, the possibility of constructing an Einstein-Strauss-de Sitter model of the Universe is discussed. (12 refs.)

104991 The dependence of the surface and interior characteristics of theoretical stellar models, evolved with variable G, on the age of the isochrone. A.D.Pinotsis, P.G.Laskarides (Dept. of Astron., Univ. of Athens, Athens, Greece).
Bull. Astron. Inst. Czech. (Czechoslovakia), vol.34, no.3, p.149-54 (June 1983).
The evolution of the surface and interior characteristics of theoretical stellar models, evolved under the assumption of the Brans-Dicke cosmology is discussed for models with the same mass in three isochrones. As the age of the isochrone increases, the less massive models behave more and more like the more massive models of the isochrone with smaller age. The theoretical isochrones cannot be used as age indicators, at least not as freely as the ones received with constant G, since the position and shape of the isochrone for clusters of the same age and chemical composition depends also on the initial value of G as well as on the law of G variation. (9 refs.)

104992 Frame dragging in Einstein and Einstein zero mass scalar cosmologies. K.D.Krori, J.C.Sarmah, D.Goswami (Math. Phys. Forum, Cotton Coll., Gauhati, India).
Can. J. Phys. (Canada), vol.61, no.8, p.1198-204 (Aug. 1983).
Investigates the perturbations caused by a spherical rotating shell in a closed homogeneous and isotropic cosmological model in Einstein and Einstein zero mass scalar theories. It is found from the solutions that in both theories the

inertial frame at the origin is dragged with the angular velocity of the rotating shell during only a certain interval in the evolution of the Universe when the shell covers the whole Universe. (8 refs.)

104993 The universe from $<10^{-36}$ second to $>10^{30}$ years. I. M.J.Rees (Inst. of Astron., Univ. of Cambridge, Cambridge, England).
Curr. Sci. (India), vol.52, no.10, p.443-9 (20 May 1983).
Progress in astronomy over the last twenty years has been apparent to any reader of the scientific press, or even the newspapers. Galaxies, quasars, black holes and the big bang have entered the general vocabulary, if not the common understanding. The author discusses galaxies and their constituent stars: how they form and evolve to their eventual fate. He asks a similar question about the entire Universe: its beginnings, and its fate in the very long term. In particular, will it go on expanding for ever, or will it recollapse in a universal cataclysm after a finite time? Research programmes now in progress may give a reliable long term forecast within this decade. (4 refs.)

104994 Geometry of multidimensional universes. R.Coquereaux, A.Jadczyk (CERN, Geneva, Switzerland).
Commun. Math. Phys. (Germany), vol.90, no.1, p.79-100 (1983).
Let G be a compact group of transformation (global symmetry group) of a manifold E (multidimensional universe) with all orbits of the same type (one stratum). The authors study G invariant metrics on E and show that there is one-to-one correspondence between those metrics and triples $(g_{\mu\nu}, A_\mu^{a}, h_{\alpha\beta})$, where $g_{\mu\nu}$ is a (pseudo-) Riemannian metric on the space of orbits (space-time), $A_\mu^{\hat{a}}$ is a Yang-Mills field for the gauge group $N|H$, where N is the normalizer of the isotropy group H in G, and $h_{\alpha\beta}$ are certain scalar fields characterizing geometry of the orbits (internal spaces). The scalar curvature of E is expressed in terms of the component fields on M. Examples and model building recipes are also given. The results generalize those of non-Abelian Kaluza-Klein theories to the case where internal spaces are not necessarily group manifolds. (41 refs.)

104995 The stability of general relativistic cosmological theory. J.D.Barrow (Astron. Centre, Sussex Univ., Brighton, England), A.C.Ottewill.
J. Phys. A (GB), vol.16, no.12, p.2757-76 (21 Aug. 1983).
The authors analyse the behaviour of homogeneous and isotropic solutions to a gravity theory that arises from the variation of an arbitrary analytic function of the space-time scalar curvature. Such a theory generalises Einstein's general relativity wherein this function is linear in the curvature. They prove conditions for the existence and stability of the general relativistic de Sitter and Friedmann solutions within the general theory, prove necessary and sufficient conditions for the existence of cosmological singularities and particle horizons and analyse the asymptotic behaviour of ever-expanding Universe models. The conditions under which Minkowski space-time and Schwarzschild space-time are stable is investigated and their instability, together with the pathological behaviour of certain cosmological models, traced back to the non-minimality of the stationary action giving rise to the field equations. The significance of these results for quantum theories of gravity and the 'inflationary' model of the early Universe is discussed. (49 refs.)

104996 Vacuum field, modified cosmical term and non-singular cosmology. V.B.Johri (Dept. of Math., Indian Inst. of Technol., Madras, India), R.Chandra.
J. Math. & Phys. Sci. (India), vol.17, no.1, p.73-86 (Feb. 1983). [received: Aug. 1983]
The significance of the cosmological principle in proposing a modified form of the cosmical term representing the vacuum field in the Einstein field equations has been discussed, particularly with regard to the initial stages of the evolution of the Universe. A non-singular cosmological model expanding out from the hadron era has been constructed with the help of the modified cosmical term. (26 refs.)

104997 Newtonian cosmology (problems of didactics of cosmology). E.Skarzynski (Inst. Filozofii, Uniwersytetu Jagiellonskiego, Krakow, Poland).
Postepy Astron. (Poland), vol.31, no.1, p.45-52 (Jan.-March 1983). In Polish.
Presents different methods of model construction in Newtonian cosmology. Newtonian cosmology is very convenient for discussion of local problems, so the problems presented are of great didactic importance. The constant k receives a new interpretation in relativistic cosmology as the curvature of space. (11 refs.)

104998 Mechanism of generating isothermal perturbation by a strong *CP* nonconservation. M.Yoshimura (Nat. Lab. for High Energy Phys., Ibaraki, Japan).
Phys. Rev. Lett. (USA), vol.51, no.6, p.439-42 (8 Aug. 1983).
A large-scale inhomogeneity of the coherent axion field may exist in the early Universe. This gives a spatially varying source of strong *CP* nonconservation and, when coupled to baryon-nonconserving interaction, may lead to generation of the isothermal perturbation of baryon density. A specific mechanism is presented, in which a three-body decay of a heavy Majorana lepton gives the additional baryon generation. (17 refs.)

104999 Compactification of Friedmann's hyperbolic model. H.V.Fagundes (Inst. de Fisica Teorica, Sao Paulo, Brazil).
Phys. Rev. Lett. (USA), vol.51, no.6, p.517-18 (8 Aug. 1983).
A compact hyperbolic three-manifold is substituted for the infinite space H^3, as space section of Friedmann's cosmological model of negative curvature. Some consequences are briefly analyzed. In particular it is shown that an apparent observational isotropy persists when the particle horizon intersects an anisotropic region of space. (8 refs.)

105000 Irregularities formed by a cosmological axion field. M.Fukugita, M.Yoshimura (Nat. Lab. for High Energy Phys., Ibaraki, Japan).
Phys. Lett. B (Netherlands), vol.127B, no.3-4, p.181-4 (28 July 1983).
A cosmological axion field which was not dissipated fast enough from the early universe may lead to a gross inhomogeneity well before the present epoch. This gives a possibility of triggering galaxy formation. Further collapse is not inhibited and can produce black holes on various mass scales. (15 refs.)

105001 New constraints on neutrino masses from cosmology. L.M.Krauss (Lyman Lab. of Phys., Harvard Univ., Cambridge, MA, USA).
Phys. Lett. B (Netherlands), vol.128B, no.1-2, p.37-43 (18 Aug. 1983).
The author raises the lower bounds on both heavy unstable and stable neutrino masses, exploiting both the phenomena of neutrino mass mixing and possible Majorana mass terms. Stable heavy neutrinos with Majorana masses (the generic case) have an annihilation rate which is p-wave suppressed. Thus in order to have sufficient cosmic annihilation it is found that the previous lower bound of $m \geq 2$ GeV must be raised to $m_\nu \gtrsim 5$ GeV assuming estimates of the present mass density remain unchanged. Unstable neutrinos are constrained by incorporating both new data on mass mixing from experiment and the annihilation suppression described above with standard nucleosynthesis cosmology. In this case the author finds $m \geq 23$ MeV, increasing the former bound by more than an order of magnitude. (11 refs.)

105002 The anthropic principle. P.C.W.Davies (School of Phys., Univ. of Newcastle upon Tyne, Newcastle upon Tyne, England).
Prog. Part. & Nucl. Phys. (GB), vol.10, p.1-38 (1983).
Starts by discussing numerical accidents in nuclear structure, stars, galaxies and particle masses and then moves on to describe cosmological dynamics, cosmic repulsion and the entropy of the Universe. The author then presents some ideas on the anthropic principle, the change from weak to strong theories and the many universes theory. (59 refs.)

105003 Energy, stability and cosmological constant. S.Deser (Dept. of Phys, Brandeis Univ., Waltham, MA, USA).
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.377-89
The definition of energy and its use in studying stability in general relativity are extended to the case when there is a nonvanishing cosmological constant Λ. Existence of energy is first demonstrated for any model (with arbitrary Λ). It is defined with respect to sets of solutions tending asymptotically to any background space possessing timelike Killing symmetry, and is both conserved and of flux integral form. When $\Lambda<0$, the energy is shown to be positive, and hence stability established, for all systems tending to anti-De Sitter space. Supergravity methods are used here, upon defining spinorial charges as flux integrals which obey the global graded algebra. For $\Lambda>0$, small excitations about De Sitter space are stable inside the event horizon. Outside excitations can contribute negatively due to the Killing vector's flip at the horizon. This is a universal phenomenon associated with the possibility of Hawking radiation. Apart from this effect, the $\Lambda>0$ theory appears to be stable, also at the semi-classical level. (18 refs.)

105004 Phase transitions in the early Universe. T.W.B.Kibble (Blackett Lab., Imperial Coll., London, England).
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.391-408
Grand unification and the hot big-bang theories both have phase transitions in the early history of the Universe, where the symmetry was reduced. The author discusses various topological structures generated at these transitions such as domain walls, strings and monopoles. (35 refs.)

105005 Complete cosmological theories. L.P.Grishchuk (Shternberg Astron. Inst., Moscow, USSR), Ya.B.Zeldovich.
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.409-22
The authors attempt to give a rational explanation for the origin of the initial conditions which lead to the so-called standard cosmological model. They discuss 'complete models' which describe the universe from the very beginning (including the quantum gravitational stage), up to the present time. (33 refs.)

105006 The cosmological constant and the weak anthropic principle. S.W.Hawking (Dept. of Appl. Math. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop, London, England, 3-21 Aug. 1981 (Cambridge, England: Cambridge 1982), p.423-32
One way of explaining why the observed cosmological constant is so small would be to appeal to the weak Anthropic Principle, that the theory which describes the Universe must be such as to allow the development of intelligent life: if it did not, there would not be anyone to observe the theory. In the case of the cosmological constant one could argue that a value slightly more negative than the observed limit would have caused the Universe to recollapse before life could have developed while a more positive value would have caused the Universe to expand too rapidly to allow the formation of galaxies. (no refs.)

Symposium uber Kosmologie und Relativistische Astrophysik (Symposium on Cosmology and Relativistic Astrophysics) .... See Entry 98639

Quantum Structure of Space and Time. Proceedings of the Nuffield Quantum Gravity Workshop .... See Entry 98651

The Universe from $<10^{-36}$ second to $>10^{30}$ years. II ....See Entry 98711

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Universe before Planck time: A quantum gravity model ....See Entry 98902

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